NASA SP-7037 (359)
October 17, 1997

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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

03 Air Transportation and Safety **4**

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

04 Aircraft Communications and Navigation **5**

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

05 Aircraft Design, Testing and Performance **8**

Includes aircraft simulation technology.

06 Aircraft Instrumentation **11**

Includes cockpit and cabin display devices; and flight instruments.

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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 **13**

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

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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)
4. Publication Date
5. Contract/Grant Number(s)
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 359)

OCTOBER 17, 1997

01
AERONAUTICS

19970027487 Federal Aviation Administration, Washington, DC USA
Aeronautical Information Publication, USA of America, 14th Edition
Jan. 30, 1997; 505p; In English
Report No.(s): PB97-142780; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

Topic considered. Gen 0.6 Table of Contents to Part 1: Gen 1. National Regulations and Requirements; Gen 2. Tables and Codes; Gen 3. Services; and Gen 4. Charges for Aeriodromes/Heliports and Air Navigation Services.
NTIS
Air Navigation; Civil Aviation; Airports; Information Retrieval; Documents

19970027742 NASA Lewis Research Center, Cleveland, OH USA
HBCUs Research Conference Agenda and Abstracts
Dutta, Sunil, Compiler, NASA Lewis Research Center, USA; HBCUs Research Conference Agenda and Abstracts; May 1997; 77p; In English; 4th, 9-10 Apr. 1997, Cleveland, OH, USA; Also announced as 19970027743 through 19970027782
Contract(s)/Grant(s): RTOP 292-10-08-07
Report No.(s): NASA-CP-10196; E-10697; NAS 1.55:10196; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The purpose of this Historically Black Colleges and Universities (HBCUS) Research Conference was to provide an opportunity for principal investigators and their students to present research progress reports. The abstracts included in this report indicate the range and quality of research topics such as aeropropulsion, space propulsion, space power, fluid dynamics, designs, structures and materials being funded through grants from Lewis Research Center to HBCUS. The conference generated extensive networking between students, principal investigators, Lewis technical monitors, and other Lewis researchers.
Author
Propulsion; Mathematical Models; Computer Programs; Research; Fluid Dynamics; Design Analysis

19970027833 Air Force Inst. of Tech., Graduate School of Logistics, Wright-Patterson AFB, OH USA
Production Team Maintenance: Systemic Constraints Impacting Implementation
Moore, Terry F., Air Force Inst. of Tech., USA; May 1997; 106p; In English
Report No.(s): AD-A326984; AFIT/GMO/LAL/97Y-9; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The purpose of this research project was two-fold: (1) to identify the factors adversely impacting implementation of Production Team Maintenance (PTM) in the KC-135 tanker maintenance community, and (2) to propose recommendations to improve PTM's viability in the field. In addition to a comprehensive historical literature review of the conceptual evolution of PTM, two assessment methods, strategic control and the Theory of Constraints, were applied to analyze PTM at both strategic and operational levels. Five implicit assumptions integral to AMC's notional PTM model were introduced. Identified constraints included: integrating the PTM positioning strategy into the AMC corporate strategic planning process, manpower modeling simulator limitations, labor force authorizations and decentralization, aircraft assignment/alignment, instructional guidance, the Integrated Tanker Unit Deployment operations concept, the 120-day personnel deployment policy, and the command training objective. Over time, the accumulation of new policies, which were developed to cope with a very different post-Cold War national security environment, left the maintenance community wrongly postured for today's defense demands. Several specific recommendations were proposed, all of which can be generalized into three categories. First, deliberately integrate PTM into the strategic-level operations management planning framework. Second, redefine PTM to better posture maintenance to support higher headquar-

ters' strategic goals, objectives and operational tasks as well as Air Force and command policies. and third, restructure PTM to promote standardization within the KC-135 community and to improve its 'fit' in the field.
DTIC
Aircraft Maintenance; Tanker Aircraft

02
AERODYNAMICS

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

19970027380 NASA Langley Research Center, Hampton, VA USA
Comparative Results from a CFD Challenge Over a 2D Three-Element High-Lift Airfoil
Klausmeyer, Steven M., Wichita State Univ., USA; Lin, John C., NASA Langley Research Center, USA; May 1997; 52p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 522-11-51-01
Report No.(s): NASA-TM-112858; NAS 1.15:112858; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A high-lift workshop was held in May of 1993 at NASA Langley Research Center. A major part of the workshop centered on a blind test of various computational fluid dynamics (CFD) methods in which the flow about a two- dimensional (2D) three-element airfoil was computed without prior knowledge of the experimental data. The results of this 'blind' test revealed: (1) The Reynolds Averaged Navier-Stokes (RANS) methods generally showed less variability among codes than did potential/Euler solvers coupled with boundary-layer solution techniques. However, some of the coupled methods still provided excellent predictions. (2) Drag prediction using coupled methods agreed more closely with experiment than the RANS methods. Lift was more accurately predicted than drag for both methods. (3) The CFD methods did well in predicting lift and drag changes due to changes in Reynolds number, however, they did not perform as well when predicting lift and drag increments due to changing flap gap, (4) Pressures and skin friction compared favorably with experiment for most of the codes. (5) There was a large variability in most of the velocity profile predictions. Computational results predict a stronger siat wake than measured suggesting a missing component in turbulence modeling, perhaps curvature effects.
Author
Computational Fluid Dynamics; Navier-Stokes Equation; Airfoils; Boundary Layers; Aerodynamic Characteristics; Aerodynamic Coefficients; Lift

19970027549 Florida State Univ., Dept. of Mathematics, Tallahassee, FL USA
Time-Domain Impedance Boundary Conditions for Computational Aeroacoustics
Tam, Christopher K. W., Florida State Univ., USA; Auriault, Laurent, Florida State Univ., USA; AIAA Journal; May 1996; Volume 34, No. 5, pp. 917-923; In English
Contract(s)/Grant(s): NAG1-1776
Report No.(s): NASA-CR-205218; NAS 1.26:205218; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

It is an accepted practice in aeroacoustics to characterize the properties of an acoustically treated surface by a quantity known as impedance. Impedance is a complex quantity. As such, it is designed primarily for frequency-domain analysis. Time-domain boundary conditions that are the equivalent of the frequency-domain impedance boundary condition are proposed. Both single frequency and model broadband time-domain impedance boundary conditions are provided. It is shown that the proposed boundary conditions, together with the linearized Euler equations, form well-posed initial boundary value problems. Unlike ill-posed problems, they are free from spurious instabilities that would render time-marching computational solutions impossible.
Author
Aeroacoustics; Acoustic Impedance; Boundary Conditions

19970027706 Lund Univ., Dept. of Heat and Power Engineering, Sweden
Measurement of the unsteady flow in a Laval nozzle and around a NACA-3506 airfoil with a periodically fluctuating back-pressure
Jordal, K., Lund Univ., Sweden; Oct. 1996; ISSN 0282-1990; 67p; In English
Report No.(s): LUTMDN-TMVK-5276; DE97-722063; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The report refers a diploma project executed at the Laboratoire de Thermique apliquee et de Turbomachines (LTT) of the Ecole Polytechnique Federale de Lausanne (EPFL) in Switzerland. The objective of the project was to build up experimental apparatus in a Laval nozzle for tests with an isolated airfoil and carry out and evaluate initial measurements for forced response by means of a periodically fluctuating back-pressure. When set up, the nozzle had a width of 40 mm, a length of 1055 mm and a height of approximately 200 mm. The upper and lower walls were inclined 0.8 deg outwards from the centerline to compensate for growing boundary layer, which gave a constant velocity for M=0.2-0.7 throughout the nozzle when empty. to induce a fluctuating back-pressure a plate rotated by a hydraulic motor was installed downstream of the test section in which the NACA-3506 airfoil eventually was mounted. A number of cases in the range of Mach numbers 0.2-0.7 were investigated and the unsteady tests were carried out for plate frequencies 20-100 Hz. The pressure amplitudes at subsonic flow (M=0.2-0.5) increased continuously along the airfoil surface as the unsteady perturbations traveled upstream. At transonic flow (M=0.6 and 0.7 upstream of the blade) a shock appeared on the airfoil suction side. The shock was located further downstream at higher Mach numbers and also further downstream without fluctuating back-pressure in the nozzle. The pressure amplitudes downstream of the airfoil were found to be influenced only by the unsteady perturbation and the duct configuration. Nondimensionalizing the unsteady pressure amplitudes on the airfoil with the downstream pressure amplitude showed that flow over the airfoil amplifies the unsteadiness.
DOE
Airfoils; Unsteady Flow; Flow Measurement; Air Flow

19970027771 Agricultural and Technical Coll. of North Carolina, College of Engineering, Greensboro, NC USA
Numerical Simulations of Wing-Body Junction Flows
Krishnamurthy, R., Agricultural and Technical Coll. of North Carolina, USA; Cagle, Corey D., Agricultural and Technical Coll. of North Carolina, USA; Chandra, S., Agricultural and Technical Coll. of North Carolina, USA; HBCUs Research Conference Agenda and Abstracts; May 1997, pp. 38; In English; Also announced as 19970027742; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The goal of the research project is to contribute to the optimized design of fan bypass systems in advanced turbofan engines such as the Advanced Ducted Propulsors (ADP). The immediate objective is to perform numerical simulation of duct-strut interactions to elucidate the loss mechanisms associated with this configuration that is characteristic of ADP. These numerical simulations would complement an experimental study being undertaken at Purdue University. As the first step in the process, a numerical study of wing-body junction flow is being undertaken as it shares a number of characteristics with the duct-strut interaction flow. The experimental data from Kubendran et al. are being used for comparison. The code NPARC is used for numerical simulations. Grids for the simulation have been generated using a multisurface algorithm. Results obtained so far are presented and discussed.
Author
Turbofan Engines; Ducted Fan Engines; Grid Generation (Mathematics); Computational Fluid Dynamics; Flow Distribution

19970028123 NASA Ames Research Center, Moffett Field, CA USA
Lift-Enhancing Tabs on Multielement Airfoils
Ross, James C., NASA Ames Research Center, USA; Storms, Bruce L., Sterling Software, Inc., USA; Carrannanto, Paul G., Ford Motor Co., USA; Journal of Aircraft; May 1995; Volume 32, No. 3, pp. 649-655; In English; Applied Aerodynamics, 9-11 Aug. 1993, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA-TM-112914; NAS 1.15:112914; AIAA Paper 93-3504; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The use of flat-plate tabs (similar to Gurney flaps) to enhance the lift of multielement airfoils is extended here by placing them on the pressure side and near the trailing edge of the main element rather than just on the furthest downstream wing element. The tabs studied range in height from 0.125 to 1.25% of the airfoil reference chord. In practice, such tabs would be retracted when the high-lift system is stowed. The effectiveness of the concept was demonstrated experimentally and computationally on a two-dimensional NACA 63(sub 2)-215 Mod B airfoil with a single-slotted, 30%-chord flap. Both the experiments and computations showed that the tabs significantly increase the lift at a given angle of attack and the maximum lift coefficient of the airfoil. The computational results showed that the increased lift was a result of additional turning of the flow by the tab that reduced or eliminated now separation on the flap. The best configuration tested, a 0.5%-chord tab placed 0.5% chord upstream of the trailing edge of the main element, increased the maximum lift coefficient of the airfoil by 12% and the maximum lift-to-drag ratio by 40%.
Author
Airfoils; Lift; Tabs (Control Surfaces); Angle of Attack; Lift Drag Ratio; Wind Tunnel Tests; Computational Fluid Dynamics

