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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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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
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AERONAUTICAL ENGINEERING

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DECEMBER 26, 1997

01 AERONAUTICS

19970040543 Instytut Lotnictwa, Warsaw, Poland

Transactions of the Institute of Aviation Scientific Quarterly, Nos. 149-150 *Prace Instytutu Lotnictwa, 149-150*

1997; ISSN 0509-6669; 276p; In Polish; Also announced as 19970040544 through 19970040568; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The following general concepts in helicopters and aviation are presented: Problem Topics; Perspectives; General Topics; Flight Mechanics; Aeroelasticity; Design and Structure; and Aeromechanics.

CASI

Aeronautics; Aeronautical Engineering; Civil Aviation; Military Aviation; Helicopters; Helicopter Design

19970040544 Polish Aviation Works, Swidnik, Poland

Nowdays and Tomorrow of Helicopters Production in WSK Swidnik *Dzis I Jutro Produkcji Smiglowcow W Wsk PzL-Swidnik Sa*

Kochanowski, Ryszard, Polish Aviation Works, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 7-12; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Problems connected with the development of new design and manufacturing of helicopters in WSK Swidnik are described. Subjects are presented in the wide range of factors conditioning rapid progress and success in the fields of helicopters. Current work conducted in WSK-Swidnik, plans for the future, cooperation with universities and different institutions in Poland, cooperation with collaboratives in Poland and abroad and a problem of education of helicopter engineers are described. Problems connected with main buyers of helicopters and activities of WSK-Swidnik to fulfill their expectations are presented also.

Author

Engineers; Helicopters; Manufacturing; Helicopter Design; Product Development

02 AERODYNAMICS

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

19970040557 Warsaw Technical Univ., Inst. Techniki Lotniczej i Mechaniki Stosowanej, Poland

Mathematical Models of Rotor Blades in the Light of Analytical Continuum Mechanics Conceptions *Modele Matematyczne Lopat Wirnika w Swietle Koncepcji Mechaniki Analitycznej Osrodkow Ciaglych*

Pietrucha, Jozef, Warsaw Technical Univ., Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 142-156; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The paper concerns problems of modeling of helicopter rotor blades for the purposes of dynamic characteristics modifications, particularly taking into account synergetic effects. Here by modeling we understand the derivation of equations of the blade motion. A brief review of physical models of blades is made. Main features of analytical continuum mechanics are presented not only as the base of mathematical modeling, but also as a guide in the study of literature on the subject. In the course of it, the key role of the deformation theory is accentuated. Finally, the most important mathematical models of rotor blades are presented.

Author

Continuum Mechanics; Dynamic Characteristics; Mathematical Models; Continuum Modeling; Rotor Blades (Turbomachinery)

19970040558 Instytut Lotnictwa, Warsaw, Poland

Simulation of the Influence of Higher Harmonic on Helicopter Main Rotor Loads *Symulacyjne Badanie Wplywu Sterowania Wyzsza Harmoniczna na Obciazenia Wirnika Nosnego Smiglowca*

Stanislowski, Jaroslaw, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 157-176; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The goal of the paper is to testify, with the help of computer simulation, the possibility of diminishing a helicopter's vibration as a result of introducing an additional control of the higher harmonic of the main rotor blade angle. A structure composed of elastic axes with dense masses placed along them was used as a physical model of rotor blades. A mathematical model consists of equations of elastic axis movement derived from second order Lagrange equations. Bending and torsional deformations of elastic axes are included. The equations of motion were solved with Galerkin's method. Changes of the load levels forcing the helicopter's vibration for a rotor with an elastic suspension of blades were tested as an effect of flight speed and additional channel (a cyclic or a general pitch). Reduction of the variable loads of a shaft depends highly on amplitude and phase shift between conventional control and a higher harmonic of the blade pitch. An unfavorable choice of additional control parameters may cause the increase of shaft loads. Together with steady states of control a failure of an additional control system has been examined using simulation. On the basis of the obtained result one may ascertain that introducing an additional control blade setting angle enables one to diminish vibrations of the helicopter by the reduction of changeable loads of the main rotor shaft. The proper selection of higher harmonic control parameters enables one to diminish the loads of the shaft to the level of 10% of the standard load value. The structure of the program packet enables extension of the numerical model using the optimizing procedure for several control channels or introducing a model of turbulence. It seems that the obtained results may be useful in continuation of work with higher harmonic control in a widened subject scale including preparation of a wind tunnel test stand or design of a new rotor control system.

Author

Aerodynamic Loads; Computerized Simulation; Harmonic Control; Vibration Damping; Galerkin Method; Helicopter Control; Rotary Wings

19970040670 San Diego State Univ., Dept. of Aerospace Engineering and Engineering Mechanics, San Diego, CA USA

Cellular Structures in the Flow Over the Flap of a Two-Element Wing

Yon, Steven A., San Diego State Univ., USA; Katz, Joseph, San Diego State Univ., USA; 1997; 15p; In English

Contract(s)/Grant(s): NCA2-786

Report No.(s): NASA/CR-97-112613; NAS 1.26:112613; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flow visualization information and time dependent pressure coefficients were recorded for the flow over a two-element wing. The investigation focused on the stall onset; particularly at a condition where the flow is attached on the main element but separated on the flap. At this condition, spanwise separation cells were visible in the flow over the flap, and time dependent pressure data was measured along the centerline of the separation cell. The flow visualizations indicated that the spanwise occurrence of the separation cells depends on the flap (and not wing) aspect ratio.

Author

Aerodynamic Stalling; Time Dependence; Rectangular Wings; Angle of Attack; Pressure Ratio; Flow Visualization

19970040807 San Diego State Univ., Dept. of Aerospace Engineering and Engineering Mechanics, San Diego, CA USA

Study of the Unsteady Flow Features on a Stalled Wing

Yon, Steven A., San Diego State Univ., USA; Katz, Joseph, San Diego State Univ., USA; 1997; 11p; In English; 28th; 4th; Fluid Dynamics Conference, 29 Jun. - 2 Jul. 1997, Snowmass Village, CO, Snowmass Village, CO, USA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCA2-786

Report No.(s): NASA/CR-97-112612; NAS 1.26:112612; AIAA Paper 97-1927; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The occurrence of large scale structures in the post stall flow over a rectangular wing at high angles of attack was investigated in a small-scale subsonic wind tunnel. Mean and time dependent measurements within the separated flow field suggest the existence of two distinct angle of attack regimes beyond wing stall. The shallow stall regime occurs over a narrow range of incidence angles (2-3 deg.) immediately following the inception of leading edge separation. In this regime, the principal mean flow structures, termed stall cells, are manifested as a distinct spanwise periodicity in the chordwise extent of the separated region on the model surface with possible lateral mobility not previously reported. Within the stall cells and on the wing surface, large amplitude pressure fluctuations occur with a frequency much lower than anticipated for bluff body shedding, and with minimum effect in

the far wake. In the deep stall regime, stall cells are not observed and the separated region near the model is relatively free of large amplitude pressure disturbances.

Author

Unsteady Flow; Angle of Attack; Subsonic Wind Tunnels; Rectangular Wings; Flow Distribution; Separated Flow; Frequencies; Aerodynamic Stalling

19970040814 Computer Sciences Corp., Hampton, VA USA

The Development of a Tool for Semi-Automated Generation of Structured and Unstructured Grids about Isolated Rotorcraft Blades

Shanmugasundaram, Ramakrishnan, Computer Sciences Corp., USA; Garriz, Javier A., Computer Sciences Corp., USA; Samareh, Jamshid A., Computer Sciences Corp., USA; 1997; 10p; In English; Technical Specialists' Meeting for Rotorcraft Acoustics and Aerodynamics, 28-30 Oct. 1997, Williamsburg, VA, USA

Report No.(s): NASA/TM-97-206146; NAS 1.15:206146; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The grid generation used to model rotorcraft configurations for Computational Fluid Dynamics (CFD) analysis is highly complicated and time consuming. The highly complex geometry and irregular shapes encountered in entire rotorcraft configurations are typically modeled using overset grids. Another promising approach is to utilize unstructured grid methods. With either approach the majority of time is spent manually setting up the topology. For less complicated geometries such as isolated rotor blades, less time is obviously required. This paper discusses the capabilities of a tool called Rotor blade Optimized Topology Organizer and Renderer (ROTOR) being developed to quickly generate block structured grids and unstructured tetrahedral grids about isolated blades. The key algorithm uses individual airfoil sections to construct a Non-Uniform Rational B-Spline (NURBS) surface representation of the rotor blade. This continuous surface definition can be queried to define the block topology used in constructing a structured mesh around the rotor blade. Alternatively, the surface definition can be used to define the surface patches and grid cell spacing requirements for generating unstructured surface and volume grids. Presently, the primary output for ROTOR is block structured grids using O-H and H-H topologies suitable for full-potential solvers. This paper will discuss the present capabilities of the tool and highlight future work.

Author

Structured Grids (Mathematics); Unstructured Grids (Mathematics); Rotary Wing Aircraft; Rotors; Computational Fluid Dynamics; Algorithms; Airfoil Profiles

19970041037 Virginia Polytechnic Inst. and State Univ., Aerospace and Ocean Engineering, Blacksburg, VA USA

A CFD/CSD Interaction Methodology for Aircraft Wings Final Report

Bhardwaj, Manoj K., Virginia Polytechnic Inst. and State Univ., USA; Oct. 1997; 211p; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC2-5097

Report No.(s): NASA/CR-97-206181; NAS 1.26:206181; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

With advanced subsonic transports and military aircraft operating in the transonic regime, it is becoming important to determine the effects of the coupling between aerodynamic loads and elastic forces. Since aeroelastic effects can contribute significantly to the design of these aircraft, there is a strong need in the aerospace industry to predict these aero-structure interactions computationally. To perform static aeroelastic analysis in the transonic regime, high fidelity computational fluid dynamics (CFD) analysis tools must be used in conjunction with high fidelity computational structural fluid dynamics (CSD) analysis tools due to the nonlinear behavior of the aerodynamics in the transonic regime. There is also a need to be able to use a wide variety of CFD and CSD tools to predict these aeroelastic effects in the transonic regime. Because source codes are not always available, it is necessary to couple the CFD and CSD codes without alteration of the source codes. In this study, an aeroelastic coupling procedure is developed which will perform static aeroelastic analysis using any CFD and CSD code with little code integration. The aeroelastic coupling procedure is demonstrated on an F/A-18 Stabilator using NASTD (an in-house McDonnell Douglas CFD code) and NASTRAN. In addition, the Aeroelastic Research Wing (ARW-2) is used for demonstration of the aeroelastic coupling procedure by using ENSAERO (NASA Ames Research Center CFD code) and a finite element wing-box code (developed as part of this research).

Author

Computational Fluid Dynamics; Dynamic Structural Analysis; Aeroelasticity; Nonlinear Systems; Finite Element Method; Dynamic Response; Aerodynamics; Aerodynamic Loads

19970041274 Old Dominion Univ., Dept. of Mechanical Engineering, Norfolk, VA USA

Drag Reduction on Circular Cylinders by Ejecting Jet from Rear Stagnation Region *Progress Report, Period ending 30 Jun. 1997*

Atsuchi, S., Old Dominion Univ., USA; Tiwari, S. N., Old Dominion Univ., USA; Nov. 1997; 117p; In English

Contract(s)/Grant(s): NCC1-232

Report No.(s): NASA/CR-97-206329; NAS 1.26:206329; ODURF-163631; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Extensive work in the field of drag reduction has been done in the past. However, this field of study is highly desirable today because of various high-speed research programs. The present study attempts to investigate the feasibility of drag reduction on a cylinder by flow injection from the rear stagnation region. A two-dimensional circular cylinder at Reynolds number 1×10^5 with a jet ejected from its tail is selected as a physical model. To tackle this problem, a numerical simulation as well as an experimental approach were used. Despite the recent development of computational fluid dynamics (CFD), computing a flow around a cylinder at a high Reynolds number is still difficult and expensive because of the massive separated region. A commercial CFD code was used in the present study after the various validations and sensitive analyses were performed. Full Navier-Stokes equations were solved in this code by the finite volume method and SIMPLE algorithm. To maximize the advantage of the implicit scheme used in the CFD code and to reduce the computational time, the computation was made under the steady-state assumption. On the other hand, a static pressure measurement and a smoke wire visualization were conducted to observe the effect of the jet experimentally. It is found that the drag can be reduced by relatively small amount of the jet ejection. When the drag is decreased the pressure in the downstream portion of the cylinder is increased. This augmentation extends from the rear stagnation point to about ± 120 deg where the minimum pressure is observed, while the jet has little effect on the front portion of the cylinder. It is also found that the flow behind the cylinder becomes rather symmetric when the drag reduction is being made. The numerical results show the same trend and reinforce the experimental results.

Author

Drag Reduction; Circular Cylinders; Stagnation Point; Ejection; Computational Fluid Dynamics; Finite Volume Method; Navier-Stokes Equation; Reynolds Number; Injection; Pressure Measurement; Algorithms

19970041617 Technische Univ., Delft, Netherlands

Procedure to Apply Unsteady Transonic Viscous Corrections in Aero-Elastic Analyses Using MSC/NASTRAN

Mangunsong, M. S. R., Technische Univ., Netherlands; Dec. 1996; 86p; In English

Report No.(s): PB97-190029; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report presents an investigation of a correction procedure to include transonic and viscous effects in the aerodynamic analysis in MSC/NASTRAN. In the first stage, a set of sectional unsteady airloads including viscous and transonic effects was generated using a version of the NLR-Quasi. Three Dimensional method for a rectangular supercritical wing oscillating in pitch. In the second stage, the above set of airloads was used as input for the correction method of Rodden in combination with the MSC/NASTRAN code, in order to obtain a correction factor matrix which may be used in subsequent flutter computations. In this report both stages are described and results are compared with experimental aerodynamic data. The results indicate some improvements in the prediction of unsteady airloads by accounting for unsteady viscous and transonic effects, and demonstrate the applicability of Rodden's method to account for these effects in aerodynamic computations with the MSC/NASTRAN code.

NTIS

Aerodynamic Characteristics; Aerodynamic Loads; Aerodynamics; Aeroelasticity

19970042790 NASA Langley Research Center, Hampton, VA, USA

Rarefied-flow transition regime orbiter aerodynamic acceleration flight measurements

Blanchard, Robert C., NASA Langley Research Cent, USA; Wilmoth, Richard G., NASA Langley Research Center, USA; Lebeau, Gerald J., NASA Langley Research Center, USA; Journal of Spacecraft and Rockets; January 1997; ISSN 0022-4650; vol. 34, no. 1, pp. 8-15; In English; Copyright; Avail: Issuing Activity

Acceleration data taken for the first time from the orbital acceleration research experiment during re-entry on Space Transportation System-62 have been analyzed using in situ calibration factors. The re-entry data include the flight regime from orbital altitudes down to about 90 km, which covers the free-molecule-flow regime and the upper altitude fringes of the rarefied-flow transition into the hypersonic continuum. Ancillary flight data on Orbiter position, orientation, velocity, and rotation rates have been used in models to transform the measured acceleration to the Orbiter center of gravity, from which aerodynamic accelerations along the Orbiter body axes have been calculated. Residual offsets introduced in the measurements by unmodeled Orbiter forces are identified and removed. The resulting aerodynamic acceleration measurements along the Orbiter's body axis and the normal to axial acceleration ratio in the free-molecule-flow and transition-flow regimes are presented, and there is excellent agreement

when compared with numerical simulations from three direct simulation Monte Carlo codes. Also, there is good agreement with a direct comparison between the experiment flight data and independent microgravity accelerometer experiment, the high-resolution accelerometer package, which also obtained flight data on re-entry during the mission down to about 95 km.

Author (EI)

Acceleration (Physics); Aerodynamics; Calibrating; Free Molecular Flow; Hypersonics; Rarefied Gas Dynamics; Velocity; Velocity Measurement

19970042792

Monte Carlo modeling and analysis of pressure sensor measurements during suborbital flight

Gatsonis, N. A., Worcester Polytechnic, USA; Maynard, E. P.; Erlandson, R. E.; Journal of Spacecraft and Rockets; January 1997; ISSN 0022-4650; vol. 34, no. 1, pp. 83-91; In English; Copyright; Avail: Issuing Activity

The response of an ionization pressure sensor onboard a rotating suborbital spacecraft is investigated with data analysis and direct simulation Monte Carlo computations. The sensor housed in a chamber was connected to the spacecraft surface with a tube and recorded asymmetric ram-wake pressure pulses during the nonthrusting period of the mission. Three-dimensional Monte Carlo computations of the external and internal flows are performed using a domain that includes the spacecraft and the pressure apparatus. Freestream parameters correspond to altitudes between 130 and 275 km. The flux and composition at the sensor tube entrance is found to depend on the tube's orientation with the freestream during the spacecraft rotation. The predicted external pressure pulse differs from measurements because of internal flow effects. The flow structure is three-dimensional at the tube entry region and becomes axisymmetric a few tube diameters inside. The temperature, density, and surface pressure distributions inside the tube and chamber are found to depend on the tube orientation with the freestream and demonstrate the coupling between external and internal flows. The predicted pressure pulse is in good qualitative agreement with measurements. Differences in magnitude are attributed to the uncertainty in the freestream parameters.

Author (EI)

Computerized Simulation; Internal Flow; Monte Carlo Method; Pressure Measurement; Pressure Sensors; Suborbital Flight

19970042970

Forced response analysis using a two-dimensional multistage Euler aeroelastic solver

Srivastava, R., Univ of Toledo, USA; Reddy, T. S. R.; Journal of Aircraft; January 1997; ISSN 0021-8669; vol. 34, no. 1, pp. 114-119; In English; Copyright; Avail: Issuing Activity

A two-dimensional cascade aeroelastic solver for analyzing a multistage turbomachine has been developed and is reported in this paper. The required unsteady aerodynamic forces are obtained from a Euler solver based on a flux differencing scheme. The aerodynamic solver is coupled with a typical section structural model to calculate the flutter and forced response characteristics. The aeroelastic equations are integrated in time domain by sequentially solving the structural and aerodynamic equations at each time step. The unsteady aerodynamic forces generated by the front row, a rotor row, are used to calculate the response of the blades in the aft rows. Response of the blades because of forces generated by blade (self) vibration are also included in the analysis.

Author (EI)

Computational Fluid Dynamics; Differential Equations; Equations of Motion; Numerical Analysis; Radial Flow; Turbomachinery

03

AIR TRANSPORTATION AND SAFETY

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

19970040556 Komisja Wroplatowa AP, Poland

Comments on Helicopter Aircraft Crashes Specifics *Uwagi na Temat Specyfiki Smigolwcowych Wypadkow Lotniczych*

Witkowski, Ryszard, Komisja Wroplatowa AP, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 133-141; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In accordance with ICAO definition, aircraft crashes are events connected with the use of an aircraft when people are killed or seriously injured and aircraft are so seriously damaged, that they have lesser or a lack of flying ability, or when an aircraft is lost. Although helicopters are hidden in this definition in the general class of "aircraft", many events in helicopter crashes differ from fixed-wing aircraft both in reason and in accident mechanism. In the paper, these differences are illustrated with examples on the basis of statistical materials taken from the 1970s and 1980s available to the author. It is proved with examples, that helicop-

ter crashes, their reasons and mechanisms are influenced by specific design, operation and handling features of helicopters. Along with international statistics, examples of helicopter crashes in Poland are mentioned as well, especially ones in which the author could acquaint with by serving as an expert of law. The principle of referring aircraft crashes to 100,000 hours of flight was introduced in Poland recently, where the coefficient of national helicopter aviation crashes appeared alarmingly high. Moreover, helicopter crashes are investigated the same way as fixed-wing aircraft without considering their specifics. It allows to conclude that in the future it would be suitable to publish an assembly of instructions on crash specifics for people, who investigate helicopter crashes and to develop the information transfer in order to avoid repeating the same helicopter crashes. The information should include unattained crashes and their circumstances.

Author

Aircraft Accidents; Crashes; Helicopters

19970040604 National Aerospace Lab., Flight Div., Amsterdam, Netherlands

Potential Safety Benefits of Take-Off Performance Monitors (TOPM): A Review of NLR TOPM Research

Khatwa, R., National Aerospace Lab., Netherlands; Verspay, J. J. L. H., National Aerospace Lab., Netherlands; Apr. 15, 1995; 20p; In English; European Aviation Safety Seminar: Safe Flight, 28 Feb. - 2 Mar. 1995; Sponsored by Flight Safety Foundation, Inc., USA

Report No.(s): PB97-191860; NLR-TP-95155-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This investigation was aimed at assessing the flight crew decision making process for take-offs conducted both with and without a Take-Off Performance Monitor (TOPM) display. Identification of the potential safety benefits of such systems was a primary objective. The development of the algorithms and candidate displays is reviewed herein. Three piloted flight simulator evaluations were conducted to establish the relative merits of the various display formats. Overall, the results indicate all TOPM displays investigated had the potential to improve performance anomaly detection.

NTIS

Flight Safety; Takeoff; Warning Systems; Pilot Performance; Decision Making; Flight Simulation

19970040800 Bellomo-McGee, Inc., Vienna, VA USA

Intermodal Ground Access to Airports: A Planning Guide Final Report

Dec. 1996; 239p; In English

Report No.(s): PB97-189484; DOT-T-97-15; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This guide is designed to provide policy guidance, rules of thumb, data, and analytical techniques related to airport access. It has been prepared to help airport operators, local governments, metropolitan planning organizations (MPOs), consultants, and others identify airport access problems, find alternative solutions, and evaluate their effectiveness. Primarily, this guide compiles information from other sources; however, it summarizes and presents this information so that it can be used to systematically analyze airport access problems and alternative solutions. The guide focuses on providing passengers access to commercial airports from primary origins or destinations. It deals with: Off-airport roads, transit, and high-occupancy vehicle (HOV) facilities up to the airport boundary; On-airport roads, parking circulation elements, transit, and curb facilities up to the terminal entrance.

NTIS

Airports; Organizations; Boundaries; Policies; Passengers

19970040832 Federal Aviation Administration, Office of Aviation Medicine, Washington, DC USA

An Evaluation of Safety Seminars Final Report

Hunter, David R., Federal Aviation Administration, USA; Jul. 1997; 41p; In English

Report No.(s): AD-A329009; 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.

DTIC

Civil Aviation; Safety Factors

19970040958 Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Atlantic City, NJ USA
General Aviation Accidents, 1983-1994: Identification of Factors Related to Controlled-Flight-Into-Terrain (CFIT) Accidents Final Report, 1983-1994

Bud, Melissa J., Federal Aviation Administration, USA; Mengert, Peter, Federal Aviation Administration, USA; Ransom, Stephen, Federal Aviation Administration, USA; Stearns, Mary D., Federal Aviation Administration, USA; Jul. 1997; 26p; In English Report No.(s): AD-A329503; DOT-VNTSC-FAA-97-8; DOT/FAA/AAR-100-97-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this report is to describe the characteristics of general aviation (GA) accidents and to identify factors related to the occurrence of controlled-flight-into-terrain (CFIT) accidents in GA. This study used the National Transportation Safety Board (NTSB) database of 31,790 aviation accidents that occurred between 1983 and 1994, inclusive. In the NTSB aviation accident database, 86.7 percent of these accidents were GA accidents. This study analyzed the subset of accidents involving GA airplanes and helicopters to investigate possible factors in CFIT accidents to guide further analyses and design of experiments to improve pilots' ability to avoid collisions with terrain.

DTIC

Aircraft Accidents; General Aviation Aircraft; Accident Investigation

19970040971 NERAC, Inc., Tolland, CT USA

Lightning as an Aircraft Hazard: (Latest citations from the Aerospace Database)

Apr. 1997; p; In English; Page count unavailable. Supersedes PB96-858634

Report No.(s): PB97-858716; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning lightning strikes as an aircraft hazard. Aircraft designs to prevent or withstand lightning strikes, statistics on lightning strikes of aircraft, detection of strikes, remote monitoring and detection of lightning, initiation of lightning strikes by aircraft, effects of lightning strikes on aircraft structural and electronic components, modeling, and simulation of lightning strikes on aircraft are discussed. Remote detection of storms with regard to aircraft safety are discussed in another bibliography. (Contains 50-250 citations and includes a subject term index and title list.)

NTIS

Aircraft Hazards; Data Bases; Lightning; Aircraft Design; Bibliographies; Statistical Analysis

19970041050 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Aircraft Accident Report: In-Flight Loss of Control and Subsequent Collision with Terrain, Cessna 177B, N35207, Cheyenne, Wyoming, April 11, 1996

Mar. 11, 1997; 67p; In English

Report No.(s): PB97-910402; NTSB/AAR-97/02; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report explains the accident involving a Cessna 177B airplane that collided with terrain after a loss of control following takeoff from runway 30 at the Cheyenne Airport, Cheyenne, Wyoming, on April 11, 1996. Safety issues in the report include fatigue, the effects of media attention and itinerary pressure, and aeronautical decision making.

NTIS

Aircraft Accidents; Cessna Aircraft; Collisions; Aircraft Accident Investigation; Flight Control

19970041087 Crew System Ergonomics Information Analysis Center, Wright-Patterson AFB, OH USA

Will Canopy-Embedded Mild Detonating Cord Affect Aircrew Visual Performance?

Gannon, Aaron J., Crew System Ergonomics Information Analysis Center, USA; Gentner, Frank C., Crew System Ergonomics Information Analysis Center, USA; Schopper, Aaron W., Crew System Ergonomics Information Analysis Center, USA; Urzi, Russell E., Wright Lab., USA; Sep. 10, 1997; 14p; In English; SAFE Association, 10 Sep. 1997, Phoenix, AZ, USA Contract(s)/Grant(s): SPO900-94-D-0001

Report No.(s): AD-A329401; CSERIAC-TP-97-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Mild Detonating Cord (MDC) in the next generation transparency can significantly improve aircrew ejection separation times. Embedded as quarter-inch thick lines outlining the ejection zone, the MDC explosive can rapidly fracture the boundaries of this zone in half. These sections open upward and outward as the ejection seat penetrates the canopy. MDC thus eliminates the need to jettison the canopy prior to ejection, preserving the critical escape time requisite for aircrew survival. Unfortunately, aircrew visual performance may suffer as a consequence of installing MDC. Necessarily, MDC is a canopy visual obstruction that may interfere with target detection and tracking. Consequently, it is prudent to identify and characterize the potential negative visual performance consequences of installing MDC, then minimize them prior to canopy production. This paper presents the most relevant results of an extensive search and analysis of research findings suggesting possible visual performance effects associated with canopy-embedded MDC.