19970028360 NASA Langley Research Center, Hampton, VA USA

Multistage Schemes with Multigrid for Euler and Navier-Strokes Equations: Components and Analysis

Swanson, R. C., NASA Langley Research Center, USA; Turkel, Eli, Tel-Aviv Univ., Ramat-Aviv, Israel; Aug. 1997; 84p; In English

Contract(s)/Grant(s): RTOP 505-59-53-01

Report No.(s): NASA-TP-3631; NAS 1.60:3631; L-17201; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A class of explicit multistage time-stepping schemes with centered spatial differencing and multigrids are considered for the compressible Euler and Navier-Stokes equations. These schemes are the basis for a family of computer programs (flow codes with multigrid (FLOMG) series) currently used to solve a wide range of fluid dynamics problems, including internal and external flows. In this paper, the components of these multistage time-stepping schemes are defined, discussed, and in many cases analyzed to provide additional insight into their behavior. Special emphasis is given to numerical dissipation, stability of Runge-Kutta schemes, and the convergence acceleration techniques of multigrid and implicit residual smoothing. Both the Baldwin and Lomax algebraic equilibrium model and the Johnson and King one-half equation nonequilibrium model are used to establish turbulence closure. Implementation of these models is described.

Author

Navier-Stokes Equation; Runge-Kutta Method; Fluid Dynamics; Finite Difference Theory; Baldwin-Lomax Turbulence Model; Multigrid Methods

03
AIR TRANSPORTATION AND SAFETY

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

19970027550 NASA Langley Research Center, Hampton, VA USA

Complex Permittivities of Candidate Radome Materials at W-band

Cravey, Robin, NASA Langley Research Center, USA; May 1997; 20p; In English

Contract(s)/Grant(s): RTOP 522-24-21-03

Report No.(s): NASA-TM-110344; NAS 1.15:110344; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of w-band complex permittivity measurements performed in NASA Langley's Electromagnetics Research Branch. The test articles included in the permittivity study were flat panels of materials which are under consideration for use in a radome for the Passive Millimeter Wave Camera (PMMWC) flight experiment. This experiment is scheduled to fly on the Air Force's 'Speckled Trout' aircraft in late 1997. The radome design is very important because the PMMWC can tolerate only a small amount of electromagnetic loss through the radome. A free space measurement system was used to obtain complex reflection and transmission coefficients of the samples. The frequency of interest was 89 GHz, so measurements were performed over a range of 79 to 99 GHz. The transmission and reflection coefficients were used, along with the measured sample thickness, to calculate complex permittivity over the frequency range. The material samples measured in this study can be divided into four categories: skin materials, core materials, coating materials, and layered samples.

Author

Permittivity; Radome Materials; Radomes; Measurement

19970027997 Clemson Univ., SC USA

An Investigation of Situation Awareness Using Aviation Incident Reports

Gibson, Jason Alan, Clemson Univ., USA; Jun. 18, 1997; 82p; In English

Report No.(s): AD-A326836; AFIT/CI-97-066; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This research was performed to determine the factors which affect the quality of situation awareness (SA) in civilian aircrew members. The recent popularity and increased investigation of SA has forced the research community to be very specific in modeling how it enhances decision-making in complex, dynamic environments. This research sought to better understand the effects of poor communication, high workload and time pressure on losses of SA for teams and individuals. Based upon Endsley's (1995a) model of SA and an analysis of aviation incident reports, it was found that 205 of the 590 incident reports investigated involved a loss in SA. This implies that SA is indeed a significant factor affecting aviation decision-making. Further, the results show that instances of poor communication and high workload occur in significantly higher proportions of team comprehension errors.

These findings point to both the usefulness of Endsley's (1995a) model and the usefulness of using incident report data for the understanding of SA.
DTIC
Flight Crews; Workloads (Psychophysiology); Decision Making

19970028215 Adsystech, Inc., Washington, DC USA
Federal Aviation Administration Plan for Research, Engineering, and Development (1997)
Politano, A., Adsystech, Inc., USA; Melton, J., Adsystech, Inc., USA; Williamson, L., Adsystech, Inc., USA; Johnson, J., Adsystech, Inc., USA; Edwards, J., Adsystech, Inc., USA; Jan. 1997; 220p; In English
Report No.(s): PB97-146625; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The 1997 Research, Engineering, and Development (R,E&D) Plan is a 5-year calendar plan that provides research program descriptions in nine aviation thrust areas: Capacity and Air Traffic Management Technology, Communications, Navigation, and Surveillance; Weather; Airport Technology; Aircraft Safety Technology; System Security Technology; Human Factors and Aviation Medicine; and Environmental and Energy. This report provides a summary of the research efforts in each area and a brief explanation of the factors driving the current and planned work. It also provides background information on: the FAA process used to create the R,E&D portfolio of research programs, challenges for the National Airspace System which drive the need for research, descriptions of the inputs from the industry/academia R,E&D Advisory Group, and descriptions of how R,E&D is being coordinated with other federal agencies and industry. Lastly, the report shows how R,E&D efforts support and integrate with the FAA Strategic Plan and Capital Investment Plan.
NTIS
Research; Air Transportation; Government/Industry Relations; Research and Development; Federal Budgets; Civil Aviation

19970028545 Federal Aviation Administration, Office of Aviation Medicine, Washington, DC USA
An Evaluation of Safety Seminars *Final Report*
Hunter, D. R., Federal Aviation Administration, USA; Jul. 1997; 50p; In English
Report No.(s): DOT/FAA/AM-97/16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Four versions of an evaluation form, each of which had a set of common items, were distributed at safety seminars conducted by the Federal Aviation Administration. These evaluation forms assessed participant satisfaction with seminars, perceptions of the seminar content and the presenter, frequency of attendance at seminars, aviation qualifications and experience, seminar content, format and venue preferences, access to computer and video technology for training delivery, self-perceived knowledge and proficiency, training activities, and maintenance activities. Seminar evaluation forms were received for 226 seminars, representing approximately 66% of the FAA Flight Standards District Offices. A total of 5,615 seminar forms were received, approximately equally divided among the four form versions. This represents approximately 44% of the reported attendance at the 226 safety seminars. Seminar participants consistently rated the seminars favorably. of the participants, 99% reported that they were satisfied with the seminar, 99% would recommend seminars to fellow pilots, and 96% either definitely or probably will attend another safety seminar in the next year. Data on computer and video ownership and use suggest that computer-based training might be a feasible means for disseminating training programs. Over half of the participants reported membership in at least one flying organization, and almost half reported that they had performed some preventive maintenance on an aircraft during the previous six months. The data provided by the study may be used to guide the content and format of future seminars, while supporting the development of alternative forms of training delivery.
Author
Aircraft Safety; Aircraft Pilots; Surveys

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

19970027493 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Selected Articles
Jigang, Li, Shanghai Bureau of Astronautics, China; Wei, Wu, Shanghai Bureau of Astronautics, China; Feb. 1997; 31p; Transl. into English of Unknow Chinese Periodical, 1993; In English
Report No.(s): AD-A325497; NAIC-ID(RS)T-0587-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The contents of this paper include: Design of flight path of jamming check flight, and the jamming of the global positioning system.
DTIC
Global Positioning System; Jamming; Electronic Warfare; Radio Frequency Interference

19970027504 Scripps Institution of Oceanography, La Jolla, CA USA
High Precision Frequent Tracking of Drifters Using Commercially Available Global Positioning System (GPS) Components ***Final Report, 1 Oct. 1994 - 30 Sep. 1996***
Alden, Douglas J., Scripps Institution of Oceanography, USA; Winant, Clinton D., Scripps Institution of Oceanography, USA; Hendershott, Myrl C., Scripps Institution of Oceanography, USA; May 1997; 18p; In English
Contract(s)/Grant(s): N00014-95-I-0088
Report No.(s): AD-A325884; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The goal of this project is to develop a suite of instruments able to quantitatively measure surface parcel displacement and dispersion in the coastal zone with an accuracy of 1.5 to 2 orders of magnitude better than those obtained using ARGOS or single-station GPS. The specific objective of this work is to instrument a low cost surface drifter of proven design having minimal windage, with tracking capability able to generate descriptions of surface parcel trajectories over distances of tens of kilometers and times of several days with individual drifter positions reported every few seconds with an absolute accuracy of a few meters relative to a fixed ground-based station.
DTIC
Global Positioning System; Satellite Tracking; Navigation; Coasts

19970027615 Federal Aviation Administration, Atlantic City, NJ USA
Symbol Development Guidelines for Airway Facilities
Wagner, Dan, Federal Aviation Administration, USA; Snyder, Michael, NYMA, Inc., USA; Dutra, Lisa, Carlow International, Inc., USA; Dolan, Nancy, CTA Launch Services, USA; Mar. 1997; 32p; In English
Report No.(s): AD-A326779; DOT/FAA/CT-TN96/3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document presents a general methodology for developing Airway Facilities (AF) symbols and provides guidelines for the coding of visual symbols and auditory signals. Coding refers to the characteristics of a symbol that developers can change to improve its interpretation or message content. These coding guidelines should not be considered exhaustive but rather represent a compilation of the most important items to consider when developing visual or auditory symbols. The decision to use a visual symbol, an auditory signal, or both, will depend on the nature of the displayed information, operational conditions, and users requirements. A list of questions for determining the best coding technique is provided. AF symbols represent facilities, equipment, services, and status information such as alarms and alerts. These guidelines also provide a systematic methodology for developing symbols that will help in the creation and testing of effective symbols.
DTIC
Decision Making; Symbols; Auditory Signals; Exhausting; Display Devices

19970028121 National Aerospace Lab., Tokyo, Japan
MLS Angle Accuracy of the MIAS Flight Test
Inokuchi, H., National Aerospace Lab., Japan; Zaayer, M., National Aerospace Lab., Japan; Sridhar, J. K., National Aerospace Lab., Japan; Mulder, J. A., National Aerospace Lab., Japan; Nov. 1996; 22p; In English
Report No.(s): PB97-151112; NAL/TR-1314T; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Multi-mode Integrated Approach System (MIAS) is an advanced approach system based on the Microwave Landing System (MLS) and the Differential Global Positioning System (DGPS). Flight tests were performed at Amsterdam's Schiphol airport in 1994 to evaluate the performance of the system. This report describes the flight test results of the MIAS in 1994. The MLS data was compared with true reference obtained from carrier phase DGPS.
NTIS
Microwave Landing Systems; Flight Tests; Global Positioning System; Aircraft Landing