DTIC

Ejection Seats; Flight Crews; Target Acquisition; Tracking (Position); Survival; Ejection

19970041115 Army Safety Center, Fort Rucker, AL USA

Flightfax: Army Aviation Risk-Management Information, Volume 25

Sep. 1997; 12p; In English

Report No.(s): AD-A329124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This periodical deals with all aspects of army aviation. In this issue the emphasis is placed on an army aviator who routinely takes unnecessary risks, and eventually died in an accident. The mission was cross-country training. The aircraft took off around 0900, and the flight proceeded normally. After two stops for fuel and to eat lunch, the crew removed the doors from the OH-58 and again took off. The PC was at the controls from the left seat. As the aircraft neared a large lake, he brought the helicopter to within 5 feet of the water and began flying along the long axis of the lake at 90 to 100 knots. After about 3 minutes, the aircraft hit the water with explosive force and immediately sank. This accident graphically illustrates what happens when there is a lack of tough caring. People who knew about the unnecessary risks that the PC took and never did anything about it, and it still continues. The periodical also talks about Aircraft recording devices. There is an article on Risk Management lessons learned and one on a New firefighting system authorized (Compressed Air Foam System).

DTIC

Management Information Systems; Risk; Education; Information Management; Helicopters; Aircraft Pilots; Fire Fighting; Armed Forces (USA)

19970041129 General Accounting Office, Washington, DC USA

Aviation Safety and Security: Challenges to Implementing the Recommendations of the White House Commission on Aviation Safety and Security. Statement by Gerald L. Dillingham, Associate Director, Transportation Issues, Resources, Community, and Econom

Mar. 11, 1997; 12p; In English

Report No.(s): PB97-201289; GAO/T-RCED-97-90; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We appreciate the opportunity to share our views on the recommendations contained in the recently released report of the White House Commission on Aviation Safety and Security. The Commission's 57 recommendations broadly cover safety, security, air traffic control, and disaster response. Our testimony this morning, based on this prior work and on an analysis of the Commission's recommendations, will focus on the implementation issues relating to three areas addressed by the Commission: aviation safety, air traffic control modernization, and aviation security.

NTIS

Air Traffic Control; Flight Safety; Transportation

19970041378 Department of Transportation, Office of Aviation and International Economics, Washington, DC USA

Low Cost Airline Service Revolution

Bennett, R. D., Department of Transportation, USA; Craun, J. M., Department of Transportation, USA; Apr. 1996; 83p; In English
Report No.(s): PB97-199806; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Since its deregulation in 1978, the U.S. airline industry has been in a continual state of evolution. The two most important operational developments that have taken place in the domestic industry are the formation of hub-and-spoke networks and the recent surge in new entrant activity, particularly new airlines with low cost operating strategies. This study concentrates on new entry by airlines with low cost operating strategies. The purpose of this study are to report in detail on the very rapid growth and competitive successes of low cost carriers, the resulting consumer benefits, to identify where low cost service has not yet succeeded and the higher prices consumers are paying there as a result, and to reaffirm the Department's resolve that new entrants

to given a fair chance to compete and underscore the Department's determination to examine why low cost new entry is more successful at some cities than others.

NTIS

Commercial Aircraft; Airline Operations; Civil Aviation

19970041407 MCA Research Corp., Washington, DC USA

Airport Surface Delays and Causes: A Preliminary Analysis

Chin, David K., MCA Research Corp., USA; Goldberg, Jay, Lockheed Martin Corp., USA; Tang, Tammy, Lockheed Martin Corp., USA; Aug. 1997; 90p; In English

Contract(s)/Grant(s): NASA Order L-3676; RTOP 538-04-14-02

Report No.(s): NASA/CR-97-201721; NAS 1.26:201721; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report summarizes FAA Program Analysis and Operations Research Service (ASD-400)/Lockheed Martin activities and findings related to airport surface delays and causes, in support of NASA Langley Research Center's Terminal Area Productivity (TAP) Program. The activities described in this report were initiated in June 1995. A preliminary report was published on September 30, 1995. The final report incorporates data collection forms filled out by traffic managers, other FAA staff, and an airline for the New York City area, some updates, data previously requested from various sources to support this analysis, and further quantification and documentation than in the preliminary report. This final report is based on data available as of April 12, 1996. This report incorporates data obtained from review and analysis of data bases and literature, discussions/interviews with engineers, air-traffic staff, other FAA technical personnel, and airline staff, site visits, and a survey on surface delays and causes. It includes analysis of delay statistics; preliminary findings and conclusions on surface movement, surface delay sources and causes, runway occupancy time (ROT), and airport characteristics impacting surface operations and delays; and site-specific data on the New York City area airports, which are the focus airports for this report.

Author

Airports; Runways; Airline Operations; Commercial Aircraft; Delay

19970041571 General Accounting Office, Washington, DC USA

Testimony Before the Committee on Commerce, Science and Transportation, US Senate. Aviation Security: Immediate Action Needed to Improve Security

Aug. 1, 1996; 15p; In English

Report No.(s): PB97-189971; GAO/T-RCED/NSIAD-96-237; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Mr. Chairman, our testimony today responds to the Committee's request for information about the threat to aviation and what can be done to increase aviation security. The testimony is based on several issued GAO reports and work we have undertaken for the House International Relations Committee and Senator D'Amato. Today, we will discuss (1) the threat to aviation from terrorist attacks; (2) the roles of FAA, the airlines and airports in providing aviation security and the vulnerabilities in the existing security system; and (3) the availability of explosives detection technology and other methods used to address the threat. Finally, we want to emphasize that the Congress, the administration--including FAA and the intelligence community, among others--and the aviation industry need to agree on methods of improving financing security procedures. to the extent necessary, the international aviation community should be involved.

NTIS

Warning Systems; International Relations; Explosives Detection; Commercial Aircraft; Civil Aviation; Airline Operations

19970041588 Booz-Allen and Hamilton, Inc., Dayton, OH USA

Halon Replacement Program for Aviation: Aircraft Engine Nacelle Application, Phase 1, Operational Parameters Study Final Report, Oct. 1992 - Sep. 1993

Kollack, Mathias L., Booz-Allen and Hamilton, Inc., USA; Wheeler, Jon A., Booz-Allen and Hamilton, Inc., USA; Bennett, J. Michael, Wright Lab., USA; Caggianelli, Gregg M., Wright Lab., USA; Apr. 1997; 67p; In English

Contract(s)/Grant(s): DLA900-90-D-0424; AF Proj. HALF

Report No.(s): AD-A329255; WL-TR-95-3077-Phase-1; SURVIAC-TR-95-011-Phase-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the work performed under Phase 1 - Operational Parameters Study. of the Halon Replacement Program for Aviation for the Aircraft Engine Nacelle Application. Phase 1 is the first of a three-phase program to determine a replacement for Halon 1301 in aircraft engine nacelle applications. The objective of Phase 1 testing was to determine which parameters, in an aircraft engine nacelle fire, most influence the amount of agent needed to extinguish that fire. of the 15 parameters tested, the factors which were most influential in an engine nacelle fire were: Surface Temperature, Fuel Temperature, Pre-Burn Time, Agent,

Fuel Type, Cross-Sectional Area, and Air Temperature. These factors were recommended for inclusion in Phase 2 of the overall test program.

DTIC

Nacelles; Extinguishing; Burning Time; Aircraft Engines

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

19970040551 Polish Aviation Works, Swidnik, Poland

Dynamics and Manoeuvrability Tests of a Helicopter During NOE (Nap-of-the-Earth) Flights *Badania Dynamiki i Manewrowosci Smiglowca w Lotach NOE (Nap-of-the-Earth)*

Bubien, Wladyslaw, Polish Aviation Works, Poland; Berezanski, Jerzy, Instytut Lotnictwa, Poland; Szumanski, Kazimierz, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 79-91; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the paper results of dynamics tests of helicopters making NOE flights are described. NOE flights - on low altitude, hedgehopping with the use of field screens, called terrain facing flights, are made in agricultural and military flying during attack on ground targets and in air battles one on one (helicopter versus helicopter or helicopter versus aeroplane). In air battles, the beginning and the end of an attack are NOE flights with the use of field screens. As a result of the use of modern rocket weaponry, of "launch and forget" types among others, effective operation of helicopters is possible. The helicopters could be of the ultralight class and operate as rocket carriers in anti-tank attack or against aeroplanes, employing NOE flight techniques during attack and retreat maneuvers. However, in defense against rockets, the most efficient action is helicopter's maneuverability and its ability to use terrain screens during hedgehopping. The paper presents the results of helicopters's dynamics tests making NOE flights. The tests were made on Mi-2 and Sokol helicopters. The test includes the selected maneuvers according to NASA criteria [1] and the slalom and dolphining tests, as well terrain NOE flights (Mi-2 helicopter) in range conditions.

Author

Aircraft Maneuvers; Nap-Of-The-Earth Navigation; Terrain Following; Maneuverability; Dynamic Tests; Flight Tests; Military Helicopters; Helicopter Performance

19970040725 Civil Aeromedical Inst., Training and Organizational Research Lab., Oklahoma City, OK USA

Designing Selection Tests for the Future National Airspace System Architecture *Final Report*

Broach, Dana, Civil Aeromedical Inst., USA; Aug. 1997; 12p; In English

Report No.(s): AD-A329231; DOT/FAA/AM-97/19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Empirical data describing the mix of human abilities required to operate and maintain the future National Airspace System (NAS) architecture are presently lacking. A research program is proposed to develop the scientific tools and collect data to describe and assess the mix of abilities likely to be required of future Federal Aviation Administration air traffic control specialists, electronics technicians, and transportation system specialists. The first phase of the proposed research program is to develop a baseline profile describing the skills, abilities, and knowledge required to use, operate, and maintain the current NAS architecture. The second phase of the program is to develop and apply scientific tools to identify changes in personnel selection requirements in parallel with air traffic control and maintenance systems development. The third step in the research program is to develop, validate, and deliver new personnel selection technologies to reflect the human ability and performance needs of the future NAS architecture. The research program is designed to provide agency managers with the selection tools needed to manage personnel costs, inevitable generational change in the technical workforces, and technological innovation in air traffic control and maintenance systems.

DTIC

Personnel Selection; Air Traffic Control; Human Performance; Air Traffic Controllers (Personnel)

19970040852 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

IGS Directory

Jan. 1997; 172p; In English

Contract(s)/Grant(s): NAS7-1260

Report No.(s): NASA/CR-97-112608; JPL-Publ-97-2; NAS 1.26:112608; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The International GPS (Global Positioning System) Service for Geodynamics (IGS) supports and helps coordinate GPS data production and parameters useful for generating more accurate data products. The IGS has operated a GPS tracking system for several years. It contains more than 100 stations worldwide and has produced a combined GPS ephemeris that has become the standard for geodesists and geophysicists worldwide. IGS data and products are freely available to all, thanks to the cooperation and participation of all the IGS members. This directory provides data on the stations and provides names and contact information with personnel involved with the IGS.

Author

Directories; Geodynamics; Global Positioning System

19970040897 Federal Aviation Administration, Airworthiness Assurance Research and Development Branch, Atlantic City, NJ USA

Video Landing Parameter Survey: John F. Kennedy International Airport *Final Report*

DeFiore, Thomas, Federal Aviation Administration, USA; Micklos, Richard, Federal Aviation Administration, USA; Barnes, Terrence, Naval Air Warfare Center, USA; Jul. 1997; 63p; In English

Report No.(s): AD-A328999; DOT/FAA/AR-96/125; AAR-432; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Federal Aviation Administration William J. Hughes Technical Center is conducting a series of video landing parameter surveys at high-capacity commercial airports to acquire a better understanding of typical contact conditions for a wide variety of aircraft and airports as they relate to current aircraft design criteria and practices. The initial parameter landing survey was conducted at John F. Kennedy (JFK) International Airport in June 1994. Four video cameras were temporarily installed along the north apron of runway 13L. Video images of 614 transport (242 wide-body, 264 narrow-body, and 108 commuter aircraft) were captured, analyzed, and the results presented herein. Landing parameters presented include sink rate; approach speed; touchdown pitch, roll, and yaw angles and rates; off-center distance; and the distance from the runway to the threshold. Wind and weather conditions were also recorded and landing weights were available for most landings. Since this program is only concerned with the overall statistical usage information, all data were processed and are presented without regard to the airline or the flight number. Subsequent surveys have been conducted at Washington National runway 36 and at Honolulu International runway 8L, and these results will be reported in future technical reports.

DTIC

Airline Operations; Pitch; Roll; Design Analysis; Aircraft Design; Runways; Aircraft Landing

19970040994 Research Inst. of National Defence, Avdelningen foer Styrning, Material och, Stockholm, Sweden

Strapdown Inertial Navigation: A Report from a Seminar *Skrovfast Troeghetsnavigering; Rapport fran kurs i USA*

Arnzen, S., Research Inst. of National Defence, Sweden; Feb. 1997; 26p; In Swedish, 30 Sep. - 4 Oct. 1996, Plymouth, MA, USA
Report No.(s): PB97-164511; FOA-R-97-00421-314-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A short summary is given of the contents and experiences from a seminar on Strapdown Inertial Navigation held at the Radisson Hotel and Conference Center in Plymouth, Minnesota, USA.

NTIS

Inertial Navigation; Conferences

19970041185 Federal Aviation Administration, Washington, DC USA

Flight 2000, Path to Free Flight: Initial Program Plan

Jul. 16, 1997; 172p; In English

Report No.(s): AD-A329055; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Flight 2000 is an aggressive initiative to deploy and evaluate selected planned air traffic management systems for the year 2005 NAS. Flight 2000 integrates for the first time the requisite systems, procedures, and training necessary to provide improved NAS safety, security, productivity, capacity, and efficiency at affordable operations and maintenance costs. This integrated demonstration and validation will begin in September 2000. The purpose of the Flight 2000 Initial Program Plan is to provide the reader with a strategic overview and details available at this stage in the planning process. The information includes: an overview of the driving forces and vision behind Flight 2000; a discussion of the customers and partners; a depiction of the benefits to be realized; a delineation of the operational concepts that will deliver those benefits; a presentation of the service architecture which will support the operational concepts; details of the capabilities that enable implementation of the service architecture; strategies to

improve the certification of those technologies; a schedule for implementing these strategies; and a cost estimate for Flight 2000 based upon the above information.

DTIC

Air Traffic Control; Management Systems

19970041187 Sandia National Labs., Albuquerque, NM USA

A Summary of the GPS System Performance for STARS Mission 3

Creel, Earl E., Sandia National Labs., USA; Jan. 1997; 13p; In English

Report No.(s): AD-A328963; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the performance of the GPS system on the most recent flight of the STARS missile, STARS Mission 3 (M3). This mission was conducted under the Ballistic Missile Defense Organization's (BMDO's) Consolidated Targets Program. The USA Army Space and Strategic Defense Command (USASSDC) is the executing agent for this mission and the Department of Energy's (DOE's) Sandia National Laboratories (SNL) is the vehicle developer and integrator. The M3 flight, dually designated as the MSX Dedicated Targets 2 (MDT-2) mission occurred on August 31, 1996. This mission was conducted for the specific purpose of providing targets for viewing by the MSX satellite. STARS M3 was the first STARS flight to use GPS-derived data for missile guidance, and proved to be instrumental in the procurement of a wealth of experimental data which is still undergoing analysis by numerous scientific agencies within the BMDO complex. GPS accuracy was required for this mission because of the prescribed targeting requirements for the MDT-2 payload deliveries with respect to the MSX satellite flight path. During the flight test real time GPS-derived state vector data was also used to generate pointing angles for various down range sensors involved in the experiment. Background information describing the STARS missile, GPS subsystem architecture, and the GPS Kalman filter design is presented first, followed by a discussion of the telemetry data records obtained from this flight with interpretations and conclusions.

DTIC

Global Positioning System; Antimissile Defense; Flight Tests

19970041501 RE/SPEC, Inc., Rapid City, SD USA

Location Referencing System to Support Data Integration Final Report

Vogt, T. J., RE/SPEC, Inc., USA; Svalstad, D. K., RE/SPEC, Inc., USA; Chieslar, J. D., RE/SPEC, Inc., USA; Cooper, F. F., RE/SPEC, Inc., USA; May 1997; 197p; In English

Report No.(s): PB97-179501; RSI-0771-FR; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An investigation of South Dakota Department of Transportation (SDDOT) location referencing practices and procedures identified the functional requirements of and specific changes that should be implemented to establish a standard location referencing system that will address SDDOT data integration needs. Critical elements of the proposed location referencing system include a relational database to enhance data access and data management capabilities, coordinate transformation interfaces to enable integration of data from diverse referencing systems, and time data attribute to enable historical data management. The study identified 13 discrete location referencing systems in use, provided insight on data sharing needs and uses of location-reference data, and provided a basis for recommended changes that should be implemented to address SDDOT data integration needs. Implementation alternatives were investigated, and a recommended implementation strategy was defined. A relational DBMS was identified as the preferred DBMS based on comparative analyses of system functionality and life cycle cost and SDDOT institutional constraints.

NTIS

Data Management; Relational Data Bases; Position (Location); Data Integration; Procedures; Coordinate Transformations; Systems Integration; Transportation

19970041630 National Aerospace Lab., Amsterdam, Netherlands

PHARE Advanced Tools

Blom, H. A. P., National Aerospace Lab., Netherlands; Dean, G. C., Eurocontrol Experimental Centre, France; Le Guillou, M., Centre d'Etudes de la Navigation Aeriennne, France; Petre, E., Eurocontrol Experimental Centre, France; Voelckers, U., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Nov. 1996; 24p; In English; AGARD Symposium: Machine Intelligence in Air Traffic Management, 11 May 1993, Berlin, Germany

Report No.(s): PB97-182588; NLR-TP-93334-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Program for Harmonization of ATM Research in Eurocontrol (PHARE) has undertaken to perform the required research work necessary for the introduction of advanced ATM. Within this PHARE framework, it is the task of the PHARE Advanced

Tools (PATS) group to develop the appropriate automation and communication tools to support the air traffic controller. Although the principles for computation, prediction and control of air traffic trajectories are well developed, the various future ATM scenarios reflect different views on the way automation and communication technology can best be applied.

NTIS

Air Traffic Control; Flight Management Systems; Software Development Tools

19970042788

Rapid development of tightly-coupled GPS/INS systems

Knight, Donald T., Knight Systems, USA; IEEE Aerospace and Electronic Systems Magazine; February 1997; ISSN 0885-8985; vol. 12, no. 2, pp. 14-18; In English; Copyright; Avail: Issuing Activity

This paper addresses the question: 'Why aren't tightly-coupled GPS/INS systems everywhere, on aircraft, ships and land vehicles?' Two barriers to the widespread use are cited. One is the high cost of the INS, and the other is the cost and complexity of tightly-coupled GPS/INS integration. One of those two barriers has recently been diminished drastically with the development of a standardized software package for tightly-coupled integration. In the past, only the largest corporations have been able to pay the initial development cost for tightly-coupled GPS/INS integration, usually with funding from a large defense program. Using the new software package, integration and van test can be accomplished in a matter of days, and this has been demonstrated with field trials. The package is intended primarily for small companies that otherwise would not be able to build tightly-coupled GPS/INS systems at all. What would have been a prohibitive 3- or 4-man year development effort is reduced to a few man weeks. To accomplish an integration, the system integrator has to find a way, through serial interfaces or by some other means, to get the INS measurements of acceleration (accumulated velocity change Delta V) and attitude rate (accumulated angle change Delta theta) into a processor, along with the raw data of a GPS receiver. He also has to find a way to time tag the INS Delta V, Delta theta with GPS time. The rest of tightly-coupled GPS/INS integration is predominately accomplished in the standardized software package. That leaves the cost of the INS as the only remaining barrier to the very widespread use of GPS/INS, and invites new development of low cost inertial sensors. The focus of this paper is on the software package, and how it achieves standardization and ease of use while retaining the flexibility to produce optimal results with a variety of INS and GPS receiver types.

Author (EI)

Computer Programs; Global Positioning System; Inertial Navigation; Standardization

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970040545 Instytut Lotnictwa, Warsaw, Poland

Outline of Helicopters' Research and Design in the Institute of Aviation *Tematka Smiglowcowa w Instytucie Lotnictwa* Szumanski, Kazimierz, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 13-19; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

An outline of helicopters' research and design conducted in the Institute of Aviation in the past, present and future is represented. Facilities in the Institute and further developing works consolidating and making independent helicopters' manufacturing base in the scientific, cadre and manufacturing matter are described. GIL, BZ-4 and Trzmiel (1950s) helicopters, also the research winged version of SM-1, further Sokol (1970s) and lately the beginning of design of IS-2 are examples of design works, which have been actively conducted in the Institute of Aviation. Laboratory aided design of helicopters is devoted to the main and tail rotors investigation and to an attempt to design the helicopter simulation. More important research work includes models of hingeless rotors in wind tunnels and a computer aided manufacturing system for helicopters by creating specialized computing programs. Research in the general utility laboratories, such as: durability laboratory, resonance laboratory and engine test benches were conducted. Wide range of helicopters flight tests concerning helicopters' operation and flight dynamics tests in extreme flying conditions are noted. Further progress of helicopters in the following subject matter in the Institute of Aviation are being planned, such as: construction of a pilotless helicopter in the limits of leading BSL system, construction of helicopters simulators, construction of main rotors and new generation tail rotors, construction of safe cockpits and works in the domain of modern helicopters avionics. An improvement of cadre educational systems for the helicopter sector is necessary as well.

Author

Computer Aided Manufacturing; Helicopters; Computerized Simulation; Computer Aided Design; Applications Programs (Computers)

19970040549 Instytut Lotnictwa, Warsaw, Poland

Quiet Rotorcraft "Ciche" Wiroplaty

Stepniewski, Wieslaw Z., Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 43-65; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this report implications of the low tip speed design philosophy are studied with respect to rotorcraft capable of fast cruise speed, roughly 50% higher than that of conventional helicopters. This is done by examining effects of tip speeds on some performance and structural-weight aspects of compounds, based on the following concepts: (1) Cold-jet-driven rotor in hover and transition flight, autorotating in cruise; (2) Single rotor configuration with shaft-driven rotor in all regimes of flight; and (3) Synchropter, incorporating the ABC principle.

Author

Tip Speed; Helicopters; Rotor Dynamics; Rotors; Aerodynamic Noise; Noise Reduction

19970040552 Military Univ. of Technology, Warsaw, Poland

Helicopter Flight Dynamics Modelling in the Conditions of Deep Dynamic Stall of Main Rotor *Modelwanie Dynamiki Lotu Smiglowca w Warunkach Głębokiego Przeciagniecia Dynamicznego Wirnika Nosnego*

Sibiński, Krzysztof, Military Univ. of Technology, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 92-109; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Executing different tasks by contemporary helicopters needs maximum application of their flight abilities. During flight, very often various flight parameters reach their maximum value (power, speed and overloads, circumcritical rotor angles of attack). Maneuvers are connected with many curiosities, including unforeseen helicopter behavior. Reflexive, improper actions of a pilot may cause an accident. It is especially dangerous during combat tasks, which are usually performed at low altitudes (a height of 3 or 5 m). At small and medium altitudes a pilot usually has some time for a correction of an improper action, but during a flight near the ground (so called Nap-of-the-Earth flight), he hasn't any time. That's why admittance to flights near the ground need not only operating boundaries recognition (limiting overloads, maximum flight speed, rotor's critical angles of attack and so on), but also knowing what could happen if these boundaries are exceeded. During control of a helicopter near boundary of flight parameters, one of the main causes of exceeding these boundaries is a sudden displacement of the different control devices (control stick and pitch and power lever) causing the dynamic stall of a rotor. In the event of deep dynamic stall of the rotor, so called "unintentional helicopter motion" can arise. This comprehension means a kind of helicopter motion, during which the helicopter doesn't follow the usual displacements of flying control devices to counterpart this motion. Sometimes motion like this is incorrectly called "uncontrollable motion". As a matter of fact the helicopter has limited maneuverability in conditions like these, but the pilotage technique differs fundamentally from a common one. Examples of unintentional helicopter motions are: a mushing, a leap, an unintentional half-roll of the loop, a bunt and a spin of helicopter. Problems connected with the helicopter flight modeling in the above mentioned conditions are represented in the paper. Some flight instabilities and unsteadiness and the aerodynamic phenomena accompanying deep stall of a blade profile and their usefulness in the modeling of the limiting helicopter flight conditions are described.

Author

Aerodynamic Stability; Aerodynamic Stalling; Boundaries; Flight Conditions; Helicopters; Nap-Of-The-Earth Navigation; Rotor Dynamics; Dynamic Models; Aircraft Models

19970040554 Instytut Lotnictwa, Warsaw, Poland

Dynamic and Operation Properties of Ultralight Helicopters on the Basis of Robinson R-22 Helicopter *Własności Dynamiczne i Eksploatacyjne Smigłowców Ultralekkich na Przykładzie Smigłowca Robinson R-22*

Berezanski, Jerzy, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 117-121; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Flight tests of an ultralight helicopter are described, which has configuration and pilotage properties noticeably different than the ones used in Poland up until now. Helicopters of this class successfully operate on western markets, because of their cheapness, serviceability and smart view. An example is Robinson R-22. In spite of opinions charging that it is a difficult helicopter to fly and that it has been involved in numerous accidents, it has performed under the condition of exact compliance with recommended pilotage techniques and maintained a high discipline level during flight tasks. The difference in pilotage properties include high control sensitivity, different propulsion characteristics (piston engine), opposite asymmetry of configuration and the ease in which it can be led into dangerous flight conditions have been the fundamentals of our own dynamic and pilotage properties recognition.

Results of R-22 tests with exact attention toward sources and character of pilotage differences in the eye of service conditions are presented.

Author

Flight Tests; Light Helicopters; Dynamic Tests; Dynamic Characteristics; In-Flight Monitoring

19970040555 Instytut Lotnictwa, Warsaw, Poland

Modelling and Research of Flight Properties for Single Rotor Helicopters *Modelowanie i Badania Własności Lotnych Śmigłowców Jednowirnikowych*

Bramski, Stefan, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 122-132; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A certain sequence of works connected with evaluations of technological progress and identification of dynamic and pilotage properties of single rotor helicopters made in the Institute of Aviation during recent years is presented. In the course of these works the sense of purpose of the use of automatic control for development of Mi-2 helicopter flight properties has been analyzed. The feasibility studies with respect to the helicopter flight simulator design have also been done. The described works have had an experimental and a theoretical character. Flight tests have included the determination of static and dynamic characteristics of Mi-1 and Mi-2. In the case of the Mi-2 helicopter, the pilotage properties have been changing due to the wide range of changes in the configuration of underslung loads during tests. The helicopter pilotage properties have been evaluated according to the Cooper-Harper scale. Static characteristics and amplitude-phase characteristics of longitudinal and lateral control channels have been elaborated and measured. Many different analogue models transforming the dynamics of helicopter motion both in basic configuration and with underslung loads have been tested. An influence of selected helicopter design parameters and an influence of atmospheric turbulence on helicopter's pilotage properties were tested. Dynamic properties of a propeller system coupled with the main and the tail rotors have also been modeled. As a result of new experiences a new method of evaluation of flight properties based on the observation of a field of control signal amplitudes has been proposed. We had started to elaborate an experimental flight simulator with the simplified visualisation of the ground and pilotage and navigation devices modelled on a few screens. Helicopter's motion relative to ground has been observed on an electronic map indicator. A separate direction of work was an analysis of the influence of helicopter parameters to the effectiveness of operation costs. Also prognostic work in the domain of helicopter technology development was initiated. The paper has been intended to be a kind of a guide on unpublished domestic issues of the Institute of Aviation, which, in the author's opinion, may be helpful in further works for development of helicopter technology.