19970028190 Naval Postgraduate School, Monterey, CA USA
The Integration of Situational Awareness Beacon with Reply (SABER) with the Enhanced Position Location Reporting System (EPLRS)
Byrd, Valerie R., Naval Postgraduate School, USA; Dec. 1996; 88p; In English
Report No.(s): AD-A326103; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In 1992, The Joint Requirements Oversight Council validated a combat identification mission need statement. In support of the requirement for system interoperability, this thesis proposes a concept of operations for integrating two systems, Situational Awareness Beacon with Reply (SABER) and the Enhanced Position Location Reporting System (EPLRS). SABER is a program initiated by Naval Space Command to provide real time combat identification (CID) to the tactical user. It uses UHF satellite communications technology in conjunction with the Global Positioning System (GPS) to provide positioning information for up to 500 users. EPLRS is a situational awareness program used extensively by the U. S. Army to support tactical battlefield operations. In addition to providing automatic friendly identification of EPLRS-equipped units, it has a communications capability that allows for the passage of intelligence and targeting data, messages, and status reports. However, EPLRS operates in a line of sight mode only and uses military grid reference coordinates vice OPS for positional information. The integration of SABER and EPLRS has the potential to serve a major role in the armed services' common goal of reduced fratricide. This thesis gives a detailed description of both systems, examines their individual capabilities and limitations, discusses the ways in which the two systems complement each other, and provides a recommended integrated concept of operations.
DTIC
Global Positioning System; Systems Integration; Real Time Operation; Satellite Communication

19970028383 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA
Air Route Surveillance Radar Model 4 (ARSR-4) Operational Test and Evaluation (OT/E) ***Final Report***
Healy, Thomas A., Federal Aviation Administration, USA; McDonald, Raymond K., Federal Aviation Administration, USA; Pomrink, Robert F., Federal Aviation Administration, USA; Conklin, William P., Federal Aviation Administration, USA; May 1997; 234p; In English
Report No.(s): AD-A327689; DOT/FAA/CT-TN96/26; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Air Route Surveillance Radar Model 4 (ARSR-4) is a state-of-the-art, three-dimensional, long-range radar. The system is being jointly procured by the Federal Aviation Administration (FAA) and the U.S. military. This radar will replace aging height-finding and long-range two-dimensional air search radars which are currently in use. Forty-four ARSR-4 systems are scheduled for installation around the coastal USA and in Hawaii, Guam, and Guantanamo Bay, Cuba. This report presents the results of the Operational Test and Evaluation (OT&E) of the ARSR-4 radar system. OT&E Integration and Operational tests were conducted in accordance with FAA Order 1810.4B to verify that the ARSR-4 is operationally suitable and effective and can meet operational requirements when integrated into the National Airspace System (NAS). Test results revealed that the ARSR-4 performs most basic functions well. Improved coverage was noted in areas with a history of poor coverage. Results also revealed that the ARSR-4 can process and provide message outputs for a capacity load within the primary coverage area. Controller comments were generally favorable although several problems were identified during testing. The ARSR-4 at Mt. Laguna had a significantly higher beacon split rate than the ARSR-3. The ARSR-4 did not perform reliably during the test period. The number of critical operational problems encountered was excessive. The ARSR-4 did not consistently recover from a short-term power loss. Several power related problems were discovered. Problems were also discovered with the ARSR-4 Built-in Test (BIT) and Fault Isolation Test (FIT) functions and resolution algorithms.
DTIC
Meteorological Radar; Air Traffic Control; Performance Tests; Operational Problems; Surveillance Radar

19970028539 Civil Aeromedical Inst., Oklahoma City, OK USA
Evaluation of a Range of Target Blink Amplitudes for Attention-Getting Value in a Simulated Air Traffic Control Display ***Final Report***
Milburn, Nelda J., Civil Aeromedical Inst., USA; Mettens, Henry W., Civil Aeromedical Inst., USA; Apr. 1997; 10p; In English
Report No.(s): AD-A326465; DOT/FAA/AM-97/10; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several sources suggest that blinking targets are more alerting than steady targets. Those sources recommend target size, color, shape, brightness contrast, frequency of blink, and parameters for the ratio of time the blink should be 'on,' relative to the time it is 'off.' However, no guidelines were found for an effective, attention-getting blink amplitude (the percentage of decrease in target brightness from a standard). Ten participants located and selected the blinking information data blocks (targets) from 16 data blocks on a Simulated Air Traffic Control Display. Seven blink amplitudes, ranging from 12.5% to 100%, were evaluated. Error and response time performance were near optimum for conditions involving a 75% to 100% decrease in brightness. For the standard luminance (51.4 Cd/sq m), frequency (2 HZ), and duration (.10 sec) used in this experiment, a decrease in brightness of at least 75% was necessary for maximum attention-getting value of a blinking target.
DTIC
Air Traffic Control; Cathode Ray Tubes; Display Devices; Blinking; Targets

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970027506 Defence Science and Technology Organisation, Airframes and Engines Div., Canberra, Australia
A Review of Australian and New Zealand Investigations on Aeronautical Fatigue During the Period April 1995 to March 1997
Martin, Colin, Defence Science and Technology Organisation, Australia; Jun. 1997; 48p; In English; 25th; Aeronautical Fatigue, 16-17 Jun. 1997, Edinburgh, UK
Report No.(s): AD-A326429; DSTO-TN-0086; DODA-AR-010-217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document is for presentation to the 25th Conference of the International Committee on Aeronautical Fatigue scheduled to be held in Edinburgh, Scotland on 16th and 17th June 1997. A review is given of the aircraft fatigue research and associated activities which form part of the programs of the Aeronautical and Maritime Research Laboratory, the Civil Aviation Safety Authority, and universities in Australia and the Defense Scientific Establishment and the University of Auckland in New Zealand. The review summarizes fatigue related research programs as well as fatigue investigations on specific military and civil aircraft.
DTIC
Aircraft Safety; Civil Aviation; Flight Safety

19970027544 NASA Ames Research Center, Moffett Field, CA USA
Capture Conditions for Merging Trajectory Segments to Model Realistic Aircraft Descents
Zhao, Yiyuan, Minnesota Univ., USA; Slattery, Rhonda A., NASA Ames Research Center, USA; Journal of Guidance, Control, and Dynamics; Mar. 1996; ISSN 0731-5090; Volume 19, No. 2, pp. 453-460; In English
Contract(s)/Grant(s): NCC2-868
Report No.(s): NASA-CR-205252; NAS 1.26:205252; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A typical commercial aircraft trajectory consists of a series of flight segments. An aircraft switches from one segment to another when certain specified variables reach their desired values. Trajectory synthesis for air traffic control automation must be consistent with practical pilot procedures. We examine capture conditions for merging trajectory segments to model commercial aircraft descent in trajectory synthesis. These conditions translate into bounds on measurements of atmospheric wind, pressure, and temperature. They also define ranges of thrust and drag feasible for a descent trajectory. Capture conditions are derived for the Center-TRACON Automation System developed at NASA Ames Research Center for automated air traffic control. Various uses of capture conditions are discussed. A Boeing 727-200 aircraft is used to provide numerical examples of capture conditions.
Author
Descent Trajectories; Commercial Aircraft; Descent; Numerical Integration; Trajectory Analysis; Capture Effect

19970027703 Virginia Polytechnic Inst. and State Univ., Dept. of Engineering Science and Mechanics, Blacksburg, VA USA
Nonlinear Aeroelasticity of Composite Wings ***Final Report, 10 Jun. 1993 - 9 Dec. 1996***
Nayfeh, A. H., Virginia Polytechnic Inst. and State Univ., USA; Mook, D. T., Virginia Polytechnic Inst. and State Univ., USA; Mar. 10, 1997; 7p; In English
Contract(s)/Grant(s): F49620-93-I-0350
Report No.(s): AD-A325525; AFOSR-97-0136TR; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have developed a scheme that couples the codes for aerodynamic and aeroelastic analyses so that the flowfield and the positions and velocities of points on the lifting surface are predicted simultaneously and interactively. The actual structural dynamic/ aerodynamic coupling is carried out by representing the deflection of the wing as an expansion in terms of a few low-frequency free-vibration modes, especially the ones involved in internal resonances. The time dependent coefficients in this expansion are then regarded as the generalized coordinates. The aerodynamic loads are also expanded in terms of the linear modes. Integration over the spatial domain reduces the problem to one of several degrees rf freedom governed by ordinary differential equations with generalized forces. An integration scheme is developed and applied to this set of equations.
DTIC
Aeroelasticity; Composite Structures; Vibration Mode; Wings; Free Vibration; Unsteady Aerodynamics; Lift

19970027713 Duke Univ., Office of Research Support, Durham, NC USA

Limit Cycle Oscillations (LCO) and Nonlinear Aeroelastic Wing Response ***Final Report, 1 Jun. 1993 - 31 May 1996***

Dowell, Earl H., Duke Univ., USA; Dec. 04, 1996; 13p; In English

Contract(s)/Grant(s): F49620-93-I-0420

Report No.(s): AD-A325524; AFOSR-97-0135TR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Limit cycle oscillations (LCO) have been observed for elastic wings at moderate to high angles of attack where separated flow is thought to occur. At transonic flow conditions with shock waves present, flow separation may occur at moderate angles of attack. For higher angles of attack, separation may occur at (low) subsonic conditions. Empirical quasi steady aerodynamic models based on steady state experimental data have shown some success in predicting the observed LCO. New theoretical aeroelastic models are proposed here to improve the prediction of LCO. Also proposed are simple, flow speed experiments to validate these theoretical models with an option for high speed experiments as well.

DTIC

Aeroelasticity; Wings; Boundary Layer Separation; Aerodynamic Characteristics; Oscillations; Separated Flow; Shock Waves; Transonic Flow; Steady State

19970027898 NASA Langley Research Center, Hampton, VA USA

High Accuracy Evaluation of the Finite Fourier Transform Using Sampled Data

Morelli, Eugene A., NASA Langley Research Center, USA; Jun. 1997; 38p; In English

Contract(s)/Grant(s): RTOP 522-22-21-01

Report No.(s): NASA-TM-110340; NAS 1.15:110340; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many system identification and signal processing procedures can be done advantageously in the frequency domain. A required preliminary step for this approach is the transformation of sampled time domain data into the frequency domain. The analytical tool used for this transformation is the finite Fourier transform. Inaccuracy in the transformation can degrade system identification and signal processing results. This work presents a method for evaluating the finite Fourier transform using cubic interpolation of sampled time domain data for high accuracy, and the chirp Zeta-transform for arbitrary frequency resolution. The accuracy of the technique is demonstrated in example cases where the transformation can be evaluated analytically. Arbitrary frequency resolution is shown to be important for capturing details of the data in the frequency domain. The technique is demonstrated using flight test data from a longitudinal maneuver of the F-18 High Alpha Research Vehicle.

Author

System Identification; Fourier Transformation; Frequencies; Flight Tests; Sampled Data Systems

19970027988 Northrop Corp., Aircraft Div., Hawthorne, CA USA

Advanced Certification Methodology for Composite Structures ***Final Report***

Kan, H. P., Northrop Corp., USA; Cordero, R., Northrop Corp., USA; Whitehead, R. S., Northrop Corp., USA; Apr. 1997; 167p; In English

Report No.(s): AD-A326762; DOT/FAA/AR-96/111; NAWCADPAX,XB-96-262-TR; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

An improved certification methodology for composite structures was developed. The methodology permits certification of bonded and concurred composite structures with the same level of confidence as bolted structures. This methodology also ensures that the threat of in service low velocity impact is adequately addressed. The methodology was demonstrated on actual composite aircraft structures to evaluate the damage tolerance capability of these structures. The F/A-18A upper wing skin was used for methodology demonstration. Sensitivity studies were conducted to determine the influence of impact damage threat scenarios and damage tolerance design requirements on the reliability of composite structures.

DTIC

Composite Structures; Impact Tests; Structural Analysis; Aircraft Structures; Impact Damage; Tolerances (Mechanics); Wings; Graphite-Epoxy Composites

19970027990 NASA Ames Research Center, Moffett Field, CA USA

Aeroelastic Stability of Modern Bearingless Rotors: A Parametric Investigation

Nguyen, Khanh Q., NASA Ames Research Center, USA; 1994; 8p; In English; Aeromechanics Specialists, 19-21 Jan. 1994, San Francisco, CA, USA; Sponsored by American Helicopter Society, Inc., USA

Report No.(s): NASA-TM-112912; NAS 1.15:112912; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

The University of Maryland Advanced Rotorcraft Code (UMARC) is utilized to study the effects of blade design parameters on the aeroelastic stability of an isolated modern bearingless rotor blade in hover. The McDonnell Douglas Advanced Rotor Technology (MDART) Rotor is the baseline rotor investigated. Results indicate that kinematic pitch-lag coupling introduced through the control system geometry and the damping levels of the shear lag dampers strongly affect the hover inplane damping of the baseline rotor blade. Hub precone, pitchcase chordwise stiffness, and blade fundamental torsion frequency have small to moderate influence on the inplane damping, while blade pre-twist and placements of blade fundamental flapwise and chord-wise frequencies have negligible effects. A damperless configuration with a leading edge pitch-link, 15 deg of pitch-link cant angle, and reduced pitch-link stiffness is shown to be stable with an inplane damping level in excess of 2.7 percent critical at the full hover tip speed.
Author
Bearingless Rotors; Aeroelasticity; Hovering; Rotary Wing Aircraft; Damping; Aerodynamic Stability

19970028021 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Development of a Composite Tailoring Technique for Airplane Wing ***Progress Report No. 3***
Chattopadhyay, Aditi, Arizona State Univ., USA; Jha, Ratneshwar, Arizona State Univ., USA; 1996; 15p; In English
Contract(s)/Grant(s): NAG2-908
Report No.(s): NASA-CR-205326; NAS 1.26:205326; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Development of a new composite beam modeling technique to represent the principal load-carrying member in the wing is reported along with the development of a formal design optimization procedure to investigate the effect of composite tailoring on aeroelastic stability and structural characteristics of airplane wings. The developed procedure is used to perform design optimization studies on realistic airplane configurations to investigate the various aeroelastic/structural/dynamic design issues.
Derived from text
Aeroelasticity; Composite Structures; Wings; Aircraft Structures; Structural Design; Structural Analysis; Unsteady Aerodynamics

19970028204 Instytut Lotnictwa, Warsaw, Poland
Transactions of the Institute of Aviation Scientific Quarterly: Ranges of Propeller- and Jet Propelled Airplanes, No. 148 ***Quarterly Report Prace Instytutu Lotnictwa: Osiagi Samolotow z Napedem Smiglowym i Odrzutowym, No. 148***
Lewandowski, Ryszard, Instytut Lotnictwa, Poland; Jan. 1997; ISSN 0509-6669; 104p; In Polish; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
In the paper formulae and charts for easy and rapid estimation of aeroplane fundamental performances, with both propeller and turbojet propulsion, are given. At first parabolic approximation of aerodynamic polar curves and examples of polars and propulsion characteristic of piston, turbopropeller and turbojet engines are presented. A method of propeller selection and propeller performance calculations indispensable for performance estimation of propeller driven airplanes are given. The reliability and accuracy of performance results depend mainly on precision of available aerodynamic data.
Author
Aerodynamics; Propeller Efficiency; Reliability; Propellers; Performance Prediction; Accuracy

19970028344 Army War Coll., Carlisle Barracks, PA USA
Unmanned Aerial Vehicles: Promises and Potential ***Topical Report***
Sosa, Arthur J., Army War Coll., USA; Apr. 1997; 47p; In English
Report No.(s): AD-A326936; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper reviews the background of Unmanned Aerial Vehicles (UAV), tracing UAV technology from its genesis through to the promising UAV systems in development today. It provides historical insight into the enabling technologies which make UAVs uniquely capable of a variety of missions beyond their traditional roles in aerial reconnaissance. Finally, the controversy over Manned vs. Unmanned Aircraft is raised to shake up the cultural inertia which seems to constrain UAV applications in the Revolution in Military Affairs. Regardless of the winner of that debate, UAV systems are politically and fiscally relevant to our military today and in the uncertain future.
DTIC
Pilotless Aircraft; Systems Engineering; Aerial Reconnaissance; Remotely Piloted Vehicles

19970028352 Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne, Australia
The Implications of Corrosion with respect to Aircraft Structural Integrity
Cole, G. K., Defence Science and Technology Organisation, Australia; Clark, G., Defence Science and Technology Organisation,

Australia; Sharp, P. K., Defence Science and Technology Organisation, Australia; Mar. 1997; 134p; In English
Report No.(s): AD-A327551; DSTO-RR-0102; AIR-95/172; DODA-AR-010-199; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report discusses the influence of corrosion on aircraft structural integrity. Brief introductions to corrosion in aircraft and aircraft structural integrity are provided and the literature concerned with the effect of prior corrosion and corrosive environments on static strength and fatigue performance is reviewed. RAAF and overseas experience with structural integrity issues associated with corrosion in aircraft is described, with emphasis placed on corrosion in airframes and other structural elements. The report discusses the difficulties associated with incorporating the effects of corrosion into conventional life management approaches and the contribution of corrosion control programs to continuing airworthiness. Where possible, current research programs throughout the world are reviewed. Finally, potential areas of research are identified, primary on the basis of their potential usefulness for the future support of RAAF aircraft, and opportunities for collaborative research.
DTIC
Structural Failure; Aircraft Reliability; Corrosion

19970028574 Massachusetts Univ., Dept. of Mechanical Engineering, Amherst, MA USA
Unsupervised Pattern Classifier for Abnormality-Scaling of Vibration Features for Helicopter Gearbox Fault Diagnosis
Jammu, Vinay B., Massachusetts Univ., USA; Danai, Kourosh, Massachusetts Univ., USA; Lewicki, David G., Army Research Lab., USA; Machine Vibration; 1996, No. 5, pp. 154-162; In English
Contract(s)/Grant(s): RTOP 581-30-13
Report No.(s): NASA-CR-205285; NAS 1.26:205285; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

A new unsupervised pattern classifier is introduced for on-line detection of abnormality in features of vibration that are used for fault diagnosis of helicopter gearboxes. This classifier compares vibration features with their respective normal values and assigns them a value in (0, 1) to reflect their degree of abnormality. Therefore, the salient feature of this classifier is that it does not require feature values associated with faulty cases to identify abnormality. In order to cope with noise and changes in the operating conditions, an adaptation algorithm is incorporated that continually updates the normal values of the features. The proposed classifier is tested using experimental vibration features obtained from an OH-58A main rotor gearbox. The overall performance of this classifier is then evaluated by integrating the abnormality-scaled features for detection of faults. The fault detection results indicate that the performance of this classifier is comparable to the leading unsupervised neural networks: Kohonen's Feature Mapping and Adaptive Resonance Theory (AR72). This is significant considering that the independence of this classifier from fault-related features makes it uniquely suited to abnormality-scaling of vibration features for fault diagnosis.
Author
Helicopters; Detection; Error Analysis; Fault Detection; Gears; On-Line Systems; Resonance

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19970027873 Illinois Univ., Urbana-Champaign, IL USA
Free Cockpit Displays of Traffic and Weather Information - Effects of Dimension and Data Base Integration
OBrien, Janelle V., Illinois Univ., USA; Jun. 24, 1997; 72p; In English
Report No.(s): AD-A327019; AFIT-97-075; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

As the concept of Free Flight continues to be explored, it becomes increasingly evident that pilots must have displays that effectively depict traffic and weather information as more and more responsibility for separation from such hazards transfers from air traffic controllers to pilots. This research effort seeks to address two display design issues: dimensionality (3D perspective versus 2D coplanar displays) and database integration (separation or integration through overlays of traffic and weather information within displays). It was hypothesized that the 2D displays would result in fewer traffic and weather conflicts then the 3D displays, replicating the findings of Merwin and Wickens (1996) regarding traffic avoidance. As suggested by the Proximity Compatibility Principle (Wickens & Carswell, 1995), the data base integrated displays were expected to result in fewer conflicts than the separated displays for trials in which both weather and traffic were critical for maneuver choice. Finally, as revealed in Merwin and Wickens (1996), it was hypothesized that display type and scenario geometry would effect maneuver strategies. 17 general aviation flight instructors flew a series of trials with four display types in which dimensionality, database integration, and hazard geometries were manipulated. Analyses of the data revealed that the 2D displays result in a smaller percentage of conflicts

with traffic and weather hazards. The results regarding database integration suggest that displays in which traffic and weather are overlaid result in fewer hazard conflicts for trials in which both hazard types are critical to maneuver selection. Display type and scenario geometry were also found to effect maneuver strategies, including a pronounced 2D advantage for trials in which the traffic is descending or ascending, while performance for level traffic trials is similar across display types.
DTIC
Display Devices; Cockpits; Free Flight; Aircraft Maneuvers; Maneuverability

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.