Author

Dynamic Characteristics; Flight Simulators; Flight Tests; Helicopters; Feasibility Analysis; Static Characteristics; Aircraft Models; Analog Simulation

19970040561 Instytut Lotnictwa, Warsaw, Poland

Selected Problems of Helicopter Resonance Tests *Wybrane Zagadnienia Badan Rezonansowych Śmigłowców*

Krzymien, Wieslaw, Instytut Lotnictwa, Poland; Wisniowski, Witold, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 192-196; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

An analysis of helicopter vibration properties takes a significant part in the process of design and development. Vibrations appearing during operation have a fundamental influence on the helicopter service life and on safety and comfort. Helicopter's vibration identification is based on results of its resonance tests. Problems discussed here are connected with resonance tests of: main and tail rotor blades; a helicopter's structure; control systems; and a helicopter's undercarriage (on-ground resonance). Some results of resonance investigations measured for Mi-2M and W-3 Sokol helicopters are included and discussed in detail.

Author

Helicopters; Resonance Testing; Rotary Wings; Helicopter Tail Rotors; Resonant Vibration

19970040562 Instytut Lotnictwa, Warsaw, Poland

Loadings of PZL-Sokol Helicopter's Design Assemblies in Air Show Flights *Obciążenia Zespołów Konstrukcyjnych Śmigłowca PZL-Sokol w Lotach Pokazowych*

Władysław, Buben, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 197-204; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In April 1995 measurements of loading on the helicopter's PZL-Sokol rotor, tail rotor blade and tail boom have been conducted. They were made during aerobatic maneuvers, when helicopter's maneuverability and dynamic properties were demonstrated. In situations like this, some limits of maneuverability included in the Flight Manual during flight may be exceeded. The flight tests included a wide range of possible aerobatic maneuvers with different take-off mass and were conducted by two pilots

one after another. Flight tests can help in selecting these flight phases, in which the level of loading exceed the nominal level corresponding to safe, typical operation. Generally such approaches refer to elements of tail rotor and main rotor blades. The process of testing and the results of measurements are described from the point of view of helicopter's fatigue strength. The results indicate that during air show flights some operation limits can be exceeded under the condition that the maneuvers resulting in decreased fatigue strength will be avoided.

Author

Flight Tests; Maneuverability; Aircraft Maneuvers; Aerodynamic Loads; Helicopter Performance; Helicopter Tail Rotors; Rotary Wings; Structural Analysis

19970040566 Warsaw Technical Univ., IPBM, Poland

Calculation of Composite Design with the Use of FEM *Obliczanie Konstrukcji Kompozytowych z Zastosowaniem MES*

Freundlich, Jan, Warsaw Technical Univ., Poland; Jachimowicz, Jerzy, Instytut Lotnictwa, Poland; Osinski, Jerzy, Warsaw Technical Univ., Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 235-244; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The potential to use the finite element method in calculations of composite designs employed in aviation with special attention paid to a problem of system stiffness is presented. Special layer finite elements are described (on the example of MIT elements from ADINA systems). The modeling of damping properties and dynamics of composite systems were especially considered in detail. As an example, the vibrations of control panels were discussed. In the analysis, the elastic and dissipative properties of orthotropic materials are included.

Author

Finite Element Method; Stiffness; Composite Materials; Aircraft Design; Dynamical Systems; Computerized Simulation; Orthotropism

19970040567 Military Univ. of Technology, Inst. Techniki Lotniczej, Warsaw, Poland

Selected Problems of 3-D Helicopter Dynamics Including Autopilot System *Wybrane Problemy Numerycznej Symulacji Dynamiki Przestrennego Ruchu Układu Smiglowiec-Autopilot*

Kowaleczko, Grzegorz, Military Univ. of Technology, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 245-261; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

On the basis of physical and mathematical models of a helicopter described in detail in [1, 2, 3] a program for simulation of three-dimensional motion was developed. Including the motion of each rotor blade, the model enables using more complex aerodynamic flow around blades than ones previously used (vortex structure, separation and unsteadiness phenomena). In analysis, a system of seventeen non-linear ordinary differential equations was used, which may be written in general form: (1) $\dot{A}(t, X) = f(t, X, S)$ (first derivative of X) where: t = time, X = flight parameters' vector, and S = control parameters' vector. Because of a helicopters' instabilities in longitudinal motion and "around hovering" also in lateral motion, the system of equations (1) was supplemented by the rights of control for a statistical autopilot model, which take the form: (2) $\dot{s} = TX$. Amplification coefficients (elements of T matrix) have been obtained on the basis of the following system of equations: $C(\text{first derivative of } x) + Dx + Es = 0$. This system was obtained as a result of the linearization of system (1). Symbols x and s designate increments of vectors X and S . A method of defining rights of control is represented in (4). In the paper some results, which were obtained by numerical solution of equations (1, 2) are represented. An influence of aerodynamic models on the problem solution has been discussed also.

Author

Mathematical Models; Three Dimensional Motion; Computerized Simulation; Flight Simulation; Differential Equations; Helicopter Control; Applications Programs (Computers)

19970040568 Instytut Lotnictwa, Warsaw, Poland

Helicopter's On-Ground Resonance: Computer Simulation of the Phenomenon *Rezonans Naziemny Symulacja Komputerowa Zjawiska*

Szrajer, Marek, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 262-272; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

On-ground resonance may happen during helicopter's standstill or on-ground maneuvers with the main rotor rotating. A characteristic feature of this phenomenon is rapid increase of vibration amplitude corresponding to certain design parameters and rotor's rotation speed. Appearance of on-ground resonance may be a reason for helicopters destruction. In the history of helicopters many catastrophes caused by on-ground resonance have been registered. A necessity to prevent the phenomenon has appeared. Investigations and theoretical analyses proved that the essence of on-ground resonance is a feedback between helicopter

fuselage's vibrations on elastic ground and rotor blades' vibration. Moreover, blade oscillation in the rotation plane is the fundamental problem. Phase inconsistent blade vibration cause displacement of center of mass from the rotor rotation axis. A consequence of this is an inertial time variable instantaneous force applied to the propeller shaft in the plane of rotation. The force is transmitted to the helicopter's fuselage generating its vibration, which being transmitted to the rotor can initiate vibration of blades. These vibrations may increase in certain conditions, causing instability of the helicopter. Simulation techniques enable one to model research of on-ground resonance, giving certain design data in the preliminary stage of helicopter design. In the stage of prototype, research enables to foresee imminence of resonance for a helicopter during take-off and landing. The elaborated simulation program enables visualisation of helicopter vibration in the shape of time curves and an animation of helicopter motion. The assumed helicopter model enables one to simulate the selected elements failure (for example damage of any blade vibration damper or a bullet hole in a blade) and also allows to introduce nonlinearity of elastic-and-damping elements. The results of calculation have been verified with a classic method of stability research (Lapunov criterion). The obtained coincidence of instability ranges encourages the use of computer simulation for more complex on-ground resonance models. It's worth noticing, that analysis of certain specific events possible with the use of simulation techniques (failures, tolerances of design elements manufacturing, nonlinearity e.t.c.) is a serious problem using the old, traditional methods.

Author

Computerized Simulation; Ground Resonance; Resonant Vibration; Aerodynamic Stability; Rotor Body Interactions; Rotary Stability

19970040596 Defence Science and Technology Organisation, Melbourne, Australia

Comparison of Analytical Crack Growth Modelling and the A-4 Wing Test Experimental Results for a Fatigue Crack in an F-111 Wing Pivot Fitting Fuel Flow Hole Number 58

Murtagh, B. J., Defence Science and Technology Organisation, Australia; Walker, K. F., Defence Science and Technology Organisation, Australia; Sep. 1997; 18p; In English

Report No.(s): DSTO-TN-0108; AR-010-319; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331 Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report details a series of analyses which were performed to develop expertise and evaluate the performance of several fatigue crack growth prediction computer codes. The analyses were performed for the case of a fatigue crack in the lower plate of the F-111 Wing Pivot Fitting, adjacent to Fuel Flow Hole No 58. This location is a known fatigue critical location and is designated as DI 86. Fatigue cracking leading to failure occurred at this location on the A4 wing full scale fatigue test after approximately 12,200 hours of testing. An experimentally derived crack growth curve was available from the A4 wing test. Analytical models were developed using conventional LEFM software codes (Fracturesearch and AFGROW) and the analytical crack closure code, FASTRAN II. The analysis results were compared with the experimental result and also with the analysis originally performed by the manufacturer, General Dynamics. Consistent with previous work, the analytical crack closure code, FASTRAN II, produced the most consistent and accurate results.

Author

F-111 Aircraft; Crack Propagation; Fatigue (Materials); Fuel Flow; Wings; Fatigue Tests; Failure; Full Scale Tests

19970040607 National Aerospace Lab., Fluid Dynamics Div., Amsterdam, Netherlands

Advanced Propeller Performance Calculation by a Lifting Surface Method

Schulten, J. B. H. M., National Aerospace Lab., Netherlands; Apr. 24, 1995; 15p; In English; 31st; AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-12 Jul. 1995, San Diego, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NIVR-01108N

Report No.(s): PB97-191894; NLR-TP-95207-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The application of a lifting surface theory to compute the aerodynamics of advanced propellers is studied. Starting from the flow equations for a perturbed, axially subsonic flow, expressions are derived for the velocity field of a propeller. by using a Green's function representation is separated, cylindrical coordinates the radial boundary condition at the hub is naturally incorporated in the velocity field. Application of the boundary condition at the blade surfaces yields an integral equation for the unknown pressure jump distribution over the blades. A Galerkin projection transforms this integral equation into a set of linear equations that is solved numerically.

NTIS

Propellers; Subsonic Flow; Green'S FUNCTIONS; Galerkin Method; Flow Equations; Aerodynamic Loads; Propeller Blades; Prop-Fan Technology

19970040675 Mississippi State Univ., Dept. of Aerospace Engineering, Mississippi State, MS USA

Manufacturing and Cost Considerations in Multidisciplinary Aircraft Design (Research on Mathematical Modeling of Manufacturability Factors), May 1995 - Oct. 1996

Rais-Rohani, Masoud, Mississippi State Univ., USA; 1996; 28p; In English

Contract(s)/Grant(s): NAG1-1716

Report No.(s): NASA/CR-96-206151; NAS 1.26:206151; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The identification of airframe Manufacturability Factors/Cost Drivers (MFCD) and the method by which the relationships between MFCD and designer-controlled parameters could be properly modeled are described.

Derived from text

Airframes; Mathematical Models; Costs; Manufacturing; Aircraft Design

19970040711 Department of the Navy, Washington, DC USA

Submarine Launched Unmanned Aerial Vehicle

Bourlett, Steven P., Inventor, Department of the Navy, USA; Apr. 01, 1997; 8p; In English

Patent Info.: Filed 11 Sep. 1995; US-Patent-Appl-SN-528627; US-Patent-5,615,847

Report No.(s): AD-D018549; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A submarine launched unmanned aerial vehicle comprises an elongated generally cylindrically-shaped body. Tail fins are stored in the body and are self deployable to extend outwardly from the body. A booster motor is fixed to an aft end of the body and is self releasable from the body. A propeller is disposed at the aft end of the body and is self deployable to an exposed position at the aft end of the body after release of the booster motor. A propulsion motor is mounted in the body and is operative to drive the propeller. Rotors are stored in the body and are self deployable to an exposed position wherein the rotors provide lift to the vehicle.

DTIC

Remotely Piloted Vehicles; Submarines; Pilotless Aircraft

19970040734 Massachusetts Inst. of Tech., Cambridge, MA USA

System Design and Communication Subsystem of an Intelligent Projectile

Burba, Matthew K., Massachusetts Inst. of Tech., USA; Sep. 1997; 78p; In English

Report No.(s): AD-A329016; AFIT-97-022; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The aerospace industry began as a market in which manufacturers for the most part had a known paying customer for their product. Even today, Boeing has aircraft buyers waiting in line for new 737 and 777 models. The industry has not fully developed, and the need of improved technology is still very present. However, as the industry matures this luxury is quickly eroding. Like most other industries, aerospace manufacturers in the future will have to independently determine some need that is present and they could fulfill, develop a product to meet that need, and then market their finished product. This can be a daunting process when considered in light of the million and billion dollar cost of most research and development programs in the aerospace industry.

DTIC

Aerospace Industry; Communication

19970040783 Air Force Academy, Dept. of Aeronautics, CO USA

Determining the Aerothermodynamic Environment of a Generic Missile

Zuber, Matthew E., Air Force Academy, USA; Towne, Matthew C., Air Force Academy, USA; Chen, Alice J., Air Force Academy, USA; Bertin, John J., Air Force Academy, USA; Butler, Robert J., Air Force Academy, USA; Jan. 1997; 16p; In English

Contract(s)/Grant(s): AF Proj. 7621

Report No.(s): AD-A329044; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There are a variety of computer codes of varying degrees of rigor which can be used by the designers of high-speed missile systems in order to define the aerothermodynamic environment at flight conditions. It is assumed that the flow models and the numerical algorithms used in these codes have been validated by their developers. However, the users of such codes must exercise them against a quality data base, gaining knowledge of the intricacies in the use of such codes and calibrating the range of conditions over which the code can be used to predict specific parameters that are important to the design objectives without necessarily verifying that all the features of the flow are correctly modeled. Data which can be used to define the aerothermodynamic environment of a generic missile have been obtained in the Tri-Sonic Wind Tunnel (TWT) of the Aeronautical Research Center (ARC) at the U. S. Air Force Academy (USAF). Forces and moments, surface pressures, surface temperatures, and flow visualization photographs have been obtained at a Mach number of 4.28 over a range of Reynolds numbers (based on the free-stream conditions and model length) from 1×10^7 to 1.5×10^7 . The experimentally-determined parameters are compared in the present

paper with parameters computed using the Reynolds-Averaged Navier-Stokes equations in the GASP v3 code and with the aerodynamic coefficients computed using the ATAP code.

DTIC

Aerothermodynamics; Computer Programs; Missile Systems; Mathematical Models; High Speed; Flight Conditions; Fluid Flow

19970040849 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA

An Instrumentation System for Lethality Evaluation of Missile Intercept Flight Tests

Thompson, T., Johns Hopkins Univ., USA; Devereux, W. S., Johns Hopkins Univ., USA; Dougherty, J. M., Johns Hopkins Univ., USA; Jan. 1997; 11p; In English

Report No.(s): AD-A328979; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper offers arguments to support the contention that a differential GPS measurement system is required for missile intercept flight testing. Simply stated there is no other system capable of sufficiently accurate relative 3-dimensional position measurements at the point of impact or fusing to support lethality evaluations of precise weapon systems. Earlier work has proven that two-centimeter accuracy can be achieved with differential GPS in a missile intercept test environment. This paper will review the earlier work, discuss the nature of the lethality evaluation process, define the basic measurement system structure, discuss some important system tradeoffs, and identify hardware characteristics needed to implement a missile intercept evaluation system.

DTIC

Global Positioning System; Antimissile Defense; Lethality; Evaluation; Flight Tests; Interception; Trajectories

19970040902 Naval Postgraduate School, Monterey, CA USA

A Robust Methodology to Evaluate Aircraft Survivability Enhancement Due to Combined Signature Reduction and Onboard Electronic Attack

Flachsbart, Brian M., Naval Postgraduate School, USA; Jun. 1997; 70p; In English

Report No.(s): AD-A329367; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis examines the effect of combining radar signature reduction and onboard electronic attack (EA) capability on the survivability enhancement of a generic joint strike fighter (JSF). The missions of a generic JSF are examined, and a tactical scenario for an air-to-air mission and a strike mission are presented. The principles of signature reduction and EA using onboard Electronic Countermeasures (ECM) are reviewed. The effect of signature level and of jammer effective radiated power (JERP) on the ability of a radar to detect the JSF are determined individually. Finally, an approach for combining the two survivability enhancement features is described, in the context of the two tactical JSF scenarios, and an EXCEL spreadsheet program entitled RCS-JERP is developed using unclassified radar and EA equipment data. Although all of the material in this thesis and in RCS-JERP are unclassified, the principles, methodology, and spreadsheet can be applied to specific (and classified) scenarios by utilizing the specific radar data, applicable mission threat analyses, and the effectiveness of the specific EA techniques employed.

DTIC

Aircraft Survivability; Radar Signatures; Electronic Countermeasures; Data Processing; Warfare

19970040909 Naval Command, Control and Ocean Surveillance Center, Research, Development, Technology and Evaluation Div., San Diego, CA USA

Air Vehicle Diagnostic System: CH-46 Aft Main Transmission Fault Diagnosis Final Report

Church, K. G., Naval Command, Control and Ocean Surveillance Center, USA; Kolesar, R. R., Naval Command, Control and Ocean Surveillance Center, USA; Phillips, M. E., Naval Command, Control and Ocean Surveillance Center, USA; Garrido, R. C., Naval Command, Control and Ocean Surveillance Center, USA; Jun. 1997; 130p; In English

Report No.(s): AD-A329362; NRAD-TD-2966; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The goal of the helicopter drive system condition monitoring component of the Air Vehicle Diagnostic System (AVDS) program is to develop technology that will facilitate transition to 'condition-based maintenance' (CBM) for these components. The specific system requirements as stated in the AVDS Execution Plan are as follows: (1) Detect and classify gearbox faults in real time in flight. (2) Cope with variations between gearboxes. (3) Perform diagnostics in a variety of flight regimes. (4) Reduce false-alarm rates. (5) Reduce maintenance costs and facilitate transition to CBM. This report describes the performance of a system developed by NRD that meets these requirements.

DTIC

Helicopter Propeller Drive; Diagnosis; Error Analysis; CH-46 Helicopter; Transmissions (Machine Elements)

19970041007 NERAC, Inc., Tolland, CT USA

Remotely Piloted Vehicles. (Latest Citations from the NTIS Bibliographic Database)

Jul. 1997; p; In English; Page count unavailable. Supersedes PB96-869854

Report No.(s): PB97-862221; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning the design and operation of remotely piloted vehicles. Topics include control equipment and techniques, testing and evaluation of vehicles and vehicle components, and program descriptions. Military and research applications are considered. (Contains 50-250 citations and includes a subject term index and title list.)

NTIS

Bibliographies; Remotely Piloted Vehicles; Research and Development; Remote Control

19970041085 General Accounting Office, Washington, DC USA

Report to the Secretary of Defense. Unmanned Aerial Vehicles: Outrider Demonstrations Will Be Inadequate to Justify Further Production

Sep. 1997; 21p; In English

Report No.(s): AD-A329483; GAO/NSIAD-97-153; B-276890; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense (DOD) has undertaken a number of efforts in the past to acquire Unmanned Aerial Vehicles (UAVs) to complement its mix of manned and national reconnaissance assets. Our previous reviews of UAV programs have shown that DOD'S acquisition efforts to date have been disappointing.' This report discusses the Outrider, a UAV system, which DOD is acquiring through a streamlined acquisition process known as an Advanced Concept Technology Demonstration (ACTD). We examined whether (1) DOD is applying lessons learned from prior UAV programs to the Outrider and (2) the Outrider is likely to meet user needs. UAVS are pilotless aircraft, controlled remotely or by preprogrammed on-board equipment. The Outrider system consists of four air vehicles, ground control equipment, one remote video terminal, four modular mission payloads, communications devices, a means of launch and recovery, and one mobile maintenance facility for every three Outrider systems. The Outrider ACTD grew out of the Joint Tactical UAV program. The original concept of the Joint Tactical UAV program was to acquire (1) a 50-kilometer UAV system, the Maneuver, to satisfy reconnaissance and surveillance needs of Army brigade and Marine Corps regimental commanders and (2) a 200-kilometer UAV system, the Hunter, to satisfy the reconnaissance and surveillance needs of Army corps and division commanders and Navy task force commanders.

DTIC

Cost Estimates; Remotely Piloted Vehicles; Reconnaissance Aircraft; Reports; Defense Program; Pilotless Aircraft

19970041120 Standard Missile Co., McLean, VA USA

Navy Theater-Wide Defense AEGIS LEAP Intercept (ALI)/STANDARD Missile Three (SM-3) Flight Test Program Overview

Robinson, Scott D., Standard Missile Co., USA; Aug. 21, 1997; 18p; In English; 6th; Annual AIAA/BMDO Technology Readiness Conference and Exhibit: Flight Test Technology and Results Session, 21 Aug. 1997, San Diego, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AD-A329084; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Navy Theater-Wide (NTW) program was established to investigate the Navy's tremendous and unique potential to provide the U.S. with a crucial, rapidly deployable, highly mobile, and readily sustainable long-range Theater Ballistic Missile Defense (TBMD) capability. to minimize the development risk inherent in this extremely challenging endeavor, the program was divided into several evolutionary phases. The initial phases of the program include a series of technology development and flight test demonstration activities involving the integration of advanced Ballistic Missile Defense (BMD) interceptor technologies with existing Navy Anti-Air Warfare (AAW) systems. The flight tests are designed to demonstrate the feasibility and the utility of the NTW concept before formal commitment to a Major Defense Acquisition Program (MDAP).

DTIC

Ballistic Missiles; Missile Defense; Risk; Defense Program; Flight Tests; Missiles

19970041126 Northrop Grumman Corp., Military Aircraft Systems Div., El Segundo, CA USA

Feasibility Assessment and Optimization Study of Smart Actuation Systems for Enhanced Aircraft Maneuver Performance Final Report, 16 Jun. 1996 - 30 Jun. 1997

Appa, K., Northrop Grumman Corp., USA; Ausman, J., Northrop Grumman Corp., USA; Jul. 1997; 31p; In English

Contract(s)/Grant(s): F33615-95-D-3215; AF Proj. 2401

Report No.(s): AD-A329138; WL-TR-97-3083; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents an analytical method developed to assess the power requirement and placement of the solid state actuators for enhanced maneuver performance of tactical fighters. Optimal control methodology is employed to compute the input stimuli such that the total power requirement is minimum with reduced peak stress levels. The study suggests that solid state actuators require some form of mechanical magnification of displacement for reduced control actuation power.

DTIC

Optimal Control; Smart Structures; Flight Control; Control Systems Design; Feasibility Analysis

19970041186 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA

Flight Demonstration of the AltAir Air Deployed Ballistic Missile Target

Snyder, J., Air Force Inst. of Tech., USA; Shanta, F., Naval Air Warfare Center, USA; Bridges, J., Space Vector Corp., USA; Mentek, J., XonTech, Inc., USA; Jul. 18, 1997; 14p; In English

Report No.(s): AD-A329032; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Theater Missile Defense (TMD) testing identified the need for a new type of TMD target system. The system must provide intercept geometries which are difficult to achieve with current ground launch systems. The government undertook the development of the Alternate Air launched short range target (AltAir) to demonstrate the feasibility of meeting these requirements with an air-launched system. The objective of this effort was to develop a target system which could be integrated at conventional range facilities, loaded into an unmodified cargo aircraft, flown to a remote location for extraction from the aircraft and launched. The AltAir program developed the following target system elements: the AltAir target vehicle with its GPS aided guidance system; a Palletized Airborne Support Equipment (PASE) module, and associated ground support equipment. The range processing and operating procedures required to integrate, transport and launch the AltAir vehicle were developed by the Navy and Air Force units supporting the program. Five airborne tests of the AltAir target system elements were performed culminating in the AltAir Demonstration Flight. The AltAir Demonstration Flight occurred on 30 January 1997 on the Sea Test Range at the Naval Air Warfare Center - Weapons Division, off the coast of California.

DTIC

Ballistic Missiles; Targets; Ground Support Equipment; Missile Defense; Global Positioning System; Flight Tests; Test Ranges; Air Launching

19970041208 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Defense Acquisition: Acquisition Plans for Training Aircraft Should be Reevaluated

Sep. 18, 1997; 19p; In English

Report No.(s): AD-A329309; GAO/NSIAD-97-172; B-277337; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Air Force and the Navy plan to spend \$4 billion on a new aircraft, referred to as the Joint Primary Aircraft Training System (JPATS), to train entry level pilots how to fly. We reviewed (1) the services' calculations of the quantity of JPATS aircraft needed to meet training requirements, (2) the impact of the Department of Defense's (DOD) procurement schedule on the aircraft's unit price, and (3) service efforts to design the JPATS cockpit to accommodate female pilots.

DTIC

Training Aircraft; Cost Analysis

19970041244 NERAC, Inc., Tolland, CT USA

Airworthiness Requirements. (Latest citations from the NTIS Bibliographic Database)

Feb. 1997; p; In English; Page count unavailable. Supersedes PB96-850532

Report No.(s): PB97-855886; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning regulations and directives, issued by the Federal Aviation Administration (FAA), for flight safety. Directives are established for commercial or business aircraft, helicopters, engines, and miscellaneous equipment. Special attention is given to structural safety of the aging commercial jet fleet. Allied topics include corrosion, fatigue, structural integrity, and damage tolerance. Handling qualities of specific helicopters are covered. Information on overhaul recommendations, standardized inspection practices, and compliance regulations are also presented. (Contains 50-250 citations and includes a subject term index and title list.)

NTIS

Bibliographies; Aircraft Reliability; Air Transportation

19970041373 Air Univ., School of Advanced Airpower Studies, Maxwell AFB, AL USA

Unmanned Aerial Vehicles and Weapons of Mass Destruction: A Lethal Combination?

Renehan, Jeffrey N., Air Univ., USA; Aug. 1997; 50p; In English

Report No.(s): AD-A329050; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study analyzes the characteristics and capabilities of Unmanned Aerial Vehicles (UAV) to determine their capability to carry Weapons of Mass destruction (WMD). The author presents an overview of the various forms of WMD chemical, biological, and nuclear weapons. The objective is to review the characteristics of both UAVs and WMD to determine if they are capable of being used together as an effective weapon. The result indicates that there is great potential for the use of UAVs as delivery systems for WMD, particularly by developing nations and nonstate actors such as terrorist groups who may not have the technical capability to employ other means. The potential exists for the proliferation of both UAVs and WMD to become widespread and thus a major security concern. There is no clear solution to this problem; however, actions including bringing the issue to the forefront, strengthening export and arms controls, deterrence, and defense will have a synergistic effect that will help mitigate this threat.

DTIC

Weapons; Destruction; Aerial Explosions

19970041445 Georgia Inst. of Tech., Computational Mechanics Center, Atlanta, GA USA

Mechanics of Widespread Fatigue Damage & Life Enhancement Methodologies for Aging Aerospace Structures *Final Report, 15 Apr. 1993 - 14 Dec. 1996*

Atluri, Satya N., Georgia Inst. of Tech., USA; May 1997; 333p; In English

Contract(s)/Grant(s): F49620-93-I-0270

Report No.(s): AD-A329633; AFOSR-TR-97-0439; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The major aircraft structural situation considered in this research is that of a thin skin stiffened by orthogonal frames and stringers, with the possibility of a lap joint. Effects on this situation considered in this research are: (1) impact by foreign objects, (2) fatigue damage due to repetitive loading, and (3) corrosion damage. Various theoretical models, pertaining to the response of the subject aircraft structure to these effects, have been considered: (1) the Finite Element Alternating Method (FEAM) applied to a single crack, (2) FEAM applied to Multiple Site Damage (MSD), and others. An analysis is also presented which pertains to the repair of cracks by application of a composite patch using adhesive.

DTIC

Aircraft Structures; Aircraft Maintenance; Commercial Aircraft; Damage Assessment; Fatigue (Materials); Cracks; Stringers; Lap Joints; Finite Element Method; Service Life

19970041492 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Improved Load Alleviation Capability for the KC-135

Mortensen, Adam L., Air Force Inst. of Tech., USA; Sep. 1997; 144p; In English

Report No.(s): AD-A329325; AFIT/GE/ENY/97S-1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Air Force will greatly increase its use of Unmanned Aerial Vehicles (UAVs) in the next century and the latter part of this decade. These UAVs will require refueling like their manned counterparts. The KC-135 and the KC-10 are candidates to provide this refueling task. The KC-10 is equipped with an automatic load alleviation system on its refueling boom which minimizes radial loads at the receiver of the aircraft being refueled. The KC-135 does not have such a system on its boom. Because the boom operator relies on visual cues to tell him when the boom is bending to adjust the boom's ruddervators, large loads may be imparted to receiver aircraft at the fuel receiver port. While load alleviation is required for all aircraft in order to ensure that binding of the nozzle does not prevent disconnect, load alleviation may also be important for the lightweight UAV in order to prevent unwanted disturbance to its flight control system. A Controller was designed to control the longitudinal motion of the boom. This controller can control the angle of the boom so no forces are imparted to the nozzle as the tanker moves from its nominal orientation. The optimal controller design uses both feed forward and rate feedback to modulate the commanded torque signal sent to the ruddervators. The results show that using an automatic controller promises to provide accurate control of the KC-135 refueling boom during refueling operations with minimal nozzle forces being imparted to the receiver aircraft.

DTIC

Refueling; Receivers; Pilotless Aircraft; Controllers; C-135 Aircraft; Aircraft Fuels

19970041535 Advisory Group for Aerospace Research and Development, Structures and Materials Panel, Neuilly-Sur-Seine, France

Aging Combat Aircraft Fleets: Long Term Applications *Les Consequences a Long Terme du Vieillissement des Flottes d'Avions de Combat*

Oct. 1996; 236p; In English; Aging Combat Aircraft Fleets: Long Term Applications, 7-8 Oct. 1996, Madrid, Pomezia, Atlanta, GA, Brussels, Spain, Italy, USA, Belgium; Also announced as 19970041536 through 19970041547

Report No.(s): AGARD-LS-206; ISBN 92-836-1044-X; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche

This Lecture Series covers systems update and structural airworthiness aspects of aging, fixed-wing aircraft. It highlights the aspect of retrofit/rejuvenation of aging aircraft through presentations relating to three front-line combat aircraft in NATO's inventory. The presentations describe the implementation strategies and ways to improve the ability of an airframe to accommodate new systems to meet present day mission requirements. Technical issues pertaining to structural safety, maintenance management, and proactive rehabilitation/retrofit schemes are also discussed. It provides technical information to fleet operators and managers to assist them to better manage aging aircraft fleets and be able to deal with aging related problems as they arise. It also targets industry personnel responsible for upgrading the capabilities of combat aircraft, maintenance personnel at air logistics centers, and specialists involved with the design of repairs and prescription of inspection methods. "Aging aircraft" has several connotations, amongst them technological obsolescence, performance upgrading, changing mission requirements unanticipated during design specification and development, the specter of runaway maintenance costs, decreased safety, impairment of fleet readiness, and unavailability of home depot facilities.

Author

Aging (Materials); Fighter Aircraft; Airframes; Safety Management; Aircraft Maintenance; Aircraft Reliability; Lectures; Specifications; Mission Planning; Aircraft Configurations

19970041536 Wright Lab., Wright-Patterson AFB, OH USA

USAF Aging Aircraft Program

Rudd, James L., Wright Lab., USA; Aging Combat Aircraft Fleets: Long Term Applications; Oct. 1996; 14p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The USA Air Force (USAF) has numerous aircraft that have already met or exceeded their original design service lives; many of these aircraft will considerably exceed their original life goals before they are retired from the inventory. Technologies are needed which will extend the lives and/or reduce the costs of these aging aircraft. Such technologies will insure flight safety, reduce maintenance and repair requirements and their associated costs, and increase operational readiness. A description of the USAF aging aircraft systems research and development efforts that are being conducted in the technology categories of Structural Integrity, Nondestructive Evaluation/Inspection, Avionics, Propulsion and Subsystems is presented. The structural integrity area considers damage that can degrade the service lives of aging aircraft; the technologies required to ensure aircraft structural integrity with such damage present are identified. Typical types of damage considered include corrosion, fatigue cracking, and the potential interaction of corrosion and fatigue. Also, the possible occurrence of widespread fatigue damage (WFD), which becomes more likely as aircraft structure ages, is addressed. Life extension methodology is described that includes the development of analytical and experimental procedures for the repair (e.g., composite patches) of metallic structure that will restore or extend the full service life the damaged structure.

Derived from text

Aging (Materials); Aircraft Structures; Fatigue (Materials); Damage; Nondestructive Tests; Systems Engineering; Structural Failure; Service Life; Maintenance; Cost Reduction; Corrosion; Avionics

19970041537 Royal Air Force, Deputy Directorate Support Management Tornado (RAF), Huntingdon, UK

Ageing Aircraft: Managing the Tornado Fleet

Marlow-Spalding, M. J., Royal Air Force, UK; Oct. 1996; 16p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

During the 1980's the RAF procured a fleet of 228 Strike/Attack and 170 Air Defense Tornado aircraft to form the back-bone of its long term fleet of combat aircraft. The Tornado aircraft was designed using 1970's technology, with a planned in-service life of 4000 flying hours and 100 Fatigue Index. The aircrafts original out of service date was 2003. Since then the primary use of the aircraft has changed to one of providing out of area support to United Nations and NATO operations. Furthermore, the aircraft's life has been extended so that it is now anticipated that the RAF will continue to fly the ADV until about 2010 and the IDS to approximately 2018, by which time the individual in-service aircraft will have accrued some 9000+ flying hours. To meet the challenge the RAF has had to address how the airworthiness of the airframe and flight safety critical components can be assured, whilst at the same time, ensuring that the aircraft continue to provide an operationally effective weapon platform at a time of unprecedented, technological advances.

Derived from text

Aging (Materials); Aircraft Reliability; Airframes; Fighter Aircraft; North Atlantic Treaty Organization (NATO); United Nations; Service Life

19970041538 National Research Council of Canada, Structures, Materials and Propulsion Lab., Ottawa, Ontario Canada

Canadian CF-18 Structural Life Management Program

Simpson, D. L., National Research Council of Canada, Canada; Oct. 1996; 36p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Canadian Forces purchased 135 CF-18 A/B Hornet aircraft in the 1980's. Usage of the CF-18 in the Canadian role was and continues to be substantially different than that defined in the original design requirements. The early usage of the aircraft was very harsh in comparison to design and there were strong indications that airframes would have to be retired before reaching their design service life of 6000 hours. This situation required the adoption of a vigorous and proactive program to manage the structural life of the aircraft. This lecture describes the situation in some detail and then provides descriptions of the programs initiated to gain control over the operational usage and to develop the engineering data that will allow cost effective and safe operation of the aircraft to at least 6000 hours.

Author

F-18 Aircraft; Aging (Materials); Structural Engineering; Airframes; Cost Effectiveness; Aircraft Safety

19970041539 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

F-16 System/Structural Upgrades

DeFazio, Mark S., Aeronautical Systems Div., USA; Oct. 1996; 18p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Several systems upgrades have occurred throughout the life of the F-16 aircraft. This paper briefly discusses various system upgrades including navigational equipment, communication equipment, radar, stability and control, flight control system, and engines. The f-16 was originally designed to be a lightweight fighter with a service life of 8,000 flight hours. Due to the usage being more severe than design and an increase in weight, several structural modifications were necessary to keep the F-16C/D in service. The structural modification program known as "Falcon Up" is being accomplished by several countries for the F-16A/B/C/D aircraft. The program began in June 1993 for USAF and will complete around the year 2001. This paper discusses each of the structural problems and the modifications necessary to reach an 8,000 hour service life.

Derived from text

F-16 Aircraft; Structural Engineering; Upgrading; Communication Equipment; Radar; Flight Control; Navigation

19970041540 Oklahoma City Air Logistics Center, KC-135 System Program Office, Tinker AFB, OK USA

Coral Reach: USAF KC-135 Aging Aircraft Program

Davidson, Paul E., Oklahoma City Air Logistics Center, USA; Oct. 1996; 8p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper is intended to serve as an aid to any aircraft manager beginning to develop or expand an aging aircraft program. It is based on the experiences of the USAF KC-135 aircraft program since the early 1990's as they have fought to gain recognition and support for the issues faced by that program. CORAL REACH is a USAF program responsible for developing a GRAND STRATEGY for all age related issues on the C/KC-135 aircraft fleet. It is intended to ensure a logical, comprehensive and proactive program to sustain the aircraft until retirement. Today, the KC-135 aircraft have an average age of 38 years and many are expected to serve until the year 2040. Specific life extension efforts for the aircraft are dependent on the outcome of analyses and studies performed by the Integrated Product Team (IPT) incorporated under the CORAL REACH program. These analyses and studies focus on the technical, economic and safety aspect of the issues and become the basis for future actions to deal with the effects of an aging aircraft fleet.

Derived from text

Aging (Materials); C-135 Aircraft; Economic Factors; Service Life; Management Systems

19970041541 R-Tec, Rolling Hills Estates, CA USA

Repair/Refurbishment of Military Aircraft

Ratwani, Mohan M., R-Tec, USA; Oct. 1996; 22p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper discusses structural life enhancement through prestressing techniques such as cold working, shot peening, laser shock processing, etc. The state-of-practice methods of repairing metallic and composite structures are outlined. Advanced repair methods such as composite patch repair of cracked metallic structures are shown. Finally, improved properties of advanced metallic materials are shown and their in-service applications to spare parts is discussed.

Derived from text

Aircraft Maintenance; Composite Structures; Prestressing; Shot Peening; Cold Working; Aging (Materials); Aircraft Structures

19970041542 Daimler-Benz Aerospace A.G., Military Aircraft, Munich, Germany

Aircraft Loads and Monitoring

Neubauer, Martin, Daimler-Benz Aerospace A.G., Germany; Guenther, Georg, Daimler-Benz Aerospace A.G., Germany; Neunaber, R., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Oct. 1996; 26p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The life of a weapon system is influenced to a high degree by the structural integrity of the airframe. Numerous programs to insure this have been established within NATO's Air Forces. Structural loads, leading to fatigue as well as corrosion, depending on the usage environment, are the major reason for the degradation of structures. The many different classes of loads, the generation of loading conditions during the design phase, consideration of static and fatigue loads for structural lay-out and their validation are presented. The fatigue life of aircrafts in service is different from the design life for many aircrafts not only due to the extended need for the airframe as a platform for new/upgraded systems (life extension), but also due to different usage compared to the design spectrum. Monitoring of the life consumption is therefore essential. Methods and concepts to establish the "used life" are described for two different aircrafts and the influence of A/C-roles and -equipment as well as structural weight increase over time are discussed.

Derived from text

Airframes; Loads (Forces); Structural Failure; Weapon Systems; Static Loads; Corrosion; Degradation; Aircraft Design; Aircraft Structures; Fatigue Life

19970041543 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

Corrosion Prevention System for the F-16 Fighter Aircraft

LaCivita, Kenneth J., Aeronautical Systems Div., USA; Oct. 1996; 28p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Corrosion Prevention System for the F-16 Fighter Aircraft is an excellent example of defining the design, materials, and process selection requirements early in the acquisition program. This process necessitates working closely with the contractors and customers throughout the life of this program and establishing and maintaining a Corrosion Prevention Advisory Board (CPAB). The corrosion prevention system used on the F-16 implements materials, surface treatments, finishes, and coating systems, that provide superior corrosion protection when manufactured and maintained properly. The F-16 has nevertheless suffered from some corrosion related problems. Although many of these problems have been corrected, field corrosion surveys are useful in identifying new issues as well as past problems that have not been adequately addressed. Results of recent field study conducted by the F-16 System Program Office (SPO), miscellaneous items from the CPAB meetings, and continuing changes brought about by environmental, health, and safety compliance provide the need for a strong, dynamic, on-going corrosion prevention program.

Derived from text

Corrosion Prevention; F-16 Aircraft; Fighter Aircraft; Coating; Finishes; Surface Treatment

19970041545 R-Tec, Rolling Hills Estates, CA USA

Prospects of Structural Health Monitoring Systems

Ratwani, Mohan M., R-Tec, USA; Oct. 1996; 8p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Recent trends in research activities are primarily geared to design future air vehicles smart so as to perform roles beyond those performed by conventional vehicles including: (1) Improved performance; (2) Reduced structural weight; (3) Reduced pilot load; (4) Increased survivability and reliability; and (5) Reduced maintenance requirements. From the structural engineer's point of view the key areas of interest are: (1) Avionics/structures integration to reduce structural weight; (2) Smart structures to improve performance, reduce maintenance cost and improve safety of flight; (3) Smart skins to reduce structural weight and improve antenna performance; (4) Infra-red (IR) signature reduction to improve survivability; and (5) Thermal management to improve performance. The majority of the research in these areas is applicable to future aircraft, however, smart structures technology has applications to in-service aging aircraft to assure the safety of flight and reduce maintenance cost.

Derived from text

Smart Structures; Structural Engineering; Loads (Forces); Cost Reduction; Safety; Structural Weight; Aircraft Design

19970041546 Wright Lab., Wright-Patterson AFB, OH USA

Durability and Damage Tolerance

Rudd, James L., Wright Lab., USA; Oct. 1996; 24p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Durability and damage tolerance are two of the most critical elements of a structural integrity program for aging aircraft. Durability is primarily concerned with economic issues, dealing with maintenance and repair requirements and their associated costs. Damage tolerance is primarily concerned with structural safety, precluding the occurrence of catastrophic failure. Both durability and damage tolerance can affect the operational readiness of aging aircraft. Significant issues involving durability and damage tolerance are widespread fatigue damage (WFD) and structural repairs. This paper considers three topics of widespread fatigue damage.

Derived from text

Durability; Damage; Tolerances (Mechanics); Fatigue (Materials); Aging (Materials); Aircraft Reliability; Maintainability; Economics; Costs; Structural Failure

19970041584 NERAC, Inc., Tolland, CT USA

Aircraft Fuel Conservation. (Latest citations from the NTIS Bibliographic Database)

Apr. 1997; p; In English; Page count unavailable. Supersedes PB96-856935

Report No.(s): PB97-858088; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning means to conserve fuel in airline operations. Included are abstracts dealing with aircraft design, engine design, propulsion efficiency, fuels, and operating procedures which conserve fuel.(Contains 50-250 citations and includes a subject term index and title list.)

NTIS

Bibliographies; Fuel Consumption; Conservation; Aircraft Fuels

19970041592 National Aerospace Lab., Amsterdam, Netherlands

Re-Analysis of European Flight Load Data: Revised Edition

de Jonge, J. B., National Aerospace Lab., Netherlands; Hol, P. A., National Aerospace Lab., Netherlands; van Gelder, P. A., National Aerospace Lab., Netherlands; Feb. 11, 1994; 81p; In English

Contract(s)/Grant(s): OV/RLD-182

Report No.(s): PB97-182414; NLR-TP-93535-U; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Existing European Data sources on c.g. acceleration experience in commercial aircraft were acquired, and combined into one Data Base. The acceleration peak/valley data were reduced to discrete gust velocities U and PSD-related gust velocities U sub omega. The U sub omega data were further analyzed to yield PSD gust intensity parameters. The present report gives an overview of the different data sources and the format in which they were made available. The data reduction procedures are described and the results are presented both in tabular and graphical format. The resulting gust statistics are compared with existing models.

NTIS

Data Reduction; Gust Loads; Transport Aircraft; Cumulative Damage; Fatigue Life; Numerical Data Bases; Acceleration (Physics)

19970041605 NASA Langley Research Center, Hampton, VA USA

A Feasibility Study to Control Airfoil Shape Using THUNDER

Pinkerton, Jennifer L., NASA Langley Research Center, USA; Moses, Robert W., NASA Langley Research Center, USA; Nov. 1997; 30p; In English

Contract(s)/Grant(s): RTOP 505-63-50-13

Report No.(s): NASA-TM-4767; L-17544; NAS 1.15:4767; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this study was to assess the capabilities of a new out-of-plane displacement piezoelectric actuator called thin-layer composite-unimorph ferroelectric driver and sensor (THUNDER) to alter the upper surface geometry of a subscale airfoil to enhance performance under aerodynamic loading. Sixty test conditions, consisting of combinations of five angles of attack, four dc applied voltages, and three tunnel velocities, were studied in a tabletop wind tunnel. Results indicated that larger magnitudes of applied voltage produced larger wafer displacements. Wind-off displacements were also consistently larger than wind-on. Higher velocities produced larger displacements than lower velocities because of increased upper surface suction. Increased suction also resulted in larger displacements at higher angles of attack. Creep and hysteresis of the wafer, which were identified at each test condition, contributed to larger negative displacements for all negative applied voltages and larger positive displacements for the smaller positive applied voltage (+102 V). An elastic membrane used to hold the wafer to the upper surface hindered displacements at the larger positive applied voltage (+170 V). Both creep and hysteresis appeared bounded based on the analysis

of several displacement cycles. These results show that THUNDER can be used to alter the camber of a small airfoil under aerodynamic loads.

Author

Actuators; Hysteresis; Airfoil Profiles; Feasibility; Wind Tunnel Tests; Electric Potential; Displacement

19970041626 National Aerospace Lab., Amsterdam, Netherlands

Jump Linear Model Based Aircraft Trajectory Reconstruction

Neven, W. H. L., National Aerospace Lab., Netherlands; Blom, H. A. P., National Aerospace Lab., Netherlands; de Kraker, P. C., National Aerospace Lab., Netherlands; Feb. 02, 1994; 26p; In English; SPIE Conference on Signal and Data Processing of Small Targets, 5 Apr. 1994, USA

Report No.(s): PB97-182547; NLR-TP-94069-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Within an Air Traffic Control (ATC) context many applications exist for off-line trajectory reconstruction such as evaluation of tracking of navigation systems and accident/incident investigations. First the paper gives an outline of EUROCONTROL's multi-radar trajectory reconstruction system MURATREC II within which the Jump-Linear techniques have been implemented and subsequently tuned to live multi-radar data. Next, the paper describes the particular Jump-Linear smoothing algorithms used: Trajectory segmentation and mode classification on the basis of a Multiple Hypotheses Tracking (MHT) algorithm; Extended Kalman Smoothing using the resulting trajectory mode classification results, and specifies both the particular implementation chosen to handle their numerical complexity and their particular parametrization found during tuning.

NTIS

Air Traffic Control; Radar Tracking; Flight Paths

19970042973

Development of a low-cost and versatile flight test platform

Campos, L. M. B.C., Inst Superior Tecnico, Portugal; Fonseca, A. A.; Azinheira, J. R. C.; Loura, J. P.; Journal of Aircraft; January 1997; ISSN 0021-8669; vol. 34, no. 1, pp. 9-19; In English; Copyright; Avail: Issuing Activity

This paper describes the creation of an independent flight test facility in Portugal, based on international and national cooperation; the flying element is the basic aircraft for flight research (BAFR), a CASA 212 Aviocar twin-turboprop light transport, fitted with a flight test instrumentation (FTI) system, from which smaller dedicated FTIs were developed for several other aircraft. A part of one of the research projects carried out with BAFR, viz., a linear longitudinal stability model, including propeller slipstream effects is described. The model is reduced from 3 x 5 form to a 4 x 4 autonomous system of differential equations, from which the frequency and damping of the phugoid and short period modes are determined. The model parameters were identified from flight tests of selected maneuvers and the reconstruction of flight data using the model served to validate the latter.

Author (EI)

Aircraft Instruments; Flight Test Instruments; Longitudinal Stability; Mathematical Models; Propeller Slipstreams; Research Aircraft

06

AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19970040550 Instytut Lotnictwa, Warsaw, Poland

Helivionics: Helicopter Avionics Smiglowce w Polsce

Mazurek, Jacek, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 66-78; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

An article represents specifics of helicopter avionics systems arising from helicopter's design features, flight conditions, tasks executed especially on low altitudes and pilotage techniques as well. Examples of modern equipment for NOE flights concerning elements of modern equipment elaborated in the Institute of Aviation are presented. The part of avionics systems integration and experiences of the Institute of Aviation in this domain are discussed here.

Author

Avionics; Helicopters; Systems Integration; Aircraft Design

19970040601 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Common Airborne Instrumentation System (CAIS): Configuration ID List

Jones, Sidney R., Naval Air Warfare Center, USA; Aug. 28, 1997; 13p; In English

Report No.(s): AD-A329363; A00.00-C009-Rev-A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense has developed the Common Airborne Instrumentation System (CAIS) to promote standardization commonality and interoperability among aircraft test instrumentation systems. The value of CAIS is that it allows aircraft test and evaluation facilities to use common airborne systems and ground support equipment as well as common technical knowledge and procedures for these systems. It is the responsibility of the CAIS Program Office, a tri-service group, to conduct requirements analyses, manage system upgrades, and provide full life cycle support for this system. This interface control document (ICD) was written to provide a single document that designers of CAIS bus controllers and data acquisition units could reference to ensure interoperability on the CAIS bus. This ICD establishes the requirements for digital command/response, time division multiplexing techniques for a single CAIS bus. It encompasses the physical, electrical, and protocol aspects of the CAIS bus.

DTIC

Airborne Equipment; Aircraft Instruments; Standardization; Data Acquisition

19970040665 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Common Airborne Instrumentation System (CAIS): CAIS Bus Interface Standard

Jones, Sidney R., Naval Air Warfare Center, USA; Aug. 28, 1997; 33p; In English

Report No.(s): AD-A329364; A00.00-C001-Rev-A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense has developed the Common Airborne Instrumentation System (CAIS) to promote standardization commonality and interoperability among aircraft test instrumentation systems. The value of CAIS is that it allows aircraft test and evaluation facilities to use common airborne systems and ground support equipment as well as common technical knowledge and procedures for these systems. It is the responsibility of the CAIS Program Office, a tri-service group, to conduct requirements analyses, manage system upgrades, and provide full life cycle support for this system. This interface control document (ICD) was written to provide a single document that designers of CAIS bus controllers and data acquisition units could reference to ensure interoperability on the CAIS bus. This ICD establishes the requirements for digital command/response, time division multiplexing techniques for a single CAIS bus. It encompasses the physical, electrical, and protocol aspects of the CAIS bus.

DTIC

Standardization; Flight Tests; Aircraft Instruments; Airborne Equipment

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.

19970040564 Instytut Lotnictwa, Warsaw, Poland

Power Units of Ultralight Helicopters *Układy Napędowe Ultralekkich Smigłowcow*

Niedzialek, Boguslaw, Instytut Lotnictwa, Poland; Perkowski, Witold, Instytut Lotnictwa, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 216-223; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Helicopters of the lightest weight categories are manufactured almost exclusively in the USA. The most famous manufacturers are Hughes, Robinson and Enstrom. The most famous designs are respectively: Hughes 300, Robinson R22 and Enstrom F28 and their development versions. Other producers we can mention here are also American firms: Schweizer, Rotorway and Hillman. The typical contemporary representative of ultralight helicopters is a straight-line descendant of the famous Sikorsky VS-300 (1939) and it has: (a) single main rotor with an intermediate power unit; (b) tail rotor for equalizing reactive moment; (c) one engine (usually a flat piston engine); (d) initial belt transmission (which also works as a coupling); (e) single stage intersecting axis gear; and (f) straight shaft transmitting power to the tail gear. Power units of selected ultralight helicopters are described (especially Hughes 300C, Robinson R22). Special consideration was paid to the belt transmission which plays the role of an initial gear and a coupling as well. Some different straining mechanisms on the transmission belts have been discussed also. Selected results of investigations into the transmission belt strain and keeping this strain constant, conducted in the Institute of Aviation, have been also presented.

Author

Light Helicopters; Transmissions (Machine Elements); Mechanical Drives; Shafts (Machine Elements)

19970040595 NASA Lewis Research Center, Cleveland, OH USA

Numerical Propulsion System Simulation Software Standards and Procedures Specification

Meinert, Karen M., NASA Lewis Research Center, USA; Seidel, Norbert L., NASA Lewis Research Center, USA; Naiman, Cynthia G., NASA Lewis Research Center, USA; Naylor, Bret, Sterling Software, Inc., USA; Farrell, Christopher, Sterling Software, Inc., USA; Follen, Gregory J., NASA Lewis Research Center, USA; Vandrei, Donald, NASA Lewis Research Center, USA; Oct. 1997; 60p; In English

Contract(s)/Grant(s): RTOP 509-10-31

Report No.(s): NASA-TP-3692; NAS 1.60:3692; E-10830; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Software Standards & Procedures Specification (SSPS) establishes the standards, procedures, guidelines, and restrictions for the design and coding of all Numerical Propulsion System Simulation NASA/Industry Cooperative Effort (NPSS/NICE) Computer Software throughout the development life-cycle.