19970027377 General Electric Co., Aircraft Engines, Cincinnati, OH USA
Estimating Engine Airflow in Gas-Turbine Powered Aircraft with Clean and Distorted Inlet Flows
Williams, J. G., General Electric Co., USA; Steenken, W. G., General Electric Co., USA; Yuhas, A. J., AS&M, Inc., USA; Sep.1996; 80p; In English; High-Angle-of-Attack Technology, 17-19 Sep. 1996, Hampton, VA, USA
Contract(s)/Grant(s): NAS3-26617; RTOP 505-68-30
Report No.(s): NASA-CR-198052; NAS 1.26:198052; H-2127; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The P404-GF-400 Powered F/A-18A High Alpha Research Vehicle (HARV) was used to examine the impact of inlet-generated total-pressure distortion on estimating levels of engine airflow. Five airflow estimation methods were studied. The Reference Method was a fan corrected airflow to fan corrected speed calibration from an uninstalled engine test. In-flight airflow estimation methods utilized the average, or individual, inlet duct static- to total-pressure ratios, and the average fan-discharge static-pressure to average inlet total-pressure ratio. Correlations were established at low distortion conditions for each method relative to the Reference Method. A range of distorted inlet flow conditions were obtained from -10 deg. to +60 deg. angle of attack and -7 deg. to +11 deg. angle of sideslip. The individual inlet duct pressure ratio correlation resulted in a 2.3 percent airflow spread for all distorted flow levels with a bias error of -0.7 percent. The fan discharge pressure ratio correlation gave results with a 0.6 percent airflow spread with essentially no systematic error. Inlet-generated total-pressure distortion and turbulence had no significant impact on the P404-GE400 engine airflow pumping. Therefore, a speed-flow relationship may provide the best airflow estimate for a specific engine under all flight conditions.
Author
F-18 Aircraft; Air Flow; Engine Tests; Flow Distortion; Inlet Flow; Inlet Pressure; Static Pressure; Flow Measurement; Gas Turbine Engines; Flow Velocity; Turbofans

19970027928 Clark-Atlanta Univ., GA USA
Research in Structural Dynamics and Control and Aeropropulsion ***Final Report, 1 Sep. 1990 - 1 Sep. 1995***
May 1996; 65p; In English
Contract(s)/Grant(s): F33615-90-C-2082; AF Proj. 2003
Report No.(s): AD-A327027; WL-TR-96-2105; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objectives of this research project are to reduce and analyze aeromechanical test data obtained from full scale engine tests at AEDC, to investigate the causes for excessive vibration response of the front frame struts of the F110-GE-129 high performance turbofan engine, and to develop analytical and/or empirical models for predicting the conditions under which such high responses occur.
DTIC
Turbofan Engines; Mathematical Models; Aircraft Engines; Dynamic Response; Vibration Effects; Fluid Flow; Unsteady Aerodynamics

08
AIRCRAFT STABILITY AND CONTROL

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

19970027378 NASA Dryden Flight Research Center, Edwards, CA USA
A Correlation Between Flight-Determined Derivatives and Wind-Tunnel Data for the X-24B Research Aircraft
Sim, Alex G., NASA Dryden Flight Research Center, USA; Aug. 1997; 70p; In English
Contract(s)/Grant(s): RTOP 521-71-01
Report No.(s): NASA-TM-113084; H-2173; NAS 1.15:113084; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Longitudinal and lateral-directional estimates of the aerodynamic derivatives of the X-24B research aircraft were obtained from flight data by using a modified maximum likelihood estimation method. Data were obtained over a Mach number range from 0.35 to 1.72 and over an angle of attack range from 3.5 deg. to 15.7 deg. Data are presented for a subsonic and transonic configuration. The flight derivatives were generally consistent and documented the aircraft well. The correlation between the flight data and wind-tunnel predictions is presented and discussed.
Author
X-24 Aircraft; Research Aircraft; Mach Number; Angle of Attack; Aerodynamics

19970027694 NASA Dryden Flight Research Center, Edwards, CA USA
Tailored Excitation for Multivariable Stability-Margin Measurement Applied to the X-31A Nonlinear Simulation
Bosworth, John T., NASA Dryden Flight Research Center, USA; Burken, John J., NASA Dryden Flight Research Center, USA; Aug. 1997; 20p; In English; 28th; Society of Flight Test Engineers, 18-22 Aug. 1997, Orlando, FL, USA; Sponsored by Society of Flight Test Engineers, USA
Contract(s)/Grant(s): RTOP 529-30-04
Report No.(s): NASA-TM-113085; NAS 1.15:113085; H-2197; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Safety and productivity of the initial flight test phase of a new vehicle have been enhanced by developing the ability to measure the stability margins of the combined control system and vehicle in flight. One shortcoming of performing this analysis is the long duration of the excitation signal required to provide results over a wide frequency range. For flight regimes such as high angle of attack or hypersonic flight, the ability to maintain flight condition for this time duration is difficult. Significantly reducing the required duration of the excitation input is possible by tailoring the input to excite only the frequency range where the lowest stability margin is expected. For a multiple-input/multiple-output system, the inputs can be simultaneously applied to the control effectors by creating each excitation input with a unique set of frequency components. Chirp-Z transformation algorithms can be used to match the analysis of the results to the specific frequencies used in the excitation input. This report discusses the application of a tailored excitation input to a high-fidelity X-31A linear model and nonlinear simulation. Depending on the frequency range, the results indicate the potential to significantly reduce the time required for stability measurement.
Author
Excitation; Stability; Control Equipment; Safety; Flight Tests; MIMO (Control Systems); Hypersonic Flight; Angle of Attack

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.

19970027370 Naval Surface Warfare Center, Dahlgren, VA USA
Reverberation Characteristics of a Large Welded Steel Shielded Enclosure ***Final Report***
Hatfield, M. O., Naval Surface Warfare Center, USA; Freyer, G. J., Northeast Consortium for Engineering Education, USA; Slocum, M. B., Computer Sciences Corp., USA; Oct. 1996; 23p; In English
Report No.(s): AD-A325881; NSWCDD/TR-96/149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For the past several years there has been an increasing interest in the possibility of testing large items such as aircraft in a reverberation chamber. One concern has been the scaleability of a chamber's operational characteristics. to test a reasonably large aircraft, a chamber would have to have a volume of 50000 cu.m. or greater. NSWCDD was given an opportunity to test an empty cavity with a volume of about 2500 cu.m. The Hewlett Packard Company made available their empty, 10-m, semi-anechoic chamber during the final stages of construction. Data collection to satisfy a limited, high priority set of objectives was limited to one weekend. Frequency range was 30 MHz to 18 GHz. (Due to tuner effectiveness and signal to noise level obtained with the limited input power available, the effective frequency coverage was 90 MHz to 6 GHz.) Within acceptable measurement uncertainty, the cavity electromagnetic environment was isotropic, randomly polarized and uniform over the frequency interval tested. The cavity quality factor was somewhat lower than expected. Within the limited data set, there were no significant departures from the theoretical scaleability.
DTIC
Anechoic Chambers; Steels; Data Acquisition; Construction

19970027586 Dayton Univ. Research Inst., OH USA
Tri-Service Thermal Radiation Test Facility Technical Support Plan (TSP) Instructions, ***26 Apr. 1991 - 17 Jul. 1994***
Olson, Nicholas J., Dayton Univ. Research Inst., USA; Jun. 01, 1997; 40p; In English
Contract(s)/Grant(s): DNA001-90-C-0081
Report No.(s): AD-A326256; UDR-TR-94-70; DNA-TR-96-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Requirements for detailed test planning, facility and personnel safety, and security requirements to be followed in using the Tri-Service Thermal Radiation Test Facility (TRTF) are described in this technical support document. Details of proposed testing including the anticipated number of tests, requested instrumentation, required thermal, aerodynamic, and mechanical load test loads, and potential hazards are addressed. Standard operating procedures for personnel safety during occupation and testing in the TRTF are also detailed. Requirements for reviewing all Material Safety Data Sheets prior to testing, indoctrination of all personnel in safe operating procedures of thermal energy sources and high pressure gases. Evacuation alarms, emergency exits and evacuation procedures are also described. Personal protection, i.e. safety glasses, other eye and ear protection, protective clothing, are also discussed. Required TRTF visit request forms for both unclassified testing and classified materials testing, and the procedures to be followed are also contained herein.
DTIC
Radiation Protection; Thermal Radiation; Radiology; Laboratories; Test Facilities; Planning; Education

19970028368 Scientific and Engineering Solutions, Inc., Orleans, MA USA
USA Experience Using Forward Scattermeters for Runway Visual Range ***Final Report, Sep. 1996 - Mar. 1997***
Burnham, David C., Scientific and Engineering Solutions, Inc., USA; Spitzer, Edward A., Department of Transportation, USA; Carty, Thomas C., Department of Transportation, USA; Lucas, Deborah B., Department of Transportation, USA; Mar. 1997; 65p; In English
Contract(s)/Grant(s): FA795/A7090
Report No.(s): AD-A326978; DOT-VNTSC-FAA-97-1; DOT/FAA/AND-97/1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The development of the forward scattermeter in the USA has spanned 25 years from the first design in 1969 to the 1994 commissioning of an airport Runway Visual Range (RVR) system that uses a forward scattermeter rather than the conventional transmissometer to measure the atmospheric extinction coefficient. The forward scattermeter has many practical advantages over the transmissometer (single mounting pole, greater dynamic range. etc.). However, before a forward scattermeter could be accepted for an RVR system, a number of criteria had to be satisfied: (1) the calibration must be accurate and consistent from one unit to the next and for all important obstructions to vision; (2) the windows of the sensors must not clog in blowing snow; and (3) scatter measurements in a small volume of space must represent conditions over the runway as well as measurements made by a transmissometer which averages over a baseline (250 feet at U.S. airports). Many different scattermeter designs were tested extensively, both in the field and in climatic chambers, before all acceptance criteria could be satisfied. The report describes the evolution of scattermeter design and presents the test methodology and results for the new RVR system.
DTIC
Scatterometers; Runways; Visual Observation; Product Development; Effectiveness

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19970028362 Boeing Defense and Space Group, Rocketdyne Div., Canoga Park, CA USA
Space Shuttle Main Engine Start with Off-Nominal Propellant Inlet Pressures
Bradley, Michael, Boeing Defense and Space Group, USA; 1997; 16p; In English; 33rd; Joint Propulsion, 6-9 Jul. 1997, Seattle, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC8-45
Report No.(s): NASA-CR-205359; NAS 1.26:205359; AIAA Paper 97-2687; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes Rocketdyne's successful analysis and demonstration of the Space Shuttle Main Engine (SSME) operation at off-nominal propellant inlet conditions during the Reusable Launch Vehicle (RLV) evaluation tests. The nominal inlet condition range is: 103 to 111 psia and 170.5 to 178 deg. R for the oxidizer and 43 to 47 psia and 37 to 40 deg. R for the fuel. The SSME start was successfully demonstrated with engine inlet pressures of 50 psia liquid oxygen (LOX) with subcooled LOX at 160 deg R and 38 psia fuel at 38 deg. R. Four tests were used to incrementally modify the start sequence to demonstrate the final goal.
Author
Space Shuttle Main Engine; Liquid Oxygen; Engine Inlets; Oxidizers; Mixing Ratios; Liquid Flow

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.

19970027352 NASA Langley Research Center, Hampton, VA USA
Fatigue Life Methodology for Tapered Composite Flexbeam Laminates
Murri, Gretchen B., Army Research Lab., USA; O''Brien, T. Kevin, Army Research Lab., USA; Rousseau, Carl Q., Bell Helicopter Co., USA; May 1997; 48p; In English
Contract(s)/Grant(s): RTOP 581-10-21-01
Report No.(s): NASA-TM-112860; ARL-TR-1400; NAS 1.15:112860; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The viability of a method for determining the fatigue life of composite rotor hub flexbeam laminates using delamination fatigue characterization data and a geometric non-linear finite element (FE) analysis was studied. Combined tension and bending loading was applied to nonlinear tapered flexbeam laminates with internal ply drops. These laminates, consisting of coupon specimens cut from a full-size S2/E7T1 glass-epoxy flexbeam were tested in a hydraulic load frame under combined axial-tension and transverse cyclic bending loads. The magnitude of the axial load remained constant and the direction of the load rotated with the specimen as the cyclic bending load was applied. The first delamination damage observed in the specimens occurred at the area around the tip of the outermost ply-drop group. Subsequently, unstable delamination occurred by complete delamination along the length of the specimen. Continued cycling resulted in multiple delaminations. A 2D finite element model of the flexbeam was developed and a geometrically non-linear analysis was performed. The global responses of the model and test specimens agreed very well in terms of the transverse flexbeam tip-displacement and flapping angle. The FE model was used to calculate strain energy release rates (G) for delaminations initiating at the tip of the outer ply-drop area and growing toward the thick or thin regions of the flexbeam, as was observed in the specimens. The delamination growth toward the thick region was primarily mode 2, whereas delamination growth toward the thin region was almost completely mode 1. Material characterization data from cyclic double-cantilevered beam tests was used with the peak calculated G values to generate a curve predicting fatigue failure by unstable delamination as a function of the number of loading cycles. The calculated fatigue lives compared well with the test data.
Author
Strain Energy Release Rate; Finite Element Method; Laminates; Delaminating; Fatigue Life; Fatigue (Materials); Glass Fiber Reinforced Plastics; Rotary Wings

19970027627 Air Force Materials Lab., Wright-Patterson AFB, OH USA

Proceedings of the Annual Mechanics of Composites Review, 10th ***Final Report, 15 - 17 Oct. 1984***

Apr. 1997; 285p; In English

Report No.(s): AD-A326834; WL-TR-97-4074; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This report contains the basic unedited vu-graphs of the presentations at the 'Mechanics of Composites Review' sponsored jointly by the Nonmetallic Materials Division of the Air Force Materials Laboratory, the Structures Division of the Air Force Flight Dynamics Laboratory and the Directorate of Aerospace Sciences of the Air Force Office of Scientific Research. The presentations cover current in-house and contract programs under the sponsorship of these three organizations.

DTIC

Conferences; Aerodynamics; Graphite-Epoxy Composites

19970027770 NASA Lewis Research Center, Cleveland, OH USA

An Investigation of SiC/SiC Woven Composite Under Monotonic and Cyclic Loading

Lang, J., Agricultural and Technical Coll. of North Carolina, USA; Sankar, J., Agricultural and Technical Coll. of North Carolina, USA; Kelkar, A. D., Agricultural and Technical Coll. of North Carolina, USA; Bhatt, R. T., NASA Lewis Research Center, USA; Singh, M., NASA Lewis Research Center, USA; Lua, J., Engineering Technical Center, USA; HBCUs Research Conference Agenda and Abstracts; May 1997, pp. 37; In English; Also announced as 19970027742; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The desirable properties in ceramic matrix composites (CMCs), such as high temperature strength, corrosion resistance, high toughness, low density, or good creep resistance have led to increased use of CMCs in high-speed engine structural components and structures that operate in extreme temperature and hostile aero-thermo-chemical environments. Ceramic matrix composites have been chosen for turbine material in the design of 21 st-century civil propulsion systems to achieve high fuel economy, improved reliability, extended life, and reduced cost. Most commercial CMCs are manufactured using a chemical vapor infiltration (CVI) process. However, a lower cost fabrication known as melt-infiltration process is also providing CMCs marked for use in hot sections of high-speed civil transports. The scope of this paper is to report on the material and mechanical characterization of the CMCs subjected to this process and to predict the behavior through an analytical model. An investigation of the SiC/SiC 8-harness woven composite is ongoing and its tensile strength and fatigue behavior is being characterized for room and elevated temperatures. The investigation is being conducted at below and above the matrix cracking stress once these parameters are identified. Fractography and light microscopy results are being studied to characterize the failure modes resulting from pure uniaxial loading. A numerical model is also being developed to predict the laminate properties by using the constituent material properties and tow undulation.

Author

Woven Composites; Ceramic Matrix Composites; Aircraft Structures; Civil Aviation; Mathematical Models; Fabrication; Tensile Strength; Fatigue (Materials)

19970028480 TDA Research, Inc., Wheat Ridge, CO USA

Organo-Aluminate Polymeric Materials as Advanced Erosion/Corrosion Resistant Thin Film Coatings ***Quarterly Report No. 4***

Cook, Ronald L., TDA Research, Inc., USA; Barron, Andrew R., TDA Research, Inc., USA; Stoffer, James O., TDA Research, Inc., USA; Anderson, Harlan, TDA Research, Inc., USA; Jun. 1997; 12p; In English

Contract(s)/Grant(s): N00014-96-0147

Report No.(s): AD-A326701; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary goal of the Defence Advanced Research Projects Agency (DARPA) program is the development of carboxylato-alumoxane based coating systems for repair and maintenance of DoD aircraft coatings. The proposed coating systems can potentially offer improved durability and corrosion protection, while avoiding the use of chromates and minimizing the emissions of both Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs). The coating system is based on the development of carboxylato- alumoxane precursors for fabrication of corrosion resistant oxide barrier layers and alumoxane-epoxy based primer coats. Carboxylato-alumoxanes are low-cost nanocomposite materials prepared from th e reaction of carboxylic acids and the mineral boehmite (AlOOH), 1/lb). The carboxylic acids are bound to the surfaces of the boehmite particles. The alumoxanes can be directly bonded into polymer matrices by the use of carboxylic acids that have the appropriate functional groups (i.e. -OH, -NH2, etc). The bonding of the particles to the polymer matrix reduces the voids inherent in filled polymers at the interface of

hydrophilic fillers and hydrophobic polymers. The 'filled' alumoxane-epoxies potentially offer better barrier properties and improved mechanical properties over current epoxy corrosion coatings.
DTIC
Aluminates; Polymer Matrix Composites; Corrosion Resistance; Thin Films; Coating; Product Development; Aircraft Maintenance; Corrosion Prevention

19970028506 Cerritos Coll., Norwalk, CA USA
Handbook: Manufacturing Advanced Composite Components for Airframes ***Final Report***
Price, Terry L., Cerritos Coll., USA; Dalley, George, Cerritos Coll., USA; McCullough, Patrick C., Cerritos Coll., USA; Choquette, Lee, Cerritos Coll., USA; Apr. 1997; 226p; In English
Report No.(s): AD-A325978; DOT/FAA/AR-96/75; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
This handbook is a compendium of information on methods of manufacture of advanced composite components for airframes. I t is aimed at familiarizing the reader with the common industry standards and aspects of using composites in aircraft applications. The handbook is intended to aid Federal Aviation Administration (FAA) personnel in assessing airworthiness of composite parts in civilian aircraft. The contents are drawn from various sources and are condensed into an easy-to-read, but comprehensive format. The contents of this handbook include introductory background on composite materials utilizing fiber reinforcements, matrix systems, core types and styles, handling, related practices found in the manufacturing and fabrication as well as the use of these materials, the concepts of producing parts utilizing tooling, various manufacturing methodologies, processing, machining, quality assurance, assembly, repair, and related safety and environmental issues. These topics are considered essential for proper assessment of the manufacturing qualities and the continued airworthiness of composite parts used in civil aviation today and in the future.
DTIC
Handbooks; Manufacturing; Composite Materials; Airframes; Standards

19970028632 Wright Lab., Aero Propulsion and Power Directorate, Wright-Patterson AFB, OH USA
High Temperature Lubrication of Rolling Contacts with Lubricants Delivered from the Vapor Phase and as Oil-Mists ***Final Report, Jan. 1994 - Dec. 1996***
Forster, Nelson H., Wright Lab., USA; Jan. 1997; 261p; In English
Contract(s)/Grant(s): AF Proj. 3048; AF Proj. 2308
Report No.(s): AD-A326456; WL-TR-97-2003; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche
Several classes of synthetic lubricants were investigated as vapor phase lubricants, using a ball-on-rod tester. In general, lubricants containing phosphorus demonstrated the best high temperature performance with sustained operation at temperatures above 600 deg C in an air environment. After testing, bearing surfaces were analyzed using FTIR, Raman spectroscopy, SEM, EDS, and AES. Condensed phosphates and graphite were identified on surfaces lubricated with a tertiary butyl phenyl phosphate (TBPP) lubricant and also with a cyclophosphazene lubricant. Abrasive iron oxides, with significantly less graphite, were identified on surfaces lubricated with a polyphenylether lubricant. The difference in deposition films is attributed to the phosphate structure formed by the organophosphorus lubricants. Additionally, AES depth profiles indicate that mass diffusion is involved in the formation of vapor deposition films for several of the lubricants tested. Subsurface stress gradients and chemical surface reactions participate in the diffusion process. Candidate lubricants were also evaluated in full scale bearings at gas turbine engine conditions. The TBPP lubricant, T15 bearing steel, silicon nitride rolling elements, C-C composite bearing cages, and oil-mist delivery provided the best performance; demonstrating sustained operation at temperatures up to 450 deg C, stress loads up to 1.8 GPa, and bearing speeds of 1.3 MDN. These conditions represent the limitations of the bearing tester, not the technology itself.
DTIC
Antifriction Bearings; Gas Turbine Engines; Lubrication; Vapor Phases; Lubricants; High Temperature Environments

12
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.

19970027401 Stanford Univ., Mechanical Engineering Dept., Stanford, CA USA
Research on Supersonic Reacting Flows ***Final Report, 15 Feb. 1994 - 14 Feb. 1997***
Bowman, C. T., Stanford Univ., USA; Hanson, R. K., Stanford Univ., USA; Mungal, M. G., Stanford Univ., USA; Reynolds, W.