Author

Software Engineering; Software Development Tools; Standards; Coding; Computer Programs; Computerized Simulation; Propulsion

19970040632 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia

Concept of a Synergetic Air-Breathing Engine for Hypersonic Flight Final Report

Lobanovsky, Yury, Tsentralni Aerogidrodinamicheskii Inst., Russia; Aug. 1997; 29p; In English

Contract(s)/Grant(s): F61708-96-W-0304

Report No.(s): AD-A329583; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Central Aerohydrodynamics Institute as follows: The contractor will investigate an analysis of main characteristics of turbo-compressor engine new design for hypersonic flight as per his 8 Mar 95 proposal.

DTIC

Air Breathing Engines; Engine Design; Hypersonic Flight; Engine Parts; Aerothermodynamics

19970041010 NERAC, Inc., Tolland, CT USA

Ceramics Technology: Aircraft Engine Component Applications: (Latest citations from the NTIS Bibliographic Database)

Apr. 1997; p; In English

Report No.(s): PB97-858708; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning the design and development of ceramic materials for use in aircraft engines. citations examine the heat, wear, and corrosion resistance of a variety of ceramics. Fabrication techniques for ignition system components, combustion chamber parts, gas-path seals, turbine rotors, stators, nozzles, blades, and heat exchangers are discussed. (Contains 50-250 citations and includes a subject term index and title list.)

NTIS

Bibliographies; Aircraft Engines; Gas Turbine Engines; Jet Engines; Ceramics; Design Analysis; Product Development; Ceramic Matrix Composites

19970041176 Alabama Univ., Dept. of Aerospace Engineering, Tuscaloosa, AL USA

Integrator Windup Protection-Techniques and a STOVL Aircraft Engine Controller Application Final Report

KrishnaKumar, K., Alabama Univ., USA; Narayanaswamy, S., Alabama Univ., USA; Jun. 1997; 99p; In English

Contract(s)/Grant(s): NAG3-1564

Report No.(s): NASA/CR-97-206027; NAS 1.26:206027; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Integrators are included in the feedback loop of a control system to eliminate the steady state errors in the commanded variables. The integrator windup problem arises if the control actuators encounter operational limits before the steady state errors are driven to zero by the integrator. The typical effects of windup are large system oscillations, high steady state error, and a delayed system response following the windup. In this study, methods to prevent the integrator windup are examined to provide Integrator Windup Protection (IW) for an engine controller of a Short Take-Off and Vertical Landing (STOVL) aircraft. A unified performance index is defined to optimize the performance of the Conventional Anti-Windup (CAW) and the Modified Anti-Windup (MAW) methods. A modified Genetic Algorithm search procedure with stochastic parameter encoding is implemented to obtain the optimal parameters of the CAW scheme. The advantages and drawbacks of the CAW and MAW techniques are discussed and recommendations are made for the choice of the IWP scheme, given some characteristics of the system.

Author

STOVL Aircraft; Aircraft Engines; Controllers; Integrators; Genetic Algorithms

19970041513 NASA Lewis Research Center, Cleveland, OH USA

Development of a Telescoping Vaned Exhaust Nozzle for the ASTOVL LiftFan(Trademark) Application

Sokhey, Jack S., Allison Advanced Development Co., USA; Vittal, Baily R., Allison Advanced Development Co., USA; Lam, David W., NASA Lewis Research Center, USA; Oct. 1997; 12p; In English; World Aviation Congress, 13-16 Oct. 1997, Anaheim, CA, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): RTOP 505-23-5B-00

Report No.(s): NASA-TM-113181; NAS 1.15:113181; Rept-97-WAC-95; E-10946; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A discussion on the development of a Telescoping, Vaned, Exhaust Nozzle (TEVEN) is presented. This nozzle was challenged to meet the thrust vectoring requirements of an Advanced Short Takeoff and Vertical Landing (ASTOVL) aircraft. The nozzle underwent a development process from concepts to detail design using computational flow analyses and from subscale performance verification tests to full-scale hardware design. The LiftFan(Trademark) nozzle is capable of providing a pitch vector range of about 80 degrees from up to 20 degrees forward to 60 degrees aft. In addition, a set of post exit yaw doors provide +/- 10 degrees yaw while maintaining a relatively high performance at all operating conditions. Further, the nozzle is axially compact, to be stowable in very short length (LJD less than 0.3), while efficiently converging the upstream nozzle flow from an annular cross section to a "D" shape at the nozzle exit. The discussion includes a review of various nozzle concepts, viscous flow analyses, and results from 1/3 scale nozzle model tests conducted at NASA LeRC Powered Lift Facility (PLF) in 1994.

Author

Exhaust Nozzles; Nozzle Flow; Powered Lift Aircraft; Vertical Landing; Analysis (Mathematics); Viscous Flow; Thrust Vector Control

19970041562 NASA Lewis Research Center, Cleveland, OH USA

Preconditioning for Numerical Simulation of Low Mach Number Three-Dimensional Viscous Turbomachinery Flows

Tweedt, Daniel L., NASA Lewis Research Center, USA; Chima, Rodrick V., NASA Lewis Research Center, USA; Turkel, Eli, NASA Lewis Research Center, USA; Oct. 1997; 28p; In English; 28th; Fluid Dynamics Conference, 29 Jun. - 2 Jul. 1997, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 523-22-13

Report No.(s): NASA-TM-113120; NAS 1.15:113120; ICOMP-97-11; E-10879; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A preconditioning scheme has been implemented into a three-dimensional viscous computational fluid dynamics code for turbomachine blade rows. The preconditioning allows the code, originally developed for simulating compressible flow fields, to be applied to nearly-incompressible, low Mach number flows. A brief description is given of the compressible Navier-Stokes equations for a rotating coordinate system, along with the preconditioning method employed. Details about the conservative formulation of artificial dissipation are provided, and different artificial dissipation schemes are discussed and compared. The preconditioned code was applied to a well-documented case involving the NASA large low-speed centrifugal compressor for which detailed experimental data are available for comparison. Performance and flow field data are compared for the near-design operating point of the compressor, with generally good agreement between computation and experiment. Further, significant differences between computational results for the different numerical implementations, revealing different levels of solution accuracy, are discussed.

Author

Numerical Analysis; Mach Number; Three Dimensional Flow; Turbomachinery; Viscous Flow; Computational Fluid Dynamics

19970041632 National Aerospace Lab., Amsterdam, Netherlands

Current and Future Materials in Advanced Gas Turbine Engines

Kool, G. A., National Aerospace Lab., Netherlands; Jan. 31, 1994; 15p; In English; 39th; ASME International Gas Turbine and Aeroengine Congress and Exposition, 13 Jun. 1994, The Hague, Netherlands; Sponsored by American Society of Mechanical Engineers, USA

Report No.(s): PB97-182539; NLR-TP-94059-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Gas turbine engines are constructed of components with excellent strength and stiffness, a minimum density, a high temperature capability for long times, and at affordable cost. Metallic materials are the centerpiece in fulfilling these requirements. Future gas turbine engines will have to have higher thrust-to-weight ratios, better fuel efficiencies and still lower costs. This will require new and advanced lightweight materials with higher temperature capabilities. The paper discusses some of the presently applied

materials in the fan, compressor and turbine sections of gas turbines, and reviews the material developments that are occurring and will be necessary for the near and long term futures.

NTIS

Gas Turbine Engines; Aircraft Engines; Titanium Alloys; Polymer Matrix Composites; Heat Resistant Alloys; Ceramics

08

AIRCRAFT STABILITY AND CONTROL

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

19970040553 Instytut Lotnictwa, Warsaw, Poland

Optimal Control of Helicopter in Vertical Autorotative Descent *Optymalne Sterowanie Ruchem Smiglowca w Pionowym Opadaniu Autorotacyjnym*

Maslowski, Piotr, Instytut Lotnictwa, Poland; Narkiewicz, Janusz, Warsaw Technical Univ., Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 110-116; In English; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Nelder-Mead optimization procedure was applied to control a rotor collective pitch to decrease the H-V zone of helicopter in vertical descent. A computer simulation showed that the method is efficient in this case and by proper control the H-V zone can be substantially decreased.

Author

Autorotation; Computerized Simulation; Descent; Helicopters; Optimal Control

19970040560 Polish Aviation Works, Swidnik, Poland

Measurements of Helicopter Rotor's Flutter Resistance *Pomiary Odpornosci na Flutter Wirnika Nosnego Smiglowca*

Hawrylecki, Wieslaw, Polish Aviation Works, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 184-191; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

An experimental method of determining an equivalent displacement of a rotor blade profile's center of gravity, necessary in the helicopter rotor's flutter resistance during ground tests has been presented. Relationships between loading in helicopter rotor's control system and the change of equivalent position of rotor blade profile's centre of gravity are determined by measurements. Numeric data for the W-3 helicopter are mentioned herein and a correlation with experimental flutter results in real conditions is shown. Some practical conclusions describing the influence of operating conditions on the flutter tests results are presented. These conclusions were collected in ZBR-WSK-Swidnik during years of testing and with the guidance of substantial experience.

Author

Center of Gravity; Ground Tests; Rotary Wings; Flutter Analysis; Measurement; Resistance

19970040650 Department of the Navy, Washington, DC USA

Debris Deflector

Vaillancourt, John J., Inventor, Department of the Navy, USA; Dubois, Neil J., Inventor, Department of the Navy, USA; Hills, Stacy J., Inventor, Department of the Navy, USA; May 27, 1997; 5p; In English; Supersedes AD-D018179

Patent Info.: Filed 5 Aug. 1996; US-Patent-Appl-SN-695843; US-Patent-5,632,218

Report No.(s): AD-D018557; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A debris deflector protects an underwater vehicle's control, surface while introducing little or no flow disturbance around the control surface. The deflector extends outward from the vehicle to peninsulate the control surface. The deflector's cross-section is defined by a wedge shape subtended by an arc with the apex of the wedge shape always pointing towards the control surface.

DTIC

Underwater Vehicles; Debris; Deflectors; Protection

19970040694 Technische Univ. (Delft, Netherlands), Delft, Netherlands

A SIMULINK Environment for Flight Dynamics and Control Analysis

Rauw, Marc, Technische Univ. (Delft, Netherlands), Netherlands; 24 Mar. 1997; 275p; In English; Diskette: 2 3.5 inch DSHD diskettes; See also 19950008401.; Copyright; Avail: Issuing Activity (Marc O. Rauw, Emmaplein 74, 3701 DC Zeist, The Netherlands), Hardcopy, Diskette

The Flight Dynamics and Control toolbox is a graphical software environment for the design and analysis of aircraft dynamics and control systems. It uses the graphical simulation environment of MATLAB and SIMULINK to provide easy access to the required models and analytical tools. A generalized non-linear aircraft model forms the basis of the toolbox. Thanks to its highly modular structure, this model can serve as a framework for the implementation of virtually any type of aircraft. Other components of the FDC toolbox include models of atmospheric disturbances (wind and turbulence), radio navigation systems, actuators, and sensors, and analytical tools for simulation, linearization, and trimming of the non-linear aircraft model. On-line help-texts have been included to enhance the accessibility of the models and tools for the users. Furthermore, several example systems demonstrate the practical use of the toolbox, including a complete simulation model of a 'classical' autopilot for the De Havilland DHC-2 'Beaver' aircraft. The FDC report not only serves as a User's Guide for the toolbox, it also gives a complete description of the underlying theory, which helps the users when they want to adapt the simulation models to their own needs. The report emphasizes the role of graphical Computer Assisted Control System Design (CACSD or CAD) programs in the development of Automatic Flight Control Systems, showing how the MATLAB/SIMULINK environment made it possible to combine linear control law design with non-linear simulations. The 'Beaver' autopilot examples provide a practical illustration of the results obtained with such a design process.

Author

Flight Characteristics; Dynamic Control; Software Development Tools; Computer Aided Design; Control Systems Design; De Havilland Aircraft; Computer Graphics

19970040704 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA

A Disturbance Attenuation Approach to Missile Guidance and Control Final Report, 1 Dec. 1993 - 30 Nov. 1996

Speyer, Jason L., California Univ., USA; Mar. 12, 1997; 48p; In English

Contract(s)/Grant(s): F49620-94-I-0084

Report No.(s): AD-A329598; AFOSR-TR-97-0376; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Solutions to stochastic control problems currently do not produce mechanizable missile control laws. To fill the gap without making excessive structure assumptions, it is suggested that the disturbance attenuation problem be extended to nonlinear guidance and control problems. The deterministic approach, which does not include all the properties of the stochastic control solution, does have characteristics which are quite appealing. For example, certain classes of partial information disturbance attenuation problems can be solved numerically essentially because variation methods are available. Over the three year period of the grant robust and adaptive guidance and control laws which are mechanizable with near future computer technology are developed which can meet system objectives in the presence of large uncertainties, system structural changes, and nonlinearities. Of particular importance emerging from our focus on disturbance attenuation is a new structure for adaptive control, new detection filters for detection and identifying structural changes, and methodologies for including system nonlinearities. Finally, a new multiple hypothesis adaptive estimator, using a single linear filter whose parameters are changing according to the on line computation of the probability of each hypothesis conditioned on the residual history, is shown to have better or equivalent performance to the current bank of filters concept with dramatic decrease in computation and ease of implementation.

DTIC

Trajectories; Miss Distance; Missile Defense; Adaptive Control; Control Systems Design; Perturbation Theory

19970040834 Naval Surface Warfare Center, Dahlgren, VA USA

Hybrid Neighboring-Optimal-Control and Lambert-Based Interceptor Boost-Phase Guidance

Lawton, John A., Naval Surface Warfare Center, USA; Martell, Craig A., Naval Surface Warfare Center, USA; Jan. 1997; 9p; In English

Report No.(s): AD-A329043; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Finding guidance methods that efficiently and effectively handle the problem of directing the boost-phase portion of an exoatmospheric tactical ballistic missile interceptor is an active area of research. This paper presents a candidate method that is a hybrid combination of three algorithms. The chief method, used throughout the majority of the flight, is a minimum-time neighboring optimal control scheme. As demonstrated through Monte Carlo simulations, perturbations in the predicted intercept point (caused by boost-phase updates of the target state estimate received from an exogenous radar) are corrected for in a smooth manner which preserves performance. Even large corrections are handled with low angles of attack, and less than one percent changes in burnout velocity relative to theoretical open-loop optimal control values. Near the end of the booster burn, the guidance scheme switches over to two Lambert-based guidance methods, which have the effect of taking out residual velocity errors, thus putting the interceptor on a nearly exact intercept path to the latest estimate of the target trajectory. The total scheme, while being somewhat computationally complex in pre-deployment development, is actually computationally simple for on-board computations, and has a

small computer memory requirement. Therefore, the robust performance combined with the light computational burden provided by this hybrid algorithm make it a competitive candidate for boost-phase interceptor guidance.

DTIC

Algorithms; Optimal Control; Ballistic Missiles; Angle of Attack; Time Optimal Control; Monte Carlo Method; Perturbation

19970040858 NASA Dryden Flight Research Center, Edwards, CA USA

Estimation of Modal Parameters Using a Wavelet-Based Approach

Lind, Rick, NASA Dryden Flight Research Center, USA; Brenner, Marty, NASA Dryden Flight Research Center, USA; Haley, Sidney M., NASA Dryden Flight Research Center, USA; Nov. 1997; 12p; In English; Atmospheric Flight Mechanics Conference, 8-11 Aug. 1997, New Orleans, LA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 505-63-50

Report No.(s): NASA/TM-97-206300; NAS 1.15:206300; H-2214; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modal stability parameters are extracted directly from aeroservoelastic flight test data by decomposition of accelerometer response signals into time-frequency atoms. Logarithmic sweeps and sinusoidal pulses are used to generate DAST closed loop excitation data. Novel wavelets constructed to extract modal damping and frequency explicitly from the data are introduced. The so-called Haley and Laplace wavelets are used to track time-varying modal damping and frequency in a matching pursuit algorithm. Estimation of the trend to aeroservoelastic instability is demonstrated successfully from analysis of the DAST data.

Author

Aeroservoelasticity; Flight Tests; Decomposition; Accelerometers; Excitation; Feedback Control; Sine Waves

19970041148 NASA Ames Research Center, Moffett Field, CA USA

Moving-Base Simulation Evaluation of Control/Display Integration Issues for ASTOVL Aircraft

Franklin, James A., NASA Ames Research Center, USA; Nov. 1997; 60p; In English

Contract(s)/Grant(s): RTOP 581-50-22

Report No.(s): NASA-TM-112213; A-977540; NAS 1.15:112213; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A moving-base simulation has been conducted on the Vertical Motion Simulator at Ames Research Center using a model of an advanced, short takeoff and vertical landing (STOVL) lift fan fighter aircraft. This experiment expanded on investigations during previous simulations with this STOVL configuration with the objective of evaluating (1) control law modifications over the low speed flight envelope, (2) integration of the throttle inceptor with flight control laws that provide direct thrust command for conventional flight, vertical and short takeoff, and flightpath or vertical velocity command for transition, hover, and vertical landing, (3) control mode blending for pitch, roll, yaw, and flightpath control during transition from wing-borne to jet-borne flight, and (4) effects of conformal versus nonconformal presentation of flightpath and pursuit guidance symbology on the out-the-window display for low speed STOVL operations. Assessments were made for takeoff, transition, hover, and landing, including precision hover and landing aboard an LPH-type amphibious assault ship in the presence of winds and rough seas. Results yielded Level 1 pilot ratings for the flightpath and vertical velocity command modes for a range of land-based and shipboard operation and were consistent with previous experience with earlier control laws and displays for this STOVL concept. Control mode blending was performed over speed ranges in accord with the pilot's tasks and with the change of the basic aircraft's characteristics between wing-borne and hover flight. Blending of yaw control from heading command in hover to sideslip command in wing-borne flight performed over a broad speed range helped reduce yaw transients during acceleration through the low speed regime. Although the pilots appreciated conformality of flightpath and guidance symbols with the external scene during the approach, increased sensitivity of the symbols for lateral path tracking elevated the pilots' control activity in the presence of turbulence. The pilots preferred the choice of scaling that was originally established during the display development and in-flight evaluations.

Author

STOVL Aircraft; Simulation; Flight Control; Propulsion System Performance; Head-Up Displays; Systems Integration; Flight Characteristics

19970041355 Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA

Yaw Card Influence on Stability and Yaw Growth for Spin-Stabilized Projectiles *Final Report*

Cooper, Gene R., Army Research Lab., USA; Fansler, Kevin S., Army Research Lab., USA; Aug. 1997; 43p; In English

Contract(s)/Grant(s): DA Proj. 1L1-62618-AH-80

Report No.(s): AD-A328915; ARL-TR-1431; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Using an impulse or Dirac delta approach, the stability and growth of yaw for a spin-stabilized projectile as it transits a yaw card range is investigated. The card-induced changes in the complex yaw arm amplitudes and phases are expressed as difference

equations. For a yaw card range with uniform spacings, the solutions to the general difference equations yield the magnitude and phase values for the complex yawing arms as a function of the card index number. A stepwise encounter with a yaw card reduces the epicyclical phase values across the yaw card. The parameters for the solution include encounter phase value at the entrance of the range, the characteristics of the yaw card, and the distance between the cards. Critical curves separating stable and unstable flight are presented as a function of yaw card spacing and a stability parameter that depends upon both the flight characteristics of the projectile and the card material and thickness. Quasi-universal curves of a transformed epicyclical phase encounter value versus a normalized epicyclical phase reduction value are graphically presented.

DTIC

Mathematical Models; Stability; Yaw; Flight Characteristics; Cards; Spin Stabilization

19970041500 NASA Ames Research Center, Moffett Field, CA USA

CONDUIT: A New Multidisciplinary Integration Environment for Flight Control Development

Tischler, Mark B., Army Aviation Systems Command, USA; Colbourne, Jason D., California Polytechnic State Univ., USA; Morel, Mark R., California Polytechnic State Univ., USA; Biezad, Daniel J., California Polytechnic State Univ., USA; Levine, William S., Maryland Univ., USA; Moldoveanu, Veronica, Maryland Univ., USA; Jun. 1997; 25p; In English
Report No.(s): AD-A329056; NASA-A-976615A; NASA-TM-112203; NAS 1.15:112203; USAATCOM,XG-TR-97-A-009; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A state-of-the-art computational facility for aircraft flight control design, evaluation, and integration called CONDUIT (Control Designer's Unified Interface) has been developed. This paper describes the CONDUIT tool and case study applications to complex rotary- and fixed- wing fly-by-wire flight control problems. Control system analysis and design optimization methods are presented, including definition of design specifications and system models within CONDUIT, and the multi-objective function optimization (CONSOL-OPTCAD) used to tune the selected design parameters. Design examples are based on flight test programs for which extensive data are available for validation. CONDUIT is used to analyze baseline control laws against pertinent military handling qualities and control system specifications. In both case studies, CONDUIT successfully exploits trade-offs between forward loop and feedback dynamics to significantly improve the expected handling qualities and minimize the required actuator authority. The CONDUIT system provides a new environment for integrated control system analysis and design, and has potential for significantly reducing the time and cost of control system flight test optimization.

DTIC

Fly by Wire Control; Tradeoffs; Optimization; Flight Tests; Flight Control; Design Analysis; Cost Reduction; Controllability; Control Theory

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.

19970040730 National Aerospace Lab., Electronics and Instrumentation, Amsterdam, Netherlands

Transputer Based Static Data Acquisition Systems at DNW

Slot, H., National Aerospace Lab., Netherlands; Joosen, C. J. J., Duits-Nederlandse Windtunnel, Netherlands; May 2, 1995; 16p; In English; 16th; International Congress on Instrumentation in Aerospace Simulation Facilities
Report No.(s): PB97-191902; NLR-TP-95227-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An important part of wind tunnel measurements consists of the acquisition of static signals. Static in this context refers to the slowly varying signals representing the steady conditions during a measurement. Recently the German-Dutch Wind Tunnel DNW has replaced its old static data acquisition systems. The data acquisition hardware for two new systems has been delivered by the Dutch National Aerospace Laboratory NLR. The channel hardware is based on the proven concept of the NLR conditioning unit. This unit was selected by DNW because of its excellent analog characteristics. The unit delivered to DNW is a further development of the generation of units in use at a number of wind tunnels (e.g. European Transonic Wind Tunnel ETW, Germany).

NTIS

Data Acquisition; Signal Processing; Wind Tunnels; Signal Detection

19970040949 Civil Aeromedical Inst., Oklahoma City, OK USA

A Flexible Cabin Simulator *Final Report*

Marcus, Jeffrey H., Civil Aeromedical Inst., USA; Aug. 1997; 19p; In English

Report No.(s): AD-A328996; DOT/FAA/AM-97/18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental research on issues related to emergency evacuation of a passenger aircraft cabin have tended to use existing aircraft cabins. While a great deal of useful information has been collected, these facilities have limited capabilities to be configured to investigate new or unusual cabin arrangements. A concept design for a flexible cabin simulator has been completed and is described. The proposed facility can simulate any aircraft cabin from a small, commuter category aircraft through a multi-aisle, multi-deck mega-jumbo transport. The simulator allows full flexibility in terms of exit type and placement, location and design of interior monuments, and the size and layout of the passenger cabin. Experimental control is possible of interior and exterior illumination levels, the presence of vision obscuring smoke, and the door sill height when using evacuation slides. Built from modular sections, it might be used in the future to investigate new and unusual cabin designs, such as the flying wing. The proposed simulator is described to illustrate its versatility. The associated building and project costs are also discussed.

DTIC

Passenger Aircraft; Emergencies; Aircraft Compartments; Commuter Aircraft; Wings; Passengers

19970041277 NASA Dryden Flight Research Center, Edwards, CA USA

Production Support Flight Control Computers: Research Capability for F/A-18 Aircraft at Dryden Flight Research Center

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

Contract(s)/Grant(s): RTOP 242-33-02-00-25; RTOP 529-50-24-00-RC

Report No.(s): NASA/TM-97-206233; NAS 1.15:206233; H-2193; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Dryden Flight Research Center (DFRC) is working with the United States Navy to complete ground testing and initiate flight testing of a modified set of F/A-18 flight control computers. The Production Support Flight Control Computers (PSFCC) can give any fleet F/A-18 airplane an in-flight, pilot-selectable research control law capability. NASA DFRC can efficiently flight test the PSFCC for the following four reasons: (1) Six F/A-18 chase aircraft are available which could be used with the PSFCC; (2) An F/A-18 processor-in-the-loop simulation exists for validation testing; (3) The expertise has been developed in programming the research processor in the PSFCC; and (4) A well-defined process has been established for clearing flight control research projects for flight. This report presents a functional description of the PSFCC. Descriptions of the NASA DFRC facilities, PSFCC verification and validation process, and planned PSFCC projects are also provided.

F-18 Aircraft; Airborne/Spaceborne Computers; Flight Control; Simulation; Ground Tests; Control Theory; Flight Tests

19970041421 NASA Lewis Research Center, Cleveland, OH USA

Design and Checkout of a High Speed Research Nozzle Evaluation Rig

Castner, Raymond S., NASA Lewis Research Center, USA; Wolter, John D., NASA Lewis Research Center, USA; Oct. 1997; 14p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 537-05-21-00

Report No.(s): NASA-TM-113179; NAS 1.15:113179; AIAA Paper 98-0711; E-10943; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The High Flow Jet Exit Rig (HFJER) was designed to provide simulated mixed flow turbojet engine exhaust for one-seventh scale models of advanced High Speed Research test nozzles. The new rig was designed to be used at NASA Lewis Research Center in the Nozzle Acoustic Test Rig and the 8x6 Supersonic Wind Tunnel. Capabilities were also designed to collect nozzle thrust measurement, aerodynamic measurements, and acoustic measurements when installed at the Nozzle Acoustic Test Rig. Simulated engine exhaust can be supplied from a high pressure air source at 33 pounds of air per second at 530 degrees Rankine and nozzle pressure ratios of 4.0. In addition, a combustion unit was designed from a J-58 aircraft engine burner to provide 20 pounds of air per second at 2000 degrees Rankine, also at nozzle pressure ratios of 4.0. These airflow capacities were designed to test High Speed Research nozzles with exhaust areas from eighteen square inches to twenty-two square inches. Nozzle inlet flow measurement is available through pressure and temperature sensors installed in the rig. Research instrumentation on High Speed Research nozzles is available with a maximum of 200 individual pressure and 100 individual temperature measurements. Checkout testing

was performed in May 1997 with a 22 square inch ASME long radius flow nozzle. Checkout test results will be summarized and compared to the stated design goals.

Author

High Speed; Nozzle Flow; Design Analysis; Evaluation; Scale Models

19970041473 Strasbourg Univ., Centre de Recherches Nucleaires, France

Factors influencing the performances of micro-strips gas chambers and microstrips gas chambers on implanted substrates

Mack, V., Strasbourg Univ., France; Brom, J. M., Strasbourg Univ., France; Fang, R., Strasbourg Univ., France; Fontaine, J. C., Strasbourg Univ., France; Huss, D., Strasbourg Univ., France; Kachelhoffer, T., Strasbourg Univ., France; Kettunen, H., Strasbourg Univ., France; Levy, J. M., Strasbourg Univ., France; Pallares, A., Strasbourg Univ., France; Bergdolt, A. M., Strasbourg Univ., France; Cailleret, J., Strasbourg Univ., France; Christophel, E., Strasbourg Univ., France; Coffin, J., Strasbourg Univ., France; Eberle, H., Strasbourg Univ., France; Osswald, F., Strasbourg Univ., France; Sigward, M. H., Strasbourg Univ., France; Barthe, S., Centre National de la Recherche Scientifique, France; Schunck, J. P., Centre National de la Recherche Scientifique, France; 1995; 20p; In English; Vienna Wire Chamber Conference, 1995, Vienna, Austria

Report No.(s): CRN-95-14; DE97-620840; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Damages to MSGCs (Micro-Strips Gas Chambers) induced by discharges have been investigated. Optimization of electrode shapes and/or deposition of a protective coating allows the potential difference between anode and cathode, thus increasing the gain. For prototypes of MSGCs made at the Centre de Recherches Nucleaires, each step of the manufacturing processes was carefully controlled. Results are presented on the influence of cleaning processes on the surface resistance of glass substrates.

DOE

Gas Discharges; Protective Coatings; Cathodes; Electrodes; Deposition

19970041496 Physics and Electronics Lab. TNO, The Hague, Netherlands

Application of Simulation within Training Courses of the Royal Netherlands Navy Final Report Toepassingsmogelijkheden van Simulatiemiddelen Binnen Opleidingen van de Koninklijke Marine

deBock, J. J. P. R., Physics and Electronics Lab. TNO, Netherlands; Gouweleeuw, R. G. W., Physics and Electronics Lab. TNO, Netherlands; Aug. 1997; 74p; In Dutch

Contract(s)/Grant(s): A95/KM/763

Report No.(s): FEL-97-A053; TD97-0102; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, Microfiche

This report answers the questions 'what are the applications for simulators in general and for the Royal Netherlands Navy in particular?' and 'how can a simulator be incorporated as a sound decision in the training trajectory?'. A distinction is made between simulator training, training with operational systems and conventional training. Furthermore, the report contains results of interviews with the schools of the RNIN to sketch the current situation and the future expectations with respect to education and training.

Author

Training Simulators; Education; Schools

19970041524 Arnold Engineering Development Center, Arnold AFS, TN USA

Seeker Testing and Facility Improvements in the AEDC 7V Sensor Chamber

Simpson, W. R., Sverdrup Technology, Inc., USA; Nicholson, R. A., Sverdrup Technology, Inc., USA; Aug. 1997; 11p; In English; AIAA/BMDO Technology Conference, Aug. 1997, San Diego, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AD-A329045; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An advanced seeker test facility at the Air Force's Arnold Engineering Development Center (AEDC) has been used for the past two years for calibration and performance characterization of infrared seekers supporting Army interceptor programs. This facility, known as the 7V Chamber, is part of a broad range of test capabilities developed at AEDC to provide comprehensive ground test support to the Kinetic Kill Vehicle (KKV) community. The 7V is a state-of-the-art cryo/vacuum facility calibration and high-fidelity mission simulation against complex backgrounds. This paper briefly reviews the 7V test capabilities, as well as a number of improvements recently completed or under development.

DTIC

Test Facilities; Infrared Detectors; Homing Devices; Infrared Tracking

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.

19970040818 IAP Research, Inc., Dayton, OH USA

Hypervelocity Launcher for Aerothermodynamic Experiments, Phase 2 Final Report

Scholz, Timothy J., IAP Research, Inc., USA; Bauer, David P., IAP Research, Inc., USA; Jul. 1995; 84p; In English

Contract(s)/Grant(s): NAS1-19727

Report No.(s): NASA/CR-95-206022; NAS 1.26:206022; IAP-TR-95-04-Phase-2; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The capability of an Ultra Distributed Energy Store System (UDESS) powered electromagnetic launcher (EM) is experimentally assessed. The UDESS system was developed specifically to address the velocity speed limit seen in plasma armature EM launchers. Metal armature launch packages were also developed and tested to assess the usefulness of the UDESS concept for low velocity applications.

Derived from text

Hypervelocity Launchers; Aerothermodynamics; Energy Storage; Performance Tests; System Effectiveness

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.

19970041015 DACCO SCI, Inc., Columbia, MD USA

The Use of Electrochemistry and Ellipsometry for Identifying and Evaluating Corrosion on Aircraft Final Report, 15 May 1995 - 14 Aug. 1997

Dacres, Chester M., DACCO SCI, Inc., USA; Davis, Guy D., DACCO SCI, Inc., USA; Krebs, Lorrie A., DACCO SCI, Inc., USA; Shook, Mark B., DACCO SCI, Inc., USA; Aug. 14, 1997; 49p; In English

Contract(s)/Grant(s): F49620-95-C-0040; AF Proj. 3005

Report No.(s): AD-A329519; AFOSR-TR-97-0298; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this SBIR Phase 2 project was to develop a sensor that could be used by the USAF to monitor the degree of corrosion in aircraft. Electrochemical Impedance Spectroscopy (EIS) has been performed on aluminum alloy samples coated under military specifications. Precise impedance signatures were acquired in order to develop a simple, yet powerful, sensor for the early detection and measurement of corrosion processes on aircraft. Two versions of prototype sensors have been developed in the Phase 2 effort to obtain the EIS signature utilizing a two-electrode approach. One version is a portable hand-held unit while the second version is permanently attached. The two-electrode approach enables reliable in-situ, real-time analyses of aircraft metal/coating systems under actual service conditions. Results of the Phase II laboratory testing show that the sensors are capable of tracking the corrosion process on the aluminum substrates under a variety of environmental conditions and substrate configurations. Field testing of the portable unit has shown that the technique can be conducted in the field with results comparable to the laboratory.

DTIC

Precision; Sampling; Electrochemistry; Ellipsometry; Evaluation; Corrosion; Aircraft Design

19970041083 Army Research Lab., Aberdeen Proving Ground, MD USA

Improved Rolled Homogeneous Armor (IRHA) Steel Through Higher Hardness Final Report, Oct. 1989 - Sep. 1995

Prifti, Joseph, Army Research Lab., USA; Castro, Michael, Army Research Lab., USA; Squillacioti, Richard, Army Research Lab., USA; Cellitti, Raymond, Army Research Lab., USA; Apr. 1997; 66p; In English

Report No.(s): AD-A329222; ARL-TR-1347; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An Improved Rolled Homogeneous Armor (IRHA) steel with enhanced ballistic performance has been developed. Increases in ballistic performance are attributed to higher hardness levels achieved by IRHA, which maintain adequate toughness and ductility. Through augmentation of a generic chemical composition for standard Rolled Homogeneous Armor (RHA) material, and optimization of heat treatment, greater hardenability, and higher hardness levels were attained. The higher hardenability ensures that

through-thickness hardness, with the desired martensite microstructure, is obtained for armor plates up to 3 in thick, using current steel mill facilities and practice. The optimal, relatively low-carbon, nickel-chromium-molybdenum (Ni-Cr-Mo) IRHA alloy was developed in-house, employing U.S. Army Research Laboratory (ARL), Materials Directorate (MD) laboratory facilities, followed by steel mill production heats demonstrating scale-up and producibility. Ballistic testing vs. projectiles, ranging from medium caliber to tank rounds, established that the IRHA material at the HRC 40 hardness level is best suited for vehicle hull applications, while material at HRC 48 provides better protection as applique armor. The armor plate at both hardness levels (HRC 40 and 48) demonstrated structural integrity upon high Kinetic Energy (KE) ballistic loading, through passing the required full-scale 105-mm Armor Piercing (AP) T182 projectile impact tests. At the HRC 40 level, the IRHA weldability and fabricability were shown to be comparable to standard RHA for tank construction.

DTIC

Homogeneity; Armor; Steels; Hardness; Product Development; Ground Effect Machines

19970041224 NERAC, Inc., Tolland, CT USA

Ceramics Technology: Automotive Gas Turbine Engine Component Applications. (Latest Citations from the Energy Science and Technology Database)

Jul. 1997; p; In English; Page count unavailable. Supersedes PB96-869136

Report No.(s): PB97-862056; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning the development and evaluation of ceramic materials for use in automotive gas turbine components. Citations discuss the design, fabrication, and testing of rotary regenerators, turbine rotors, blades, stators, combustion chambers, heat exchangers, nozzles, and seals. References to high-strength ceramic materials, thermodynamic properties, thermal efficiency, and environmental effects are included. (Contains 50-250 citations and includes a subject term index and title list.)

NTIS

Bibliographies; Gas Turbine Engines; Ceramics; Technologies

19970041395 Vanderbilt Univ., Nashville, TN USA

Fatigue Reliability of Gas Turbine Engine Structures Final Report

Cruse, Thomas A., Vanderbilt Univ., USA; Mahadevan, Sankaran, Vanderbilt Univ., USA; Tryon, Robert G., Vanderbilt Univ., USA; Oct. 1997; 58p; In English

Contract(s)/Grant(s): NAS3-24389; AGT-H135571; NGT-51053; RTOP 523-22-13-00

Report No.(s): NASA/CR-97-206215; NAS 1.26:206215; E-10951; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The results of an investigation are described for fatigue reliability in engine structures. The description consists of two parts. Part 1 is for method development. Part 2 is a specific case study. In Part 1, the essential concepts and practical approaches to damage tolerance design in the gas turbine industry are summarized. These have evolved over the years in response to flight safety certification requirements. The effect of Non-Destructive Evaluation (NDE) methods on these methods is also reviewed. Assessment methods based on probabilistic fracture mechanics, with regard to both crack initiation and crack growth, are outlined. Limit state modeling techniques from structural reliability theory are shown to be appropriate for application to this problem, for both individual failure mode and system-level assessment. In Part 2, the results of a case study for the high pressure turbine of a turbo-prop engine are described. The response surface approach is used to construct a fatigue performance function. This performance function is used with the First Order Reliability Method (FORM) to determine the probability of failure and the sensitivity of the fatigue life to the engine parameters for the first stage disk rim of the two stage turbine. A hybrid combination of regression and Monte Carlo simulation is used to incorporate time dependent random variables. System reliability is used to determine the system probability of failure, and the sensitivity of the system fatigue life to the engine parameters of the high pressure turbine. The variation in the primary hot gas and secondary cooling air, the uncertainty of the complex mission loading, and the scatter in the material data are considered.

Author

Fatigue Life; Reliability; Gas Turbine Engines; Examination; Technologies

19970042626

Rolling-ball device for producing surface fatigue and its application to dental materials

Mccabe, J. F., Univ of Newcastle upon Tyne, UK; Kasim, N. H. Abu; Cleary, S.; Journal of Materials Science; January 15 1997; ISSN 0022-2461; vol. 32, no. 2, pp. 283-287; In English; Copyright; Avail: Issuing Activity

A new method of producing and evaluating surface fatigue using a rolling-ball device has been developed. The method involves constraining a rolling ruby ball between the 'v' groove of a rotor and the test specimen. The ball applies a compressive stress to the surface of the test material whilst it rolls in a circular pattern across the specimen surface. The fatigue life is defined as the time taken for surface degradation to begin to occur. The method is simple and reproducible and allows fatigue data to be gathered using a relatively small number of specimens. A series of model dental composites having varying filler fractions (23.7 - 66.4 vol%) were used to assess the potential of the method. The pattern of material loss as well as scanning electron microscopy examination of the damaged surfaces of test specimens confirmed that a fatigue mechanism was responsible for material loss. The fatigue life varied markedly with filler volume fraction being optimized at values in the range 30-50 vol%. Lower and higher volume fractions reduced the fatigue life. Filler silanation significantly improves fatigue life. The results suggest that the rolling ball device will prove useful in comparing the properties of different materials and in the development of improved products.

Author (EI)

Composite Materials; Composition (Property); Compressive Strength; Dentistry; Fatigue Tests; Mechanical Devices; Rotors

19970042974

Microdebonding study of the high-temperature oxidation embrittlement of a cross-ply glass-ceramic/SiC composite

Kahraman, R., King Fahd Univ, Saudi Arabia; Composites Science and Technology; December 1996; ISSN 0266-3538; vol. 56, no. 12, pp. 1453-1459; In English; Copyright; Avail: Issuing Activity

A constant cross-section specimen with adhesively bonded tabs has been used for an investigation of the high-temperature tensile behavior of a cross-ply glass-ceramic-matrix composite consisting of CAS-II reinforced with Nicalon SiC fiber. Oxidation of the exposed interfaces along matrix cracks in 0 deg plies lowers the composite failure strain at 800 C to the 0 deg ply matrix-cracking strain. Scanning electron microscopy and microdebonding analysis of the fracture surfaces indicate that the embrittlement process is the result of oxidation of the carbon-rich interphase as the matrix crack encounters 0 deg ply fibers, the interphase subsequently fuses with a higher bond strength and the crack grows through the fibers. Planar cracks grow inwards from the surface, covering the entire fracture surface given enough time (or sufficient strain). Degradation of the fibers does not appear to contribute to the embrittlement. Transverse ply crack at a lower strain than does the matrix in the 0 deg plies. However, it appears that oxygen does not enter 90 deg ply cracks in sufficient quantity to produce oxidation embrittlement, at least up to the 0 deg matrix-cracking strain. The strain to crack the 90 deg plies does not decrease significantly at high temperatures despite the fact that the cracks are primarily in the fiber/matrix interphase as they grow across the 90 deg plies.

Author (EI)

Adhesive Bonding; Calcium Compounds; Ceramic Fibers; Ceramic Matrix Composites; Embrittlement; High Temperature; Oxidation; Ply Orientation; Silicon Carbides; Tabs (Control Surfaces)

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.

19970040587 University of Western Michigan, Dept. of Mechanical and Aeronautical Engineering, Kalamazoo, MI USA

Unsteady Blade Row Interaction in a Transonic Turbine Final Report

Dorney, Daniel J., University of Western Michigan, USA; Jul. 15, 1996; 65p; In English

Contract(s)/Grant(s): NAG3-1671

Report No.(s): NASA/CR-96-206021; NAS 1.26:206021; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that unsteady blade row interaction effects can have a significant impact on the performance of multiple-stage turbines. The magnitude of blade row interaction is a function of both blade-count ratio and axial spacing. In the current research program, numerical simulations have been used to quantify the effects of blade count ratio on the performance of an advanced turbine geometries.

Author

Engine Tests; Supersonic Turbines; Jet Engines; Unsteady Flow; Turbomachinery; Three Dimensional Flow

19970040682 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Report to Congressional Committees. Electronic Warfare: Towed Decoys Could Improve Survivability of Current Navy Aircraft

Sep. 1997; 17p; In English

Report No.(s): AD-A329082; GAO/NSIAD-97-94; B-272628; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have completed our review of the Department of Defense's (DOD) acquisition plans for the ALE-50 towed decoy system and the Radio Frequency Countermeasures System (RFCM), which includes a more advanced towed decoy. The RFCM is part of the Integrated Defensive Electronics Countermeasures System being developed for some Navy and Air Force aircraft. Our objective was to determine whether towed decoys could improve the survivability of these aircraft. In addition, because Congress has expressed concern for F/A-18C/D survivability, we are issuing this report to bring to your attention the opportunity towed decoy systems offer to potentially enhance survivability of the F/A-18C/D.

DTIC

Aircraft Equipment; Reports; Electronic Warfare; Surveillance; Attack Aircraft

19970040880 California Univ., Dept. of Materials Science and Engineering, Los Angeles, CA USA

Development of the Microstructure Based Stochastic Life Prediction Models Final Report, 15 Dec. 1990 - 31 Dec. 1996

Przystupa, Marek A., California Univ., USA; Jul. 18, 1997; 433p; In English

Contract(s)/Grant(s): N00014-91-J-1299

Report No.(s): AD-A329190; Rept-910878-00-A12; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

The goal of this program was to develop a methodology for predicting fatigue lives of structural alloys based on their microstructural characteristics and mechanical properties. Such methodology has been successfully implemented and verified by predicting fatigue lives of the four different variants of the aluminum airframe 7050-T7451 plate alloy and, with modifications, of the butt welds of the ship hull HSLA-80 steels. The key features of the method is the assumption that the incipient fatigue crack size distribution is related to the size distribution of the bulk material flaws through the statistics of extreme. When combined with the Monte-Carlo (MC) crack growth model the extreme value estimates of the initial crack sizes gave excellent predictions of the fatigue lives of the 7050-T7451 alloy for samples both with and without stress concentrators. The specially for this purpose developed MC model utilized initial crack size distribution, crack location, crystallographic texture on the crack path and crack deflections as the random variables. A modified, closed-form three-parameter version of the model has been proposed for the butt welds of the HSLA-80 steels. This version, with parameters obtained based on the constant amplitude data, showed outstanding predictive capabilities for the samples with welds subjected to the variable amplitude loading conditions. Both versions of the model represent very useful and economical alternative to the lengthy fatigue testing programs. They allow for rapid differentiation between fatigue qualities of different material variants and on the parametric studies of the effects of the microstructural variables on fatigue lives. The methodology should be instrumental in aiding alloy designers and process engineers in optimizing alloy microstructures for fatigue performance.

DTIC

Microstructure; Prediction Analysis Techniques; Fatigue (Materials); Mechanical Properties; Butt Joints; Welded Joints; Airframes; Crack Propagation; Metal Fatigue; Monte Carlo Method

19970040898 Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA

Database of Ground-Based Anemometer Measurements of Wake Vortices at Kennedy Airport Final Report, Sep. 1994 - Mar. 1995

Burnham, David, Scientific and Engineering Solutions, Inc., USA; Abramson, Steve, Federal Aviation Administration, USA; Jul. 1997; 30p; In English

Report No.(s): AD-A329010; DOT-VNTSC-FAA-97-10; DOT/FAA/ND-97/6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 700 foot array of horizontal and vertical single-axis anemometers was installed at New York's Kennedy Airport on 30-foot poles under the approach to Runway 31R. Although the original purpose for the anemometers was to track the lateral position of wake vortices, new processing algorithms were developed that permit assessment of vortex height and circulation. Data from more than 20,000 landings have been recorded and processed. This report documents the current state of algorithm development and provides processed data for other researchers to analyze.

DTIC

Aircraft Landing; Data Bases; Vortices; Airports; Aircraft Wakes

19970040955 Raytheon Co., Electronics Systems Div., Tewksbury, MA USA

Asymmetric Lateral Jet Interaction Studies for a Supersonic Missile: CFD Prediction and Comparison to Force and Moment Measurements

Srivastava, B., Raytheon Co., USA; Jan. 1997; 34p; In English

Report No.(s): AD-A329063; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Computational Fluid Dynamics (CFD) predictions are compared with the wind-tunnel tests for a missile consisting of ogive-nose cylindrical body, four wings and four in-lined tail panels at nominal supersonic Mach Nos. 2, 3, 4 and 5 at angles-of-attack ranging from 0 to 35 deg with and without a lateral jet thruster with thrust ratios of 1 and 4. Comparisons also include roll angles that lead to asymmetric missile configuration with the thruster jet. Excellent comparisons of the predicted normal force, side force, pitching moment, yawing moment and rolling moment coefficients with the measured data are shown. CFD computed flow field is then utilized to show that the lateral thruster jet effectiveness diminishes as the jet thruster is gradually rolled towards the windward side of the missile. Flow-physics associated with this phenomenon and possible mechanisms to alleviate this effect is discussed.

DTIC

Computational Fluid Dynamics; Wind Tunnel Tests; Missile Configurations; Mach Number; Missiles; Angle of Attack; Flow Distribution; Aerodynamic Coefficients

19970041517 NERAC, Inc., Tolland, CT USA

Servomotors . (Latest citations from the Aerospace Database)

Jun. 1997; p; In English; Page count unavailable. Supersedes PB96-865563

Report No.(s): PB97-861165; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning the design, testing, and application of servomotors. AC, DC, and brushless motor drives are discussed. Applications are examined, including use in hydraulic presses; teleprinters; machine tools; sewing machines; and servocontrol devices for instrumentation, robots, and aircraft control. Testing methods evaluate precision, vibration and vibration reduction, and stability of servomotors.

NTIS

Servomotors; Servocontrol; Alternating Current; Aircraft Control

19970041544 R-Tec, Rolling Hills Estates, CA USA

Visual and Non-Destructive Inspection Technologies

Ratwani, Mohan M., R-Tec, USA; Oct. 1996; 16p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper discusses currently available techniques for detecting damage in structures and their limitations. Inspection of cracks in substructure and hidden corrosion has always presented a nightmare for NDI engineers. Some recent advances made in the NDI technology to solve these problems are discussed. Proper inspection at regular intervals is one technology area which plays an important role in the safety of flight of military and commercial aircraft. Reliable visual and nondestructive inspection (NDI) methods are needed to assure the airworthiness of these aircraft and at the same time keep maintenance costs to a minimum. Derived from text

Aircraft Reliability; Substructures; Cracks; Damage; Inspection; Commercial Aircraft; Nondestructive Tests

19970041547 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA

Airframe Inspection Reliability

Sampath, S. G., Federal Aviation Administration, USA; Oct. 1996; 10p; In English; Also announced as 19970041535; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Inspection reliability is a cornerstone of the damage tolerance philosophy underlying the U. S. Air Force Airframe Structural Integrity Program (ASIP) and their Engine Structural Integrity Program (ENSIP), which are designed to ensure continued airworthiness of its fleet. Inspection data are essential to deriving inspection thresholds and inspection intervals; elements of every maintenance program for the constituents within a fleet. Frequency and the method of inspection are primary drivers of maintenance costs and thus life-cycle costs. On the other hand, structural safety also depends on inspection reliability, i.e., the ability to detect damage in a timely fashion. This presentation highlights certain aspects of inspection reliability that primarily relate to airframe

structures and recommends the establishment of an international data collection and cataloging activity for improving inspection reliability.

Derived from text

Inspection; Tolerances (Mechanics); Aircraft Reliability; Aircraft Structures; Airframes; Life Cycle Costs; Structural Failure; Structural Stability; Costs; Damage

19970041578 Technische Univ., Delft, Netherlands

Development of a Numerical Method for the Airflow over a Thin Layer of Liquid

deJong, H., Technische Univ., Netherlands; Dec. 1996; 114p; In English; Figures in this document may not be legible in mic Report No.(s): PB97-190011; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Mathematical models which describe the two-dimensional flow over a transient thin liquid layer on a solid surface, driven by gravitational-, inertial-, and shear-forces are derived. These models are used as a basic for a computational method to simulate fluid flow-off, aimed at predicting the influence of the transitional liquid layer on the aerodynamic characteristics of airfoil sections. The methodology chosen determines the solution of the complete flow by the interactive coupling of an outer potential flow and an inner combined gas-boundary-layer/ thin-liquid-layer flow. The position and shape of the free interface between the liquid-layer and the gas-boundary-layer is determined as part of the solution. The solution for the outer inviscid flowfield is obtained using an unsteady panel method to solve Laplace's equation. The solution of the viscous gas flow is determined by a finite-volume method for the unsteady boundary-layer equations and an integral method for the viscous flow in the thin liquid layer.

NTIS

Panel Method (Fluid Dynamics); Two Dimensional Flow; Viscous Flow; Inviscid Flow; Boundary Layers; Finite Volume Method; Airfoil Profiles; Aerodynamic Characteristics

19970041597 Michigan State Univ., Dept. of Mechanical Engineering, East Lansing, MI USA

An Experimental Study of the Near Field Region of a Free Jet with Passive Mixing Tabs Final Report

Bohl, D. G., Michigan State Univ., USA; Foss, J. F., Michigan State Univ., USA; Nov. 1997; 162p; In English Contract(s)/Grant(s): NAG3-1459; RTOP 537-05-21-00

Report No.(s): NASA/CR-97-206296; NAS 1.26:206296; E-10993; MSU-ENGR-04-96; TSFL-R-044; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

An experimental study was performed to determine the flow characteristics of a tabbed free jet. Results were acquired in the near field (nominally 2 tab widths upstream to 2 tab widths downstream of the exit plane) of a tabbed jet. Upstream pressure results showed static pressure distributions in both the x-and y-directions along the top surface of the tunnel. Hot-wire measurements showed rapid expansion of the core fluid into the ambient region. Two counter rotating regions of streamwise vorticity were shown on each side of the primary tab. An enhancement of the tabbed jet concept was proposed and tested. Specifically, two tabs, half the scale of the primary tab, were added to the primary tab to provide attachment surfaces for the normally occurring ejection of fluid. The secondary tabs caused a slight increase in the streamwise vorticity created from the upstream static pressure gradient while significantly increasing the re-oriented boundary layer vorticity. The combined pumping effect of the two counter rotating regions of vorticity caused a significant increase in the transport of the jet core fluid into the surrounding region.

Author

Data Acquisition; Experimentation; Tabs (Control Surfaces); Free Jets; Flow Characteristics

19970041798

Evaluations of a hybrid-type superconducting magnetic bearing system

Komori, Mochimitsu, Kyushu Inst of Technology, Japan; Matsuoka, Shinya; Fukata, Satoru; IEEE Transactions on Applied Superconductivity; December 1996; ISSN 1051-8223; vol. 6, no. 4, pp. 178-182; In English; Copyright; Avail: Issuing Activity

This paper describes a hybrid-type superconducting magnetic bearing (SMB) system. The system is composed of a pair of SMB's and a pair of active magnetic bearings (AMB's). The hybrid-type SMB system does not need bias currents applied to the electromagnets for supporting the rotor, because the rotor mass is supported by the SMB's. The displacements of the rotor are suppressed by both the SMB's and the AMB's. The superconductors of the SMB's were field-cooled. Impulse responses of the rotor in the hybrid-type SMB system and the system with only SMB's working are investigated. The results show that the hybrid-type SMB system has a good performance in impulse responses. In order to investigate the usefulness of the hybrid-type SMB system, displacements of the rotating rotor and energy loss of the system are discussed.