C., Stanford Univ., USA; Feb. 14, 1997; 48p; In English
Contract(s)/Grant(s): F49620-94-I-0152; AF Proj. 2308
Report No.(s): AD-A325760; AFOSR-97-0199TR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental and computational investigation of supersonic combustion flows was carried out. The principal objective of the research was to gain a more fundamental understanding of mixing and chemical reaction in supersonic flows. The research effort comprised three inter-related elements: (1) stability analyses and numerical simulations of compressible reacting flows; (2) development of laser induced fluorescence techniques for time resolved multidimensional imaging of species concentration, temperature, velocity, and pressure; and (3) an experimental study of mixing and combustion in a supersonic plane mixing layer with the additional development of simple mixing enhancements. The specific objectives and results of the research of each of these program elements have been summarized in this report. New results include: (1) a detailed stability map for reacting, compressible shear layers; (2) new PLIF techniques for transient facilities; and (3) new measurements of mixing efficiency in compressible flows and demonstration of simple mixing enhancement techniques with low pressure drop.
DTIC
Supersonic Flow; Laser Induced Fluorescence; Supersonic Combustion

19970027511 Defence Science and Technology Organisation, Airframe and Engines Div., Canberra, Australia
Experimental Stress Analysis of a Plate Containing an Elongated Hole to Determine Buckling Behaviour under Representative F-111 C Loading Conditions
Allan, Robert B., Defence Science and Technology Organisation, Australia; Mar. 1997; 28p; In English
Report No.(s): AD-A326432; DSTO-TN-0073; DODA-AR-010-167; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents an experimental investigation into the tension and compression behavior of a plate specimen with a angled elongated hole. This specimen type will be used for validation of three life management options on the F-111 wing pivot fitting (DADTA, cold expansion/interference fit plug and stress bridge). Two different brands of strain gauges were used to determine their suitability for use in regions of high plastic strains. The buckling load capability of the plate specimen was determined and found to be suitable for further validation tests.
DTIC
F-111 Aircraft; Stress Analysis; Wings; Loads (Forces); Fitting; Buckling

19970027536 High Technology Corp., Hampton, VA USA
Linear and Nonlinear Evolution of Disturbances in Supersonic Streamwise Vortices ***Final Report, 1 Dec. 1994 - 31 Jan. 1997***
Khorrami, Mehdi, High Technology Corp., USA; Chang, Chau-Lyan, High Technology Corp., USA; Mar. 1997; 87p; In English
Contract(s)/Grant(s): F49620-95-C-0011
Report No.(s): AD-A325675; HTC-FR-1703; AFOSR-97-0172TR; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Evolution of disturbances in a supersonic vortex is studied by using quasi-cylindrical linear stability analysis and parabolized stability equations (PSE) formulation. Appropriate mean flow profiles suitable for stability analysis were identified and modeled successfully. Using the quasi-cylindrical linear stability code, the stability characteristics of cylinder axisymmetric vortices were mapped thoroughly and discussed in detail. Important trends such as viscous and compressibility effects were obtained and analyzed. The results indicate that viscosity has very little effect while increasing Mach number significantly stabilizes the disturbance. The streamwise evolution of the constructed base flow was obtained by solving quasi-cylindrical steady-state equations using finite-difference techniques and the resulting mean flow was analyzed by using PSE. Linear PSE analysis shows that the effect of streamwise mean flow variation (non-parallelism) is small for the case considered here. Nonlinear evolution of helical modes as well as modal interaction is also studied by using PSE. It is found that the growth of the disturbances results in the appearance of coherent large scale motion and significant mean flow distortion in the axial velocity and temperature fields. In the end, nonlinear effects tend to stabilize the vortex.
DTIC
Base Flow; Cylindrical Bodies; Finite Difference Theory; Viscous Flow; Compressibility Effects; Aerodynamic Stability; Supersonic Speed; Viscosity; Vortices; Steady State; Flow Distortion

19970027710 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Advantages and Disadvantages of Using Absorption Chillers to Lower Utility Bills
Kistler, Paul, Naval Facilities Engineering Service Center, USA; Apr. 1997; 5p; In English
Report No.(s): AD-A325700; NFESC-2041-E&U; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Absorption chillers have a proven history of providing low-cost reliable cooling and should continue to do so in the future. Absorption chiller systems can provide significant energy savings for a particular application. to maximize savings, the various system arrangements should be evaluated; for example, single effect versus double effect, chiller versus chiller/heater, straight absorption chiller or the electric/absorption hybrid.
DTIC
Energy Conservation; Electric Power; Air Conditioning Equipment; Compressors; Absorption Cooling; Costs

19970027775 Southern Univ., Baton Rouge, LA USA
Inlet Distortion and Surge/Stall Instabilities in Axial Compression Systems
Grewal, G. S., Southern Univ., USA; Happawana, G. S., Southern Univ., USA; Nwokah, O. D. I., Southern Univ., USA; HBCUs Research Conference Agenda and Abstracts; May 1997, pp. 42; In English; Also announced as 19970027742; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

In this paper, we develop a set of nonlinear partial differential equations, using fluid mechanics, to predict axial compression system instabilities: rotating stall and surge, in the presence of inlet distortion. With mode truncation, it is possible to reduce these equations to ordinary differential equations. Bifurcation analysis is then performed to study the types and regions of instabilities due to parameter changes.
Author
Partial Differential Equations; Nonlinear Equations; Rotating Stalls; Inlet Flow; Turbocompressors

19970028056 Sandia National Labs., Albuquerque, NM USA
A nondestructive test for aircraft Halon bottles, the development of an acoustic emission application
Beattie, A. G., Sandia National Labs., USA; [1996]; 10p; In English; 13th; Acoustic Emission, 27-30 Nov. 1996, Nara, Japan
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-2497C; CONF-9611105-1; DE97-000746; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An acoustic emission test for aircraft Halon bottles has been developed in response to a need expressed by the US Airline Industry. During this development many choices had to be made about test methods, procedures and analysis techniques. This paper discusses these choices and how successful they were. The test itself was designed to replace the currently required hydrostatic test for these bottles. The necessary load is applied by heating the sealed bottles. Acoustic emission is monitored, during the heating, by six sensors held in position by a special fixture. A prototype of the test apparatus was constructed and used in two commercial Halon bottle repair and test facilities. Results to date indicate that about 97% of the bottles tested show no indications of flaws. The other 3% have had indications of possible flaws in non-critical areas of the bottles. All bottles tested to date have passed the hydrostatic test subsequent to the acoustic emission test.
DOE
Nondestructive Tests; Hydrostatics; Airline Operations; Acoustic Emission; Aircraft Design

19970028118 National Inst. of Standards and Technology, Gaithersburg, MD USA
Analysis of High Bay Hangar Facilities for Fire Detector Sensitivity and Placement
Gott, Joseph E., National Inst. of Standards and Technology, USA; Lowe, Darren L., National Inst. of Standards and Technology, USA; Notarianni, Kathy A., National Inst. of Standards and Technology, USA; Davis, William, National Inst. of Standards and Technology, USA; Feb. 1997; 325p; In English
Report No.(s): PB97-153605; NIST/TN-1423; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This study was undertaken to investigate the response of various fire detectors and automatic sprinklers in high bay aircraft hangars. Fully scale experiments were conducted in collaboration with other Federal and industrial organizations in actual Naval aircraft hangars located in Hawaii and Iceland. Temperature distribution across the ceiling was measured along with the response of various fire protection devices as a function of fire size (100 kW to 33 MW), fuel type (JP-5 and JP-8), ceiling geometry (flat, 15 m high, barrel-vaulted, 22 m high, with and without draft curtains), and ventilation conditions. Key findings are presented

relating to detector spacing, threshold fire sizes, sprinkler type and temperature ratings, heat release rates, and the effect of draft curtains.
NTIS
Hangars; Sprinkling; Fire Extinguishers; Smoke Detectors

19970028548 Pratt and Whitney Aircraft, West Palm Beach, FL USA
Twin Rotor Turbopump Program ***Progress Report, 1-31 Jul. 1997***
Aug. 02, 1997; 124p; In English
Contract(s)/Grant(s): NAS8-97161
Report No.(s): NASA-CR-205209; NAS 1.26:205209; FR-24756-4; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

NASA Marshall Space Flight Center (MSFC) has committed its resources to develop the Bantam System Technology Program. This initiative seeks to demonstrate technology applicable to low-cost, innovative, and unique rocket system payoffs for the next generation rocket propulsion systems. One component of this project is the MSFC Ablative Engine. The objective of the Ablative Engine Program is to demonstrate low-cost hardware using low part count design, commercial off-the-shelf (COTS) materials, and low cost fabrication methods. Pratt & Whitney's Twin Rotor Turbopump (TRT) program will produce a demonstrator of an alternative turbopump configuration for the MSFC Ablative Engine. The TRT is a liquid oxygen/kerosene (LOX/RP-1) turbopump that incorporates two similar counter-rotating rotors in a back-to-back configuration. These one-piece rotors have integrally bladed propellant impellers and drive turbines, and are supported by hydrostatic bearings. The rotors are housed in two similar housings, which are assembled back-to back. The configuration is shown in Figure 1. The program consists of five tasks: (1) projkect direction; (2) systems engineering; (3) turbopump design; (4) hardware fabrication; (5) hardware assembly and delivery.
Author
Turbine Pumps; Rotors; Hydrostatics; Impellers; Systems Engineering; Turbines; Rocket Engines; Counter Rotation; Ablation

13
GEOSCIENCES

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

19970027741 Army Research Inst., Institute for Behavioral and Social Sciences, Alexandria, VA USA
Terrain Appreciation in Virtual Environments: Spatial Knowledge Acquisition, ***Jul. 1994 - Jan. 1997***
Singer, Michael J., Army Research Inst., USA; Allen, Robert C., University of Central Florida, USA; McDonald, Daniel P., University of Central Florida, USA; Gildea, John P., University of Central Florida, USA; Jan. 15, 1997; 76p; In English
Contract(s)/Grant(s): 20262785A791
Report No.(s): AD-A325520; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The U. S. Army Research Institute is investigating the requirements for using Virtual Environments (VE) in training dismounted soldiers. This experiment investigated the effects of different VE parameters on spatial knowledge acquisition by comparing learning in advanced VE, restricted VE, and standard map training. This report also provides information about VE displays, head-coupling, presence, and simulator sickness associated with spatial knowledge acquisition in VE. The activities used during the learning phase of the experiment are generic to dismounted soldier activities. The high level virtual environment (Hi-VE) condition had a Stereoscopic Head Mounted Display (HMD) with fully head-coupled gaze control, and treadmill-based movement control. The restricted VE configuration (Low-VE) used the same HMD with both gaze direction and viewpoint movement controlled by a joystick. The map training participants used expanded topographical maps and were subsequently tested in the Hi-VE configuration. Participants were all trained on the definitions and representational configuration of a reduced set of topographical features, and dismissed if unable to reach a minimum criterion. The Simulator Sickness Questionnaires (SSQ), and the Immersive Tendencies Questionnaire (ITQ) were administered before the VE experience. Participants received training in VE movement and control before the experimental training and testing was conducted. The SSQ was repeated, and a Presence Questionnaire (PQ) was administered after the experimental session.
DTIC
Virtual Reality; Computerized Simulation; Flight Simulators; Display Devices; Education; Training Devices

19970027878 Department of Energy, Assisstant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Windpower '96 - Proceedings of the American Wind Energy Association
[1996]; 682p; In English, 23 - 27 Jun. 1996, Denver, CO, USA; Sponsored by National Renewable Energy Lab., USA
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): CONF-960630-; DE97-002833; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This document consists of eighty individual papers submitted to this conference. Wind power is discussed from many perspectives ranging from non-technical to technical. The include: energy policy; the world wide market to include Europe, Asia, the Americas, marketing strategies to promote wind power, economics, turbine development, electrical systems, testing, advanced components, utility issues, resource assessment, aerodynamics studies, wind-diesel systems, and dynamic modeling. Individual papers are indexed separately on the Energy Data Base.
DOE
Conferences; Windpower Utilization; Aerodynamics

14
LIFE SCIENCES

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

19970027508 National Defence Research Establishment, Div. of Command and Control Technology, Linkoeping, Sweden
Decision-Making Using Temporal Reasoning and Situation Adapted Sensor Control ***Topical Report Beslutsfattande med Anvaendning av Temporal Omvaerldsuppfattning och Situationsanpassad Sensorstyning***
Stroemberg, Dan, National Defence Research Establishment, Sweden; Sep. 1996; ISSN 1104-9154; 33p; In English
Report No.(s): PB97-144547; FOA-R-96-00302-3.4-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report consists of three parts: state of the art of Pilot's Associate; the temporal decision support paradigm in avionics, and sensor management to relieve pilot's work load. The purpose of the American Pilot's Associate research program was to apply artificial intelligence to aid aircraft pilots, creating intelligent assistance. The second part of the report covers important background to the temporal decision support paradigm that is currently under development. The third part deals with the problem of managing all sensor systems.
NTIS
Aircraft Pilots; Decision Making; Automatic Control; Measuring Instruments; Pilot Performance; Artificial Intelligence

19970028358 Civil Aeromedical Inst., Oklahoma City, OK USA
Use of Object-Oriented Programming to Simulate Human Behavior in Emergency Evacuation of an Aircraft's Passenger Cabin ***Final Report***
Court, M. C., Oklahoma Univ., USA; Marcus, J. H., Civil Aeromedical Inst., USA; Aug. 1997; 14p; In English
Report No.(s): DOT/FAA/AM-97/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Progress in the development of a computerized aircraft cabin evacuation model is described. The model has a two-fold purpose (1) to supplement current certification tests that use human subjects, and (2) to serve in the investigation of aircraft accidents as a reconstruction tool and identify factors influencing survival of passengers. For the model to be a valid predictive tool when simulating aircraft accidents, the toxic and debilitating effects on passenger behavior of fire and smoke must be modeled. Other aircraft cabin evacuation models use an expert system/rule-based approach to simulate these effects. The work described here presents an object-oriented approach to modeling human behavior in aircraft cabin evacuations. Object-oriented programming (OOP) lends itself to the modeling of complex systems. OOP's foundation is modularity. OOP allows a one-to-one correspondence with the physical world, and thus, eases the burden of model validation. Validation is critical to the successful use of a model as a predictive tool and involves testing to ensure that the model accurately reflects the behavior of a real system. Easing model validation is of particular importance since the real system's environment is hazardous, and performing any tests on the real system is either impossible or not repeatable. The result of this work will help to expand the simulation's capabilities in improved passenger queuing analysis by allowing the incorporation of human behavior into class objects.
Author
Object-Oriented Programming; Human Behavior; Passengers; Aircraft Accidents; Computerized Simulation; Emergencies; Predictions

19970028377 Naval Postgraduate School, Monterey, CA USA

Aircrew Centered System Design Analysis Considerations for The MH-53E Helicopter

Gibson, Gregory J., Naval Postgraduate School, USA; Dec. 1996; 140p; In English

Report No.(s): AD-A326856; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

An analysis was made of the aircrew centered system design aspects for the MH-53E helicopter. These aircrew centered design features included changes in the cockpit, aircraft weight, and drag coefficient. The cockpit evaluation compared the current MH-53E cockpit configuration with design changes currently under review by the Navy. This evaluation suggests that the proposed cockpit design display change may reduce aircrew load stress and improve mission effectiveness. Changes in subsystem components may either increase or decrease the weight of the MH-53E. Similarly, changes in crew tasking may result in a need for more or less fuselage volume size. Therefore, the sensitivity of MH-53E performance to generic changes in weight and drag was investigated in order to make source assessment of equipment and crew tasking changes upon MH-53E mission effectiveness. DTIC

Helicopter Design; Cockpits; Aerodynamic Coefficients; Design Analysis; Flight Crews; Helicopters; Systems Engineering; Human Factors Engineering

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19970028182 Army War Coll., Carlisle Barracks, PA USA

Decision from the Sky: Airpower as a Decisive Instrument of National Power ***Topical Report***

Gann, Timothy D., Army War Coll., USA; Apr. 15, 1997; 42p; In English

Report No.(s): AD-A326954; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper explores airpower as a decisive instrument of national power and examines the key impediments that prevent it from reaching its full potential. The paper begins by examining the use of the term 'decisive' within the defense community and offers a definition. Next, three examples of the decisive use of airpower are explored: the Berlin Airlift, Operation Linebacker II, and Operation Deliberate Force. Emphasis is placed on how each operation helped to achieve the stated political objective. Succeeding sections include a look at the evolution of US airpower thinking, current and projected state of airpower capability and role of the decisionmaker in strategy development.

DTIC

Air Transportation; Decision Making; Rescue Operations

19970028379 General Accounting Office, Washington, DC USA

Report to the Honorable Dale Bumpers, US Senate. Tactical Aircraft: Restructuring of the Air Force F-22 Fighter Program

Jun. 1997; 31p; In English

Report No.(s): AD-A327625; GAO/NSIAD-97-156-F-22; B-276815; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The F-22 is an air superiority aircraft with a capability to deliver air-to-ground weapons. Advanced technology being developed for the F-22 makes it a very ambitious, challenging program, probably the most challenging program in recent times, according to the Department of Defense's (DOD) Defense Science Board. The most significant features include supercruise, the ability to fly efficiently at supersonic speeds without using fuel-consuming afterburners; low observability to adversary systems that have the objective of locating and shooting the F-22; and integrated avionics to significantly improve the pilot's battlefield awareness. The F-22 program began the engineering and manufacturing development phase of the acquisition process in 1991. According to the fiscal year 1997 President's budget, the Air Force planned to develop the F-22 and build nine development aircraft, two nonflying structural test articles, and four preproduction aircraft at a cost of about $17.4 billion. The Air Force planned to buy 76 aircraft during the LRIP phase of the program and 362 aircraft during the full-rate production phase. The total estimated production cost was about $48 billion.

DTIC

F-22 Aircraft; Observability (Systems); Defense Program; Avionics; Aircraft Structures; Afterburning

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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.

19970027894 NASA Langley Research Center, Hampton, VA USA
XV-15 Structural-Acoustic Data
Lyle, Karen H., Army Research Lab., USA; Jun. 1997; 28p; In English
Contract(s)/Grant(s): RTOP 538-03-14-01
Report No.(s): NASA-TM-112855; NAS 1.15:112855; ARL-TR-1423; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tiltrotor aircraft are a potentially viable means of intercity travel. The tiltrotor is able to transport passengers relatively quickly from the center of a city to destinations within a 300-mile radius. For such vehicles to be commercially viable, the interior noise and vibration levels must be acceptable to the passengers. A review of the literature revealed very little structural-acoustic data related to the tiltrotor. For this reason, structural-acoustic measurements were taken aboard an XV-15 tiltrotor. The six flight conditions included five in level flight, nominally 140-220 knots, for airplane mode (nacelle at 0 degrees) and one out-of-ground-effect (OGE) hover (nacelle at 90 degrees). The flight test measurements included nine exterior surface pressures, five structural accelerations, and two interior pressures. These sensors were located near the tip path plane on the port side of the aircraft. One minute of data was acquired at each condition. The data is presented as time histories, autospectra, coherence functions, and cross-spectra. In general, for level flight, the measured data showed very little effect of forward flight speed except to change the amplitude of the response; however, the character of the response was found to be dependent on spatial location. In contrast, in the hover mode the spatial location had very little effect on the character of the response. Additionally, the report highlights: the coherence between the transducer data and the rotor tach signal; and transfer function calculations between the exterior pressures.
Author
Tilting Rotors; Acoustic Measurement; Flight Tests; Ground Effect (Aerodynamics); Noise Intensity; Hovering; Nacelles; XV-15 Aircraft; Acoustic Properties; Flight Conditions; Horizontal Flight

17
SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19970027745 Central State Univ., Psychology Dept., Wilberforce, OH USA
Development of a Searchable Database on General Aviation Propulsion
Ikomi, Philip, Central State Univ., USA; HBCUs Research Conference Agenda and Abstracts; May 1997, pp. 11; In English; Also announced as 19970027742; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Central State University, under NASA sponsorship, is developing a user-friendly, business-oriented, computer-based database of literature related to key technological developments that could impact the field of general aviation propulsion. The database draws on a broad range of information sources, and is intended to serve the needs of general aviation propulsion equipment and component manufacturers seeking information which will help them to improve their existing products or develop new products to serve the needs of this market. Information to guide the design of the database was developed through a telephone and mail survey of relevant attributes of companies in the general aviation propulsion industry. Examples of the types of information gathered include: areas of company technical information interest, favored information sources, research needs and objectives, available computer hardware and software resources, etc. As one result of the survey, Microsoft(reg) ACCESS(copyright) was selected as the application to house the database. The database design was developed by students and faculty at Central State. One group of students is currently actively gathering and entering literature citations into the database. A second group is continually testing and upgrading the operational aspects of the database. The database archives information from books, journal articles, conference proceedings, popular articles and other information sources. The archived data includes key fields related to authors (name, address, phone/fax, etc.), titles and subtitles of articles, information source (type, name, volume and issue numbers, pages, date of publication, etc.) key words, abstracts/summaries, author's affiliation, and publisher. Queries based on any of the fields, including Boolean combinations, are supported. The database will be available for distribution by mid-year 1997, and will be provided

to industrial firms and schools, including selected high schools. Plans to allow periodic updating of the database via the Internet are being considered.
Author
General Aviation Aircraft; Data Bases; Technologies; Propulsion

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Report Documentation Page

1. Report No. NASA SP-7037 (359)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Aeronautical Engineering A Continuing Bibliography (Supplement 359)		5. Report Date October 17, 1997 6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No. 10. Work Unit No.
9. Performing Organization Name and Address NASA Scientific and Technical Information Program Office		11. Contract or Grant No.
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681		13. Type of Report and Period Covered Special Publication 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report lists reports, articles and other documents recently announced in the NASA STI Database.

17. Key Words (Suggested by Author(s)) Aeronautical Engineering Aeronautics Bibliographies	18. Distribution Statement Unclassified – Unlimited Subject Category – 01

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	46	A03/HC

For sale by the NASA Center for AeroSpace Information, 800 Elkridge Landing Road, Linthicum Heights, MD 21090-2934