Author (EI)

Magnetic Bearings; Rotors; Superconducting Magnets

19970042130

Turbulent flow and heat transfer in rotating different aspect ratio channels

Dutta, Sandip, Univ of South Carolina, USA; Andrews, Malcolm J.; Han, Je-Chin; Journal of Thermophysics and Heat Transfer; April 1997; ISSN 0887-8722; vol. 11, no. 2, pp. 318-319; In English; Copyright; Avail: Issuing Activity

The heat transfer and turbulent flow in rotor blade coolant passages of different aspect ratios were studied. Five different aspect ratios of the coolant passages were selected to cover different regions of a turbine blade. The leading edge of the blade had more space to accommodate a low aspect ratio coolant channel and the narrow trailing edge had a high aspect ratio coolant passage. A two-equation turbulence model with rotation-modified turbulence terms was used. A Boussinesq approximation in which the density was constant except in the rotational buoyancy terms was used for the analysis. Since flow Mach number was less than 0.1, compressible effects in the energy equation were neglected.

Author (EI)

Aspect Ratio; Boussinesq Approximation; Coolants; Heat Transfer; Mach Number; Nusselt Number; Rotors; Turbomachine Blades; Turbulent Flow

19970042162 NASA Ames Research Center, Moffett Field, CA, USA

Design and flight test of 35-GigaHertz radar for terrain and obstacle avoidance

Zelenka, Richard E., NASA Ames Research Cent, USA; Almsted, Larry D., NASA Ames Research Center, USA; Journal of Aircraft; March 1997; ISSN 0021-8669; vol. 34, no. 2, pp. 261-263; In English; Copyright; Avail: Issuing Activity

A 35-GHz scanning, pencil beam millimeter wave (MMW) radar forward sensor determines whether an aircraft's flight path is clear of obstructions. The three-dimensional radar's returns are used to construct a terrain and obstacle database surrounding the aircraft, which is presented to the pilot as a synthetic perspective display. Narrow beam shapes and small antennas allows operation of the MMW band during bad weather. The radar-derived high-resolution, high accuracy database can also be used to drive aircraft guidance trajectories.

Author (EI)

Aircraft Equipment; Collision Avoidance; Data Bases; Radar Equipment

19970042584

Experimental measurements in a centrifugal pump impeller

Bwalya, A. C., Univ of Liverpool, UK; Johnson, M. W.; Journal of Fluids Engineering, Transactions of the ASME; December 1996; ISSN 0098-2202; vol. 118, no. 4, pp. 692-697; In English; Copyright; Avail: Issuing Activity

Measurements of the 3-d velocities, total and static pressures have been made in a 0.89 m diameter commercial pump impeller, using air as the working fluid. Results at the peak efficiency operating point show separation of the flow near the shroud on the pressure side of the blade at the leading edge. This separation results in a low energy region which initially travels axially through the impeller to form a wake in the suction side shroud corner region. A region of reversed radial velocity is observed at the outlet, which is due to high blade sweep angle together with the poor guidance given to the flow by the blades in the mid-passage region.

Author (EI)

Centrifugal Pumps; Experiment Design; Flow Measurement; Pump Impellers; Rotors

19970042995

Instability analysis of unsymmetrical rotor-bearing systems using the transfer matrix method

Kang, Y., Chung Yuan Christian Univ, USA; Lee, Y.-G.; Chen, S.-C.; Journal of Sound and Vibration; January 23 1997; ISSN 0022-460X; vol. 199, no. 3, pp. 381-400; In English; Copyright; Avail: Issuing Activity

In this study, a modified transfer matrix approach, valid for complex rotor-bearing systems, was developed to analyze the instability in unsymmetrical rotor-bearing systems. Specifically, the transfer matrices of non-axisymmetrical shaft segments were derived by using a continuous-system sense to obtain an accurate formulation. The influences of bearing characteristics and shaft asymmetry on the transition curves of T-type and 2T-type solutions were evaluated by using Bolotin's method.

Author (EI)

Bearings; Matrices (Mathematics); Matrix Methods; Rotors; Systems Stability

19970042996

Development and modification of a unified balancing method for unsymmetrical rotor-bearing systems

Kang, Y., Chung Yuan Christian Univ, USA; Sheen, G.-J.; Wang, S.-M.; Journal of Sound and Vibration; January 23 1997; ISSN 0022-460X; vol. 199, no. 3, pp. 349-368; In English; Copyright; Avail: Issuing Activity

On the basis of theoretical developments, this study proposes procedures for a modified unified balancing method for unsymmetrical rotor-bearing systems. A formulation of modal influence coefficient matrices is derived from the motion equations for unsymmetrical rotors, using a complex co-ordinate representation and the finite element method. Due to unequal properties in two principal directions, two sets of modal influence coefficients are presented. This formulation indicates that two trial masses in different directions are required in the two trial operations for each balancing plane. Also, the modal influence coefficients are found to be correlated with forward precession and unbalanced forces when asymmetry of bearings is considered. Therefore, forward precessions instead of measured displacements are required to calculate the unbalance distribution. Several examples are presented to verify the validity of the present work.

Author (EI)

Balancing; Bearings; Influence Coefficient; Matrix Theory; Rotors

19970043192

Circumferentially smeared computed effects of rim seal clearance on wheelspace thermal distributions

Ko, S. H., Chungnam Natl Univ, USA; Rhode, D. L.; Guo, Z.; Journal of Turbomachinery, Transactions of the ASME; January 1997; ISSN 0889-504X; vol. 119, no. 1, pp. 157-159; In English; Copyright; Avail: Issuing Activity

An advanced finite volume computer code, recently benchmarked against rotor-stator cavity measurements (Ko and Rhode, 1992), was used to obtain an enhanced partial understanding of hot gas ingress heating of a generic turbine wheelspace cavity. This problem is extremely complicated, with a three-dimensional, probably circumferentially periodic ingress/egress flow through the rim seal due to mainstream pressure asymmetries resulting from the presence of blades, etc. The present study does not assume that the complete problem can be modeled as steady and two-dimensional axisymmetric. Rather, the objective of this study is to obtain a partial understanding of the complete problem from investigating the circumferentially smeared, steady, two-dimensional axisymmetric sub-problem. It was found that, contrary to the case of the nominal rim seal axial clearance, for a clearance of one-fourth of the nominal value, the temperature of the 'hot spot' on the rotor is sharply reduced with increasing purge-coolant flow because the rim seal gap recirculation zone does not form. Also, it was found that smaller rim seal axial clearances give less rotational drag as well as less heat transport from the mainstream into the wheelspace.

Author (EI)

Computer Programs; Computerized Simulation; Finite Volume Method; Gas Heating; Heating; High Temperature Gases; Rotors; Stators; Temperature Effects; Turbomachinery

19970043193

Performance assessment of an annular S-shaped duct

Bailey, D. W., Loughborough Univ, UK; Britchford, K. M.; Carrotte, J. F.; Stevens, S. J.; Journal of Turbomachinery, Transactions of the ASME; January 1997; ISSN 0889-504X; vol. 119, no. 1, pp. 149-156; In English; Copyright; Avail: Issuing Activity

An experimental investigation has been carried out to determine the aerodynamic performance of an annular S-shaped duct representative of that used to connect the compressor spools of aircraft gas turbine engines. For inlet conditions in which boundary layers are developed along an upstream entry length, the static pressure, shear stress and velocity distributions are presented. The data show that as a result of flow curvature, significant streamwise pressure gradients exist within the duct, with this curvature also affecting the generation and suppression of turbulence. The stagnation pressure loss within the duct is also assessed and is consistent with the measured distributions of shear stress. More engine representative conditions are provided by locating a single-stage compressor at inlet to the duct. Relative to the naturally developed inlet conditions, the flow within the duct is less likely to separate, but mixing out of the compressor blade wakes increases the measured duct loss. With both types of inlet condition, the effect of a radial strut, such as that used for carrying loads and engine services, is also described both in terms of the static pressure distribution along the strut and its contribution to overall loss.

Author (EI)

Aerodynamics; Aircraft Engines; Annular Ducts; Boundary Conditions; Compressors; Ducts; Gas Turbine Engines; Gas Turbines; Pressure; Stagnation Pressure; Static Pressure; Velocity Distribution

19970043195

Boundary layer development in axial compressors and turbines: Part 4 of 4 - computations and analyses

Halstead, D. E., GE Aircraft Engines, USA; Wisler, D. C.; Okiishi, T. H.; Walker, G. J.; Hodson, H. P.; Shin, H.-W.; Journal of Turbomachinery, Transactions of the ASME; January 1997; ISSN 0889-504X; vol. 119, no. 1, pp. 128-139; In English; Copyright; Avail: Issuing Activity

This is Part Four of a four-part paper. It begins with Section 16.0 and concludes the description of the comprehensive experiments and computational analyses that have led to a detailed picture of boundary layer development on airfoil surfaces in multi-

stage turbomachinery. In this part, the computational predictions made using several modern boundary layer codes are presented. Both steady codes and an unsteady code were evaluated. The results are compared with time-averaged and unsteady integral parameters measured for the boundary layers. Assessments are made to provide guidance in using the predictive codes to locate transition and predict loss. Conclusions from the computational analyses are then presented.

Author (EI)

Axial Flow; Boundary Layer Flow; Boundary Layers; Compressors; Computational Fluid Dynamics; Computerized Simulation; Steady Flow; Turbines; Turbomachinery

19970043196

Boundary layer development in axial compressors and turbines: Part 1 of 4 - composite picture

Halstead, D. E., GE Aircraft Engines, USA; Wisler, D. C.; Okiishi, T. H.; Walker, G. J.; Hodson, H. P.; Shin, H.-W.; Journal of Turbomachinery, Transactions of the ASME; January 1997; ISSN 0889-504X; vol. 119, no. 1, pp. 114-127; In English; Copyright; Avail: Issuing Activity

Comprehensive experiments and computational analyses were conducted to understand boundary layer development on airfoil surfaces in multistage, axial-flow compressors and LP turbines. The tests were run over a broad range of Reynolds numbers and loading levels in large, low-speed research facilities which simulate the relevant aerodynamic features of modern engine components. Measurements of boundary layer characteristics were obtained by using arrays of densely packed, hot-film gauges mounted on airfoil surfaces and by making boundary layer surveys with hot wire probes. Computational predictions were made using both steady flow codes and an unsteady flow code. This is the first time that time-resolved boundary layer measurements and detailed comparisons of measured data with predictions of boundary layer codes have been reported for multistage compressor and turbine blading. Part 1 of this paper summarizes all of our experimental findings by using sketches to show how boundary layers develop on compressor and turbine blading. Parts 2 and 3 present the detailed experimental results for the compressor and turbine, respectively. Part 4 presents computational analyses and discusses comparisons with experimental data. Readers not interested in experimental detail can go directly from Part 1 to Part 4. For both compressor and turbine blading, the experimental results show large extents of laminar and transitional flow on the suction surface of embedded stages, with the boundary layer generally developing along two distinct but coupled paths. One path lies approximately under the wake trajectory while the other lies between wakes. Along both paths the boundary layer clearly goes from laminar to transitional to turbulent. The wake path and the non-wake path are coupled by a calmed region, which, being generated by turbulent spots produced in the wake path, is effective in suppressing flow separation and delaying transition in the non-wake path. The location and strength of the various regions within the paths, such as wake-induced transitional and turbulent strips, vary with Reynolds number, loading level, and turbulence intensity. On the pressure surface, transition takes place near the leading edge for the blading tested. For both surfaces, bypass transition and separated-flow transition were observed. Classical Tollmien-Schlichting transition did not play a significant role. Comparisons of embedded and first-stage results were also made to assess the relevance of applying single-stage and cascade studies to the multistage environment. Although doing well under certain conditions, the codes in general could not adequately predict the onset and extent of transition in regions affected by calming. However, assessments are made to guide designers in using current predictive schemes to compute boundary layer features and obtain reasonable loss predictions.

Author (EI)

Airfoils; Axial Flow; Boundary Layer Flow; Boundary Layer Separation; Compressors; Computation; Low Pressure; Separated Flow; Turbines; Turbomachinery

19970043198

Three-dimensional unsteady flow and forces in centrifugal impellers with circumferential distortion of the outlet static pressure

Fatsis, A., von Karman Inst for Fluid Dynamics, Belgium; Pierret, S.; Van Den Braembussche, R.; Journal of Turbomachinery, Transactions of the ASME; January 1997; ISSN 0889-504X; vol. 119, no. 1, pp. 94-102; In English; Copyright; Avail: Issuing Activity

This paper describes the numerical investigation of the centrifugal impeller response to downstream static pressure distortions imposed by volutes at off-design operations. An unsteady three-dimensional Euler solver with nonreflecting upstream and downstream boundary conditions and phase-lagged periodicity conditions is used for this purpose. The mechanisms governing the unsteady flow field are analyzed. A parametric study shows the influence of the acoustic Strouhal number on the amplitude

of the flow perturbations. Radial forces calculated on backward leaned and radial ending centrifugal impellers show nonnegligible influence of the impeller geometry.

Author (EI)

Centrifugal Force; Loads (Forces); Numerical Analysis; Periodic Variations; Rotors; Shafts (Machine Elements); Static Pressure; Strouhal Number; Torque; Unsteady Flow

19970043199

Evaluation of the interaction losses in a transonic turbine HP rotor/LP vane configuration

Jennions, I. K., ABB Power Generation Ltd, USA; Adamczyk, J. J.; Journal of Turbomachinery, Transactions of the ASME; January 1997; ISSN 0889-504X; vol. 119, no. 1, pp. 68-76; In English; Copyright; Avail: Issuing Activity

Transonic turbine rotors produce shock waves, wakes, tip leakage flows, and other secondary flows that the downstream stators have to ingest. While the physics of wake ingestion and shock interaction have been studied quite extensively, few ideas for reducing the aerodynamic interaction losses have been forthcoming. This paper aims to extend previously reported work performed by GE Aircraft Engines in this area. It reports on both average-passage (steady) and unsteady three-dimensional numerical simulations of a candidate design to shed light on the interaction loss mechanisms and evaluate the design. The results from these simulations are first shown against test data for a baseline configuration to engender confidence in the numerical approach. Simulations with the proposed newly designed rotor are then performed to show the trade-offs that are being made in such designs. The new rotor does improve the overall efficiency of the group and physical explanations are presented based on examining entropy production.

Author (EI)

Heat Transfer; Rotors; Shock Wave Interaction; Shock Waves; Stators; Supersonic Turbines; Turbines

19970043221

Experimental investigation on the flow and heat transfer around holes with compound-angle and cooled with single film

Xu, Hongzhou, Northwestern Polytechnical Univ, China; Liu, Songling; Xu, Duchun; Tuijin Jishu/Journal of Propulsion Technology; October 1996; ISSN 1001-4055; vol. 17, no. 6, pp. 12-17; In Chinese; Copyright; Avail: Issuing Activity

The experiments were carried out under the following condition: blowing ratio $M = 1.0, 2.0$; flow orientation angle (with respect to the test surface) is 30 deg/60 deg in a stream/normal plane projection, and 30 deg/45 deg in a spanwise/normal plane projection; and the hole with a fan-shaped angle of 0 deg/30 deg. The measurements were carried out with a five-hole directional probe and thermocouple to investigate the 3-D flow-field and temperature-field distribution. It was found that (1) there is a pair of counterrotating vortices, one is strong and another is weak, in the downstream region of jet exit; (2) the contours of longitudinal velocity U/U and isoline of nondimensional temperature show an asymmetric kidney shape; (3) the area covered by the cooling film for the fan-shaped hole is wider than the one of circular hole hence the cooling efficiency can be greatly improved.

Author (revised by EI)

Film Cooling; Flow Distribution; Gas Cooling; Gas Turbines; Heat Transfer; Temperature Distribution; Turbojet Engines

13 GEOSCIENCES

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

19970041099 Lockheed Martin Energy Systems, Inc., Oak Ridge, TN USA

Remedial Investigation Report for the 144th Fighter Wing, California Air National Guard, Fresno Air Terminal, Fresno, California Final Report

May 1997; 646p; In English

Contract(s)/Grant(s): DE-AC05-840R-21400

Report No.(s): AD-A328527; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Remedial Investigation Report documenting the results of soil and groundwater samples obtained during the 1992 field effort. This report covers Site 5 - Base Collection Pond. Based on the data the Site was recommended for further action under the IRP. The State concurred with this recommendation.

DTIC

Restoration; Water Quality; Investigation; Armed Forces (USA); Wings; Data Acquisition; Military Air Facilities; Installing

19970041011 NERAC, Inc., Tolland, CT USA

Windshear: Detection and Avoidance: (Latest citations from the NTIS Bibliographic Database)

Apr. 1997; p; In English; Page count unavailable. Supersedes PB96-858402

Report No.(s): PB97-858641; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)), Microfiche

The bibliography contains citations concerning techniques and technologies conceived to avoid or correct for windshear or microbursts. Active techniques such as microwave radar, millimeter wave radar, and laser radar are discussed. Techniques such as passive infrared imaging are also discussed. Citations cover sensor research, algorithm development, and windshear or microburst case studies.(Contains 50-250 citations and includes a subject term index and title list.)

NTIS

Bibliographies; Wind Shear; Data Bases; Detection; Avoidance; Flight Safety; Radar Imagery; Microbursts (Meteorology)

19970041909

Atmospheric research with the Small Expendable Deployer System: Preliminary analysis

Grassi, Michele, Univ of Naples 'Federico II', Italy; Cosmo, Mario L.; Journal of Spacecraft and Rockets; January 1996; ISSN 0022-4650; vol. 33, no. 1, pp. 70-78; In English; Copyright; Avail: Issuing Activity

Data on the structure of the lower thermosphere are extremely limited because of the inaccessibility of this region to research vehicles. Downward-deployed tethered satellites can provide access to this region of the atmosphere. A preliminary analysis of the potential use of the end mass of the Small Expendable Deployer System as a scientific platform for atmospheric and aerothermodynamic research is presented. To this end, the deployment and attitude dynamics of the end mass during the first mission have been numerically simulated. It is shown that measurements of the atmospheric mean density with the end-mass onboard accelerometers can be performed only in a short time interval around the orbit perigee; in addition, the analysis of the payload attitude dynamics shows the need for attitude control. A preliminary analysis of end-mass attitude control techniques is then performed. Results show that the stringent attitude control requirements can be satisfied by active control devices.

Author (EI)

Aerodynamics; Atmospheric Density; Atmospheric Heating; Attitude Control; Density (Mass/Volume); Meteorological Satellites; Upper Atmosphere

14

LIFE SCIENCES

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

19970040653 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

Effects of Pilot Workload on EEG Activity Recorded during the Performance of In-Flight Maneuvers in a UH-1 Helicopter Final Report

Caldwell, John A., Jr., Army Aeromedical Research Lab., USA; Roberts, Kristi A., Army Aeromedical Research Lab., USA; Kelly, C. F., Army Aeromedical Research Lab., USA; Jones, Heber D., Army Aeromedical Research Lab., USA; Lewis, James A., Army Aeromedical Research Lab., USA; Aug. 1997; 62p; In English

Contract(s)/Grant(s): DA Proj. 3M1-62787-A-879

Report No.(s): AD-A329208; USAARL-97-31; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The present investigation was designed to: (1) assess the overall quality of EEG recordings collected from helicopter pilots during the actual performance of in-flight maneuvers; (2) determine whether there are workload-induced changes in the EEGs recorded under resting in-flight conditions and 'on-the-controls' in-flight conditions; and (3) evaluate whether in-flight EEGs are sufficiently sensitive to detect small changes in the workload levels associated with different types of flight maneuvers. Twenty subjects (10 aviators and 10 nonaviators) were tested during the performance of standardization flight profiles in a UH-1 helicopter. There was a resting eyes-open EEG condition at the beginning which EEG data were recorded. During the maneuvers, the pilots maintained full control of the aircraft and attempted to maintain ideal flight parameters. The nonaviators sat quietly with their eyes focused on a fixation point.

DTIC

Aircraft Pilots; Electroencephalography; Workloads (Psychophysiology); Pilot Performance; UH-1 Helicopter; Aerospace Medicine; Aircraft Maneuvers

19970040666 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

Effects of Pilot Workload on EEG Activity Recorded during the Performance of In-Flight Maneuvers in a UH-1 Helicopter Final Report

Caldwell, John A., Jr., Army Aeromedical Research Lab., USA; Roberts, Kristi A., Army Aeromedical Research Lab., USA; Kelly, C. F., Army Aeromedical Research Lab., USA; Jones, Heber D., Army Aeromedical Research Lab., USA; Lewis, James A., Army Aeromedical Research Lab., USA; Aug. 1997; 63p; In English

Contract(s)/Grant(s): DA Proj. 3M1-62787-A-879

Report No.(s): AD-A329232; USAARL-97-31; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The present investigation was designed to: (1) assess the overall quality of EEG recordings collected from helicopter pilots during the actual performance of in-flight maneuvers; (2) determine whether there are workload-induced changes in the EEGs recorded under resting in-flight conditions and on-the-controls in-flight conditions; and (3) evaluate whether in-flight EEGs are sufficiently sensitive to detect small changes in the workload levels associated with different types of flight maneuvers.

DTIC

Electroencephalography; Workloads (Psychophysiology); Pilot Performance; UH-1 Helicopter; Aircraft Maneuvers

19970040673 Institute for Human Factors TNO, Soesterberg, Netherlands

Cockpit Information for Local and Global Spatial Task Support in Fighter Aircraft Interim Report Cockpit informatie voor de ondersteuning van lokale en globale taken in gevechtsvliegtuigen

deVries, S. C., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Sep. 25, 1997; 33p; In English

Contract(s)/Grant(s): A95/KLu/341

Report No.(s): TD97-0243; TM-97-A061; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands), Hardcopy, Microfiche

An experiment was conducted to investigate the potential benefits of perspective displays in the cockpit for support of global spatial orientation tasks in fighter aircraft. In a flight simulator, eight pilots were required to simultaneously perform a local task and a global task, i.e. closely follow a leading aircraft, and detect threat zones. The lead aircraft was visible in the outside scene, the threat zones were presented on three different display configurations in the cockpit: a plan-view map display as is currently used in fighter aircraft, a plan-view moving map display as will be used shortly, or a perspective map display. Pilot performance was determined in terms of tracking accuracy (local task) and threat-zone detection accuracy (global task). The results of the experiment indicate that navigational performance was best with the perspective map display, followed by the moving map display. Worst performance was found with the static map display. Display type did not significantly affect the tracking accuracy. Implications of the use of perspective radar displays in the cockpit are discussed.

Author

Fighter Aircraft; Pilot Performance; Cockpits; Radarscopes; Tracking (Position); Flight Simulators; Accuracy

19970040821 Armstrong Lab., Human Systems Center, Wright-Patterson AFB, OH USA

The Optokinetic Cervical Reflex (OKCR) in Pilots of High-Performance Aircraft Interim Report, Jun.1995 - Dec. 1995

Merryman, Ronald F. K., Armstrong Lab., USA; Apr. 1997; 93p; In English

Contract(s)/Grant(s): AF Proj. 7184

Report No.(s): AD-A329028; AL/CF-TR-1997-0082; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

For over sixty years, researchers and engineers have based investigations and the design of cockpit displays and structures upon the presupposition that, during flight, the pilot maintains a head alignment coincident with the aircraft's vertical axis (Z-axis). Recent flight simulator studies have verified the existence of a pilot neck reflex which refutes this long-standing assumption. This reflex, named the OptoKinetic Cervical Reflex (OKCR), occurs during visual flight and is theorized to be an attempt by the pilot to stabilize a retinal image of the horizon to maintain spatial orientation. As a result, pilots view a fixer-horizon image and not a moving-horizon. The objectives of the research were to determine if the optokinetic cervical reflex occurs during actual flight of high performance jet aircraft and to model the response. This was an observational study in which the head positions of nine pilots were recorded during actual F-15 aircraft flight and analyzed. Results indicate that the OKCR caused pilots to tilt their heads during aircraft bank. Also, the reflex was found to be independent of the bank phase: entering versus exiting the turn. The OKCR was shown to be a strong, natural response and the flight results correlated extremely well with the simulator results. The impact of these results on pilot training, spatial disorientation, physiological injury and safety, and the re-design of displays for aircraft attitude and virtual reality are discussed.

DTIC

Flight Simulators; Aircraft Performance; Disorientation; Display Devices; Reflexes; Pilot Training; Physical Examinations

19970040820 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

A Comparison of EEG and Evoked Response Data Collected in a UH-1 Helicopter to Data Collected in a Standard Laboratory Environment *Final Report*

Caldwell, John A., Jr, Army Aeromedical Research Lab., USA; Kelly, C. Frank, Army Aeromedical Research Lab., USA; Roberts, Kristi A., Army Aeromedical Research Lab., USA; Jones, Heber D., Army Aeromedical Research Lab., USA; Lewis, James A., Army Aeromedical Research Lab., USA; Aug. 1997; 120p; In English

Contract(s)/Grant(s): DA Proj. 3M1-62787-A-879

Report No.(s): AD-A329017; USAARL-97-30; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The in-flight collection and analysis of physiological data such as central nervous system activity may provide real-time, objective evaluations of aviator status during flight operations. However, little research has been done to assess the feasibility and validity of such a strategy. Some investigations (conducted in the fixed wing environment) have suggested that tape-recorded electroencephalographic (EEG) data are sensitive to changes in cockpit workload, but similar studies have not been performed in rotary-wing aircraft. In addition, none of the past investigations have focused on real-time telemetry of EEG from pilots under actual in-flight conditions, nor have they considered the feasibility of collecting valid cortical evoked potentials from helicopter or fixed wing pilots in flight. The present investigation was designed to verify indications from a small, previously conducted USAARL investigation that useable spontaneous EEG recordings could be made from helicopter pilots in flight. In addition, this study examined the feasibility of recording and telemetering cortical evoked potentials from subjects flying a UH-1 helicopter. Twenty subjects (10 aviators and 10 nonaviators) were tested both in the laboratory and in the aircraft. Spontaneous EEGs were collected once during eyes-open and eyes-closed conditions on the ground and once again in the air. Cortical evoked responses (P300s) were collected once on the ground and twice in the air (initially after takeoff and prior to flying an instrument approach). The pilots remained 'on the controls' during the collection of the second in-flight P300. Results confirmed indications from an earlier investigation that it was feasible to collect and telemeter valid spontaneous EEG activity from personnel flying onboard a UH-1 helicopter.

DTIC

Physiological Effects; Central Nervous System; Data Acquisition; Rotary Wings; In-Flight Monitoring

19970040947 Armstrong Lab., Human Resources Directorate, Mesa, AZ USA

Above Real-Time Training Applied to Air Combat Skills *Final Report, Jul. 1995 - Dec. 1996*

Crane, Peter M., Armstrong Lab., USA; Guckenberger, Dutch, ECC International Corp., USA; Schreiber, Brian T., Hughes Training, USA; Robbins, Robert L., Hughes Training, USA; Aug. 1997; 77p; In English

Contract(s)/Grant(s): F41624-95-C-5011; AF Proj. 1123

Report No.(s): AD-A329018; AL/HR-TR-1997-0104; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Above real-time training (ARTT) is an instructional strategy in which events in a training simulator occur faster than normal. Three experiments were conducted to evaluate applications of ARTT for training air combat skills and emergency procedures. Two of these experiments were conducted with experienced Air Force F-16 pilots who practiced air-to-air radar skills, air intercepts, and emergency procedures using conventional, real-time simulation or ARTT at 1.5 times real time. The pilots trained using ARTT received the same number of training trials but less clock time in the simulator as pilots trained in real time. All pilots were then tested in real time. Pilots trained using ARTT performed radar-skills tasks as well as pilots trained in real time. Pilots trained using ARTT performed emergency procedures tasks more quickly than pilots trained in real time. In a third experiment, student F-16 pilots practiced using air-to-air radar in real time or ARTT. Students trained using ARTT received more training trials in approximately the same amount of clock time as the students trained in real time. ARTT students performed better on a real-time test than students trained in real time. It is concluded that for selected tasks ARTT is more time efficient than conventional, real-time simulation because it allows more events to be experienced within a given period of training time. ARTT also supported better real-time test performance under some conditions.

DTIC

Aircraft Pilots; Pilot Performance; Training Simulators

19970041109 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

The Use of Bifocal Soft Contact Lenses in the Fort Rucker Aviation Environment *Final Report*

Morse, Stephen E., Army Aeromedical Research Lab., USA; Reese, Melisa A., Army Aeromedical Research Lab., USA; Aug. 1997; 95p; In English

Contract(s)/Grant(s): DA Proj. 3M1-62787-A-879

Report No.(s): AD-A329048; USAARL-97-27; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

There are problems with the compatibility of spectacles and certain helmet mounted electro-optical visual display systems. The incompatibility has been partially resolved with single vision contact lenses. However, these contact lenses have not helped senior aviators, who must wear bifocal glasses due to their presbyopia. The purpose of this study was to compare the performance of bifocal soft contact lenses with that of bifocal spectacle lenses to determine if contact lenses are an option for helping older aviators meet the visual requirements needed to fly military aircraft. Seventeen volunteer presbyopic aviators from Fort Rucker were fitted with five bifocal soft contact lens combinations and bifocal glasses. A four-phase investigation was conducted: a clinical phase involving the fitting of the bifocal contact lenses; a laboratory phase involving measurements of visual functions; a simulator phase involving measures of visual performance in simulated flight conditions; and an operational phase consisting of subjective responses regarding in-flight use of bifocal contact lenses. In general, vision in the best performing bifocal contact lenses typically was slightly reduced from vision in bifocal spectacles. The amount of the reduction, and whether it was clinically significant, depended on the refractive error of the subject (myopes generally performed better), the add group of the subject (low add group subjects performed better), and the type of bifocal contact lens. Aviators performed flight simulation maneuvers better in bifocal contact lenses than in bifocal glasses, and they evaluated their own ease of vision while performing aviation duties to be much easier in bifocal contact lenses than in bifocal glasses. In actual flight operations, each aviator preferred bifocal contact lenses over bifocal spectacles. Bifocal soft contact lenses are an acceptable alternative to glasses for presbyopic aviators. However, there is not one specific bifocal lens type that performs optimally on all subjects.

DTIC

Presbyopia; Flight Safety; Contact Lenses

19970041113 Logicon Technical Services, Inc., Dayton, OH USA

Computer Modeling of Operator Mental Workload during Target Acquisition: An Assessment of Predictive Validity Interim Report, Apr. - Dec. 1996

Vidulich, Michael A., Armstrong Lab., USA; See, Judi E., Logicon Technical Services, Inc., USA; Jan. 1997; 47p; In English Contract(s)/Grant(s): F41624-94-C-6007; AF Proj. 7184

Report No.(s): AD-A328970; AL/CF-TR-1997-0018; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The predictive validity of computer simulation modeling of the operator's mental workload and situational awareness (SA) during a target acquisition mission was assessed in the present study. In Phase 1, twelve participants completed a series of target acquisition trials in a laboratory flight simulator and provided subjective ratings of workload (using the Subjective Workload Assessment Technique (SWAT)) and SA (using the Situational Awareness Rating Technique (SART)). In Phase 2 computer models of the laboratory task were constructed using the Micro Saint modeling tool. The visual, auditory, kinesthetic, cognitive, and psychomotor components of the workload associated with each task were estimated and used to obtain the measures of average and peak workload. The results from the lab data versus the Micro Saint data were similar but not identical, indicating the computer models were partially, but not completely valid predictors of mental workload and SA. The computer modeling appeared to be a more effective predictor of SA rather than mental workload.

DTIC

Computerized Simulation; Workloads (Psychophysiology); Psychomotor Performance; Flight Simulators; Mental Performance; Ratings

19970041217 Oklahoma Univ., Norman, OK USA

Use of Object-Oriented Programming to Simulate Human Behavior in Emergency Evacuation of an Aircraft's Passenger Cabin Final Report

Court, Mary C., Oklahoma Univ., USA; Marcus, Jeffrey H., Federal Aviation Administration, USA; Aug. 1997; 11p; In English Report No.(s): AD-A329462; 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.

DTIC

Object-Oriented Programming; Computer Programs; Computerized Simulation; Evacuating (Transportation); Aircraft Accidents; Aircraft Compartments; Human Behavior; Flight Simulation

19970041345 Armstrong Lab., Neuropsychiatry Branch, Brooks AFB, TX USA

Pilot Personality: Gender and Career-Level Differences *Interim Report, Aug. 1996 - Jul. 1997*

King, Raymond E., Armstrong Lab., USA; Callister, Joseph D., Armstrong Lab., USA; Retzlaff, Paul D., Armstrong Lab., USA; McGlohn, Suzanne, Armstrong Lab., USA; Jul. 1997; 19p; In English; Sponsored in part by the Air Force Medical Operating Agency

Report No.(s): AD-A328845; AL/AO-TR-1997-0095; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Little work has been done to examine personality differences between female and male Air Force pilots. The current study investigates gender differences at beginning and mid-career points. These samples are compared to non-pilots controls. Female pilots differ from control subjects on most variables. Female student pilots are higher on Neuroticism and Openness than male student pilots. Mid-career female pilots are found only to be higher on Agreeableness compared to mid-career male pilots. Finally, differences are also found when comparing female student pilots to female mid-career pilots with the student pilots higher on Neuroticism and lower on Agreeableness.

DTIC

Psychological Tests; Aircraft Pilots; Personnel Development

19970041435 Armstrong Lab., Brooks AFB, TX USA

Psychological Aspects of Aviators' Success *Final Report, 22 Dec. 1995 - 30 Sep. 1996*

McGlohn, Suzanne E., Armstrong Lab., USA; Dec. 1996; 67p; In English

Contract(s)/Grant(s): MIPR-96MM6644

Report No.(s): AD-A328834; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This study compared female and male Air Force pilots across four differing methodologies. A computerized interview survey indicated several gender differences in attitudes toward military aviation. Males appear to continue to be uncomfortable with mixed squadrons. Females seem to have concerns about flying in combat. An in-depth personality test showed female pilots were in between male pilots and college student controls. A more global personality study showed that there are differences between early and mid-career female pilots with apparent changes across time. Finally, a new test of personality, psychopathology, and crew interaction was developed in order to more specifically quantify gender, selection, training, and retention issues.

DTIC

Personality; Aircraft Pilots; Males; Females; Personality Tests; Surveys

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.

19970040559 Polish Aviation Works, SZEF Programu, Swidnik, Poland

Computer Simulation of a Hovering Helicopter's Rotor Blade Motion and During Hovering Manoeuvres *Symulacja Komputerowa Ruchu Lopaty Wirnika Smiglowca w Zawisie i Podczas Manewrow w Zawisie Smiglowca*

Bronowicz, Jan, Polish Aviation Works, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 177-183; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Results of computer simulation of a PZL-Sokol main rotor blade during hovering maneuvers are presented. The most important parameters, which have been analyzed were the distance of rotor blade's end from helicopter's tail boom and the distance of blade's end from the ground. The case of landing in inclined terrain during hovering maneuvers while leaning the front landing gear on the ground was considered. The analysis assumed that: a) main rotor blades are completely efficient; b) the rotor control form is taken from an on-board recorder BUR 1-2 without any changes and smoothing. Swashplate's position is sampled every 0.25 s. There was assumed that swashplate's position changes linearly between sampling; c) fuselage's position in the coordinate system connected with the ground (y axis is vertical, x axis is pointed ahead perpendicularly to y, z axis is pointed to the right) is read from BUR 1-2 recorder; and d) atmospheric parameters were assumed as follows: wind speed $w = 7$ m/s, the helicopter

is in wind's bed, barometric height $H = 1700$ m, air temperature $t(\text{sub } H) = +12.0$ C. The analysis consisted of computational simulation of main rotor blade's motion with main rotor control parameters assumed ($\chi, \eta, \phi(\text{sub } 07\text{WN}) = f(t)$). Main rotor angle of attack was assumed $\alpha(\text{sub } \text{WN}) = \theta - 4.5$ deg., where 4.5 deg. is an angle of inclination of rotor shaft to the line perpendicular to a horizontal assembly line of a helicopter (θ angle is measured in the coordinate system connected with the horizontal assembly line of a helicopter). Blade motion was simulated with the use of a computer program, which is the property of a design bureau of ZBR WSK PZL-Swidnik SA. In the program, blade deformation and nonstationary aerodynamics were included. Blade deformation is determined on the basis of Galerkin's method. The problem of blade deformation is solved in three planes together; two bendings and a torsion of the blade. Ten forms of free vibration of the blade were assumed (3 in the plane of rotation, 5 in the plane of thrust, 2 torsional). Forms of vibrations are of two different kinds; articulated blade with stiffness in the rotation articulated joint, and blade with the blocked horizontal articulated joint (a blade on bottom limiter) and with stiffness in rotation articulated joint. Both kinds of vibration forms enabled to model the normal action of the blade and its action after hitting the bottom limiter. Simulation shows, that during hovering while leaning the front landing gear on the slope 13 deg. inclined, the ends of the rotor blades may approach the ground at a distance smaller than a man's stature. Moreover the simulation shows, that during hovering even very brutal longitudinal control doesn't make any collisions with the helicopter design parts.

Author

Computerized Simulation; Hovering; Helicopter Control; Rotary Wings; Rotor Blades (Turbomachinery)

19970040606 National Aerospace Lab., Flight Div., Amsterdam, Netherlands

Embedding Adaptive JLQG into LQ Martingale Control with a Completely Observable Stochastic Control Matrix

Everdij, M. H. C., National Aerospace Lab., Netherlands; Blom, H. A. P., National Aerospace Lab., Netherlands; Feb. 21, 1996; 43p; In English; Figures in this document may not be legible in mic

Report No.(s): PB97-191886; NLR-TP-95202-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With jump linear quadratic Gaussian (JLQG) control one refers to the control under a quadratic performance criterion of a linear Gaussian system, the coefficients of which are completely observable, while they are jumping according to the finite-state Markov process. With adaptive JLQG one refers to the more complicated situation that the finite-state process is only partially observable. Although many practically applicable results have been developed, JLQG and adaptive JLQG control are lagging behind those for linear quadratic Gaussian (LQG) and adaptive LQG. The aim of this paper is to help improve the situation by introducing an exact transformation which embeds adaptive JLQG control into LQM control with a completely observable stochastic control matrix.

NTIS

Adaptive Control; Stochastic Processes; Aircraft Control; Martingales; Linear Quadratic Gaussian Control; Control Theory

19970040659 National Aerospace Lab., Amsterdam, Netherlands

Elliptic Surface Grid Generation on Minimal and Parametrized Surfaces

Spekreijse, S. P., National Aerospace Lab., Netherlands; Nijhuis, G. H., National Aerospace Lab., Netherlands; Boerstoeel, J. W., National Aerospace Lab., Netherlands; Mar. 8, 1995; 37p; In English; NASA Workshop on Surface Modeling, Grid Generation and Related Issues in CFD Solutions, May 1995, Cleveland, OH, USA; Figures in this document may not be legible in mic

Contract(s)/Grant(s): NIVR-03303N

Report No.(s): PB97-191845; NLR-TP-95122-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An elliptic grid generation method is presented which generates excellent boundary conforming grids in domains in 2D physical space. The method is based on the composition of an algebraic and elliptic transformation. The composite mapping obeys the familiar Poisson grid generation system with control functions specified by the algebraic transformation. New expressions are given for the control functions. Grid orthogonality at the boundary is achieved by modification of the algebraic transformation.

NTIS

Grid Generation (Mathematics); Computer Aided Design; Aircraft Design; Computational Fluid Dynamics; Two Dimensional Bodies; Minimal Surfaces

19970041397 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Simulation of a Controlled Airfoil with Jets Final Report

Allan, Brian G., Institute for Computer Applications in Science and Engineering, USA; Holt, Maurice, California Univ., USA; Packard, Andrew, California Univ., USA; Oct. 1997; 20p; In English

Contract(s)/Grant(s): NAS1-19480; NCA2-782; NCC2-5035; NGT-51030; RTOP 505-90-52-01

Report No.(s): NASA/CR-97-201750; NAS 1.26:201750; ICASE-97-55; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Numerical simulations of a two-dimensional airfoil, controlled by an applied moment in pitch and an airfoil controlled by jets, were investigated. These simulations couple the Reynolds-averaged Navier-Stokes equations and Euler's equations of rigid body motion, with an active control system. Controllers for both systems were designed to track altitude commands and were evaluated by simulating a closed-loop altitude step response using the coupled system. The airfoil controlled by a pitching moment used an optimal state feedback controller. A closed-loop simulation, of the airfoil with an applied moment, showed that the trajectories compared very well with quasi-steady aerodynamic theory, providing a measure of validation. The airfoil with jets used a controller designed by robust control methods. A linear plant model for this system was identified using open-loop data generated by the nonlinear coupled system. A closed-loop simulation of the airfoil with jets, showed good tracking of an altitude command. This simulation also showed oscillations in the control input as a result of dynamics not accounted for in the control design. This research work demonstrates how computational fluid dynamics, coupled with rigid body dynamics, and a control law can be used to prototype control systems in problematic nonlinear flight regimes.

Author

Navier-Stokes Equation; Feedback Control; Nonlinear Systems; Airfoils; Active Control; Computational Fluid Dynamics; Rigid Structures; Control Theory; Controllers; Dynamic Control; Equations of Motion; Pitching Moments

19970041485 Old Dominion Univ., Dept. of Mechanical Engineering, Norfolk, VA USA

Nonlinear Transient Thermal Analysis by the Force-Derivative Method Final Report, Period ending 3 Jan. 1996

Balakrishnan, Narayani V., Old Dominion Univ., USA; Hou, Gene, Old Dominion Univ., USA; Nov. 1997; 165p; In English
Contract(s)/Grant(s): NAG1-1567

Report No.(s): NASA/CR-97-206354; NAS 1.26:206354; ODURF-140452; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

High-speed vehicles such as the Space Shuttle Orbiter must withstand severe aerodynamic heating during reentry through the atmosphere. The Shuttle skin and substructure are constructed primarily of aluminum, which must be protected during reentry with a thermal protection system (TPS) from being overheated beyond the allowable temperature limit, so that the structural integrity is maintained for subsequent flights. High-temperature reusable surface insulation (HRSI), a popular choice of passive insulation system, typically absorbs the incoming radiative or convective heat at its surface and then re-radiates most of it to the atmosphere while conducting the smallest amount possible to the structure by virtue of its low diffusivity. In order to ensure a successful thermal performance of the Shuttle under a prescribed reentry flight profile, a preflight reentry heating thermal analysis of the Shuttle must be done. The surface temperature profile, the transient response of the HRSI interior, and the structural temperatures are all required to evaluate the functioning of the HRSI. Transient temperature distributions which identify the regions of high temperature gradients, are also required to compute the thermal loads for a structural thermal stress analysis. Furthermore, a nonlinear analysis is necessary to account for the temperature-dependent thermal properties of the HRSI as well as to model radiation losses.

Derived from text

Space Shuttle Orbiters; Thermal Protection; Structural Analysis; Preflight Analysis; Reentry Effects; Insulation; Aerodynamic Heating; Structural Failure; Temperature Dependence; Temperature Distribution; Temperature Effects; Thermal Stresses

19970041631 National Aerospace Lab., Amsterdam, Netherlands

Mission Support System Computer Aided Mission Preparation at Airbase Level (MSS/C)

de Moel, R. P., National Aerospace Lab., Netherlands; Aug. 18, 1995; 16p; In English; Netherlands Association of Aeronautical Engineers Meeting, 28 Apr. 1994, USA; Sponsored by Netherlands Association of Aeronautical Engineers, Netherlands
Report No.(s): PB97-182570; NLR-TP-94552-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

All route planning systems need geographical information as background for navigation. The current geographical information is not appropriate for usage in automated mission planning/preparation systems. After an overview of today's MSS/C characteristics the design decisions concerning geographical information in MSS/C will be presented and a historical overview will be given. It appears that this type of application is a continuous struggle between requirement and state-of-the-art technology.

NTIS

Aircraft Instruments; Computer Aided Mapping; Mission Planning; Product Development

19970041699

Note on pole assignment in uncertain systems

Soylemez, M. T., Univ of Manchester Inst of Science and Technology, UK; Munro, N.; International Journal of Control; March 10 1997; ISSN 0020-7179; vol. 66, no. 4, pp. 487-497; In English; Copyright; Avail: Issuing Activity

A new method for full-rank state-feedback pole assignment is introduced. A particular advantage of this method is that no freedom in the design parameters is lost. Hence, further design problems such as robust pole assignment in uncertain systems are alleviated. An application of this feature is shown for a particular linear model of the F16 aircraft. The connections between state feedback and several concepts in the literature such as incomplete input feedback, incomplete state feedback, output feedback and incomplete pole assignment are also given.

Author (EI)

Aircraft Models; Applications of Mathematics; Control Theory; Feedback Control; Parameter Identification

16 PHYSICS

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

19970040793 Boston Univ., College of Engineering, Boston, MA USA

Analytical Studies of Boundary Layer Generated Aircraft Interior Noise Final Report, 15 Mar. 1995 - 30 Sep. 1997

Howe, M. S., Boston Univ., USA; Shah, P. L., Boston Univ., USA; Oct. 06, 1997; 115p; In English

Contract(s)/Grant(s): NAG1-1688

Report No.(s): NASA/CR-97-205881; NAS 1.26:205881; AM-97-027; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An analysis is made of the "interior noise" produced by high, subsonic turbulent flow over a thin elastic plate partitioned into "panels" by straight edges transverse to the mean flow direction. This configuration models a section of an aircraft fuselage that may be regarded as locally flat. The analytical problem can be solved in closed form to represent the acoustic radiation in terms of prescribed turbulent boundary layer pressure fluctuations. Two cases are considered: (i) the production of sound at an isolated panel edge (i.e., in the approximation in which the correlation between sound and vibrations generated at neighboring edges is neglected), and (ii) the sound generated by a periodic arrangement of identical panels. The latter problem is amenable to exact analytical treatment provided the panel edge conditions are the same for all panels. Detailed predictions of the interior noise depend on a knowledge of the turbulent boundary layer wall pressure spectrum, and are given here in terms of an empirical spectrum proposed by Laganelli and Wolfe. It is expected that these analytical representations of the sound generated by simplified models of fluid-structure interactions can be used to validate more general numerical schemes.

Author

Aircraft Noise; Turbulent Boundary Layer; Boundary Layers; Pressure Oscillations; Subsonic Flow; Vibration; Fuselages; Sound Waves; Turbulent Flow; Wall Pressure

19970040804 National Aerospace Lab., Fluid Dynamics Div., Amsterdam, Netherlands

Prevention of Buzz-Saw Noise by Acoustic Lining

Sijtsma, P., National Aerospace Lab., Netherlands; Mar. 24, 1995; 36p; In English; 1st; 16th; Joint CEAS/AIAA Aeroacoustic Conference, 12-15 Jun. 1995, Munich, Munich, Germany, Germany; Sponsored by National Oceanic and Atmospheric Administration, USA

Report No.(s): PB97-191852; NLR-TP-95154-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Expressions are derived describing the generation of buzz-saw noise, occurring upstream of a ducted rotor with supersonic relative tip speed. In contrast with earlier work on this matter, a fully three-dimensional, non-linear theory is used, in which the effect of acoustic treatment is included. In the sound spectrum of a hard-walled duct, the theory predicts peaks at close-to-resonance frequencies. Moreover, a substantial suppression of buzz-saw noise is predicted for a duct wall with acoustic lining, depending on the liner characteristics. Calculations with estimated input are in good agreement with measurements.

NTIS

Aircraft Engines; Turbofans; Noise Reduction; Supersonic Speed; Ducts; Compressor Rotors

19970041566 Cambridge Acoustical Associates, Inc., Medford, MA USA

An Evaluation of Structural Damage (Window Breakage) Potential in Caliente, NV Under Current Supersonic Flight Restrictions at Nellis AFB Interim Report, Oct. 1996 - Jan. 1997

Garrellick, Joel, Cambridge Acoustical Associates, Inc., USA; Martini, Klye, Cambridge Acoustical Associates, Inc., USA; Brown, Ron, Wyle Labs., Inc., USA; Downing, J. M., Armstrong Lab., USA; Jan. 1997; 19p; In English

Contract(s)/Grant(s): F41624-94-C-9007; AF Proj. 3005

Report No.(s): AD-A329470; AL/OE-TR-1997-0115; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During November 1996 a series of tests was performed in and around Caliente, NV. These tests, performed by the firms of Cambridge Acoustical Associates, Inc., and Wyle Laboratories, Inc., are part of a Small Business Innovative Research (SBIR) project, being sponsored by the Armstrong Laboratory of the USA Air Force. The project objective is to perfect measurement techniques that simulate structural response to sonic booms, and in turn allow one to assess potential damage, especially to unconventional structures. The goals of the Caliente tests were twofold. The first was to provide additional data for the validation of the techniques. The second was to demonstrate the process by which such measurements may be used to perform an environmental (structural) damage assessment. This report focuses on the latter. to limit the overall environmental impact on Caliente, supersonic operations from Nellis AFB have recently been prohibited within five miles of the town. to evaluate the adequacy of this restriction with respect to avoiding structural damage, window damage to be exact, a part of our test plan was devoted to a measurement survey of various windows throughout the town. From these data we have simulated their peak response (stress) to the sonic boom environment evaluated under the above mentioned flight restriction. Twenty windows were tested, including those of a number of commercial buildings, the library, train station, and one of the auxiliary hospital buildings. (Window installations with a noticeable rattle are not readily simulated and were excluded from the ensemble.) Based on our simulations, the least susceptible to damage is a window of the Bureau of Land Management (BLM) Building and a train station window is the most vulnerable. For all windows, no additional breakage is anticipated under current flight restrictions.

DTIC

Damage Assessment; Environmental Control; Sonic Booms; Buildings; Performance Tests

19970042874 NASA Ames Research Center, Moffett Field, CA, USA

Image registration for pressure-sensitive paint applications

Bell, J. H., NASA Ames Research Cent, USA; McLachlan, B. G., NASA Ames Research Center, USA; Experiments in Fluids; November 1996; ISSN 0723-4864; vol. 22, no. 1, pp. 78-86; In English; Copyright; Avail: Issuing Activity

Pressure-sensitive paint (PSP) data are generally derived by rationing two images of a PSP-coated wind tunnel model. One image is taken at a known 'wind-off' reference pressure while the other is taken at the test condition, in order to factor out the effects of nonuniform illumination and paint thickness. However, airloads on the model cause it to move during testing with respect to both the camera and the illumination source used to excite the PSP. Thus, the raw PSP images must be aligned, or registered, by means of a spatial transform. Once a proper ratioed image is obtained, image coordinates must be related to model coordinates so that pressure data can be obtained at the desired points on the model. This article compares several transforms used for image registration, and demonstrates the use of the projective equation of photogrammetry to relate model to image coordinates. An application in a small-scale wind tunnel test is shown, demonstrating mapping of pressure data to the three-dimensional model surface.

Author (EI)

Image Processing; Mathematical Models; Paints; Pattern Registration; Pressure Measurement; Wind Tunnels

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.

19970040547 Warsaw Technical Univ., Inst. Techniki Lotniczej i Mechaniki Stosowanej, Poland

Education in Helicopter Engineering at Warsaw University of Technology *Kształcenie w Dziedzinie Smiglowcow na Politechnice Warszawskiej*

Lucjanek, Wieslaw, Warsaw Technical Univ., Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 31-36; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Warsaw University of Technology is only one of two civil universities in Poland which together with the Military Academy of Technology offers education and research in helicopter engineering. At the Faculty of Power and Aeronautical Engineering, in the framework of Mechanics and Design of Machines and within the speciality of Aeronautics and specialization Aircraft, the program of Helicopters is placed. In the paper particular attention is paid to the 5-year Master of Science degree helicopter program is described. Since the 1991/92 academic year, the Faculty has implemented a new, individual, credit based system of education.

The general idea of the system is described, an example of the Helicopter program is given and some topics of diploma projects, recently completed, are included.

Author

Aeronautical Engineering; Education; Helicopters

19970040548 Komisja Wiroplatowa AP, Poland

International Helicopter Institutions and Organizations *Międzynarodowe Instytucje i Organizacje Śmigłowcowe*

Witkowski, Ryszard, Komisja Wiroplatowa AP, Poland; Transactions of the Institute of Aviation Scientific Quarterly; 1997, no. Nos. 149-150, pp. 37-42; In Polish; Also announced as 19970040543; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The portion of helicopters in world aerial fleets make up approx. 10% in civil aviation and approx. 50% in air forces. The dynamic and fatigue character of helicopter design loading and operational specifics in the helicopter fleet, which operate from field aerodromes and at low altitude, don't fit the laws and technical regulations for aeroplanes. Differences in operation have caused the need for separate rights and rules for helicopters to be written. These rules are often different in different countries and areas. In order to unify the principles of helicopters' design and operation, a trend to set up organizations, associations and institutions on an international scale, which are involved in selected helicopter subjects is taking place. Equal rules of helicopters' design or unified regulations are described in the FAI Sport Statute-Book. The paper mentions and briefly describes fields of activity and goals of the most famous institutions and helicopter (rotorcraft) organizations, which include also national organizations available for foreign members (for example AHA). A short review of Polish connections with some of these organizations is included. In conclusion, the paper considers the increasing Polish activity in the international helicopter forum, especially in the aspect of approaching Poland's integration with international structures like the European Union or NATO. An expression of the increased activity is made by the establishment of the Polish Helicopter Association (PHA). This establishment could pave the way in becoming a member of the European Helicopter Association.

Derived from text

Helicopters; Organizations; Regulations; Rules; International Cooperation

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