NASA/SP—1999–7037/SUPPL399
April 30, 1999

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
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
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9. Subject Terms

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 399)

APRIL 30, 1999

01 AERONAUTICS

19990027061 Institute for Human Factors TNO, Technische Menskunde, Soesterberg, Netherlands

Evaluation of the Training Value of Alternative Simulator Configurations for the Chinook and Cougar Transport Helicopters *Final Report Evaluatie van deTrainingswaarde van Alternatieve Simulator Configuraties voor de Chinook enCougar Transporthelikopters*

vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; Boot, E. W., Institute for Human Factors TNO, Netherlands; deVries, S. C., Institute for Human Factors TNO, Netherlands; Kappe, B., Institute for Human Factors TNO, Netherlands; Ligthart, V. H. M., National Aerospace Lab., Netherlands; Marsman, A. P. L. A., National Aerospace Lab., Netherlands; Jul. 17, 1998; 70p; In Dutch

Contract(s)/Grant(s): A97/KLu/307; TNO Proj. 730.1

Report No.(s): TD-98-0251; TM-98-A042; Copyright; Avail: Issuing Activity (TNO technische Menskunde, Kampweg 5, Postbus 23, 3769 ZG Soesterberg, Netherlands), Hardcopy, Microfiche

In the context of the procurement of simulator capacity for training pilots of Chinook CH-47D and Cougar MK2 cargo helicopters, in a previous study a global training analysis has been conducted. Also, requirements for different possible simulator configurations have been formulated. On the basis of these requirements the Royal Netherlands Air Force (RNLAF) has formulated and issued a Request for Information (RFI) to potential suppliers. The aim of the RFI is to gather information about the technical and financial feasibility of the proposed simulator configurations. In order to evaluate the responses to the RFI on basis of their training value, a more detailed training analysis has been conducted and is reported here. Within the context of this analysis the minimally required level of simulator configuration and necessary training time for each training topic has been determined. On the basis of these results it is concluded that: (1) more than a quarter of all training hours can only be performed with the most advanced level of simulator configuration (about the same as FAA level D). These training hours are mostly concerned with training topics associated with flight safety (emergency procedures) and operating under maximum and special conditions; (2) given such a level of simulator configuration, the total training time for both helicopter types will be at least 1200 hours. If those training topics which could be trained in a helicopter are also trained on this simulator configuration, the total training time amount to 1660 hours for both types. There is reason to believe that these estimates are conservative. It is expected that once such a level of simulator configuration is available, the total training time for both types could exceed 2600 hours. to specify simulator requirements more accurately, training scenarios have been specified for each of the essential (level D) training topics. For each scenario, the minimum requirements have been determined. On the basis of these requirements RFI responses can be evaluated and compared. It appeared that a number of suppliers can meet the requirements. During subsequent phases of the procurement process, the training scenarios can be used to specify test scenario's for evaluating proposals. Ultimately the results reported can also be used for the development of the training programmes that are delivered on the simulators). The training analysis and the specification of the simulator requirements have been mainly focussed on the most important cost drivers, viz. the image systems and the moving bass systems. It is recommended to pay also attention during subsequent phases to the requirements with respect to the instructional facilities. Although they are not the main cost drivers, they are important benefit drivers, i.e. they are essential for effective and efficient use of the simulator facilities.

Author

Training Evaluation; Training Simulators; Technology Assessment; CH-47 Helicopter

19990027429 NASA Langley Research Center, Hampton,VA USA

Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 397

Apr. 01, 1999; 62p; In English

Report No.(s): NASA/SP-1999-7037/SUPPL397; NAS 1.21:7037/SUPPL397; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.
Derived from text
Bibliographies; Data Bases; Indexes (Documentation)

02
AERODYNAMICS

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

19990027435 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA
Remote Infrared Thermography for In-Flight Flow Diagnostics *Final Report*
Shiu, H. J., California Univ., USA; vanDam, C. P., California Univ., USA; February 1999; 31p; In English
Contract(s)/Grant(s): NCC4-114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The feasibility of remote in-flight boundary layer visualization via infrared in incompressible flow was established in earlier flight experiments. The past year's efforts focused on refining and determining the extent and accuracy of this technique of remote in-flight flow visualization via infrared. Investigations were made into flow separation visualization, visualization at transonic conditions, shock visualization, post-processing to mitigate banding noise in the NITE Hawk's thermograms, and a numeric model to predict surface temperature distributions. Although further flight tests are recommended, this technique continues to be promising.
Author
Boundary Layer Separation; Flight Tests; Incompressible Flow; Flow Visualization; Infrared Radiation; Boundary Layers

19990027451 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Investigation of Effects of Surface Roughness on Symmetric Airfoil Lift and Lift-to-Drag Ratio
Beierle, Mark T.; Feb. 08, 1999; 192p; In English
Report No.(s): AD-A360065; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This research investigated the effects of surface roughness in the form of protuberances on the lift and lift-to-drag ratio of an airfoil with a NACA 0015 profile. Russian researchers first recorded the positive effect on lift from naturally formed surface protuberances in 1984 and reported on their research in 1991. Based on experimental studies, the Russian researchers identified a protuberance geometry on a low aspect ratio wing which created both additional lift and an improved lift-to-drag ratio for a given angle-of-attack over the low to moderate angle-of-attack region. The primary objective of this research was to develop a phenomenological understanding of the flow physics related to the effects of surface roughness on the lift and lift-to-drag ratio of a symmetric airfoil. Two wind tunnel experiments were conducted at the University of Maryland's Glenn L. Martin Wind Tunnel to investigate the effect of protuberance coverage, size, and density. A two-dimensional computational experiment studied the effect of protuberance location, geometry, and spacing using the OVERFLOW Navier-Stokes flow solver. Results indicated that the variation of the aerodynamic lift and the lift-to-drag ratio for symmetric airfoils and wings populated with protuberances is due to the increased pressure induced by a recirculation region downstream of the protuberance. An alternative understanding based on changes in the effective camber and thickness of the airfoil was developed. Wind tunnel and computational results qualitatively validated the lift enhancement on symmetric airfoils due to surface roughness. Results indicated that the magnitude of the lift increment was strongly dependent on airfoil angle-of-attack and protuberance height and had a weak dependence on protuberance width and spacing. Just one configuration, based on a wind tunnel test of a wing with protuberances, generated a larger lift-to-drag ratio compared to a smooth wing.
DTIC
Surface Roughness Effects; Airfoils; Wind Tunnel Tests; Lift; Low Aspect Ratio Wings; Protuberances

19990027594 Naval Postgraduate School, Dept. of Aeronautics and Astronautics, Monterey, CA USA
Summary of Research 1997, Department of Aeronautics and Astronautics, *1 Jan. - 31 Dec. 1997*
Lindsey, Gerald H.; Biblarz, Oscar; Jan. 1999; 60p; In English
Report No.(s): AD-A360675; NPS-09-98-015; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains summaries of research projects in the Department of Aeronautics and Astronautics. A list of recent publications is also included which consists of conference presentations and publications, books, contributions to books, published journal papers, technical reports, and thesis abstracts.
DTIC
Spacecraft; Air Navigation; Aerodynamics

19990027831 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Regional Nature of Aerodynamic Jump *Final Report, Nov. 1997 - Nov. 1998*
Bundy, Mark; Jan. 1999; 60p; In English
Report No.(s): AD-A360570; ARL-TR-1872; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

It is shown that aerodynamic jump for a nonspinning kinetic energy penetrator is neither a point change in direction, nor a curving change that takes place over a domain of infinite extent, as conventional definitions may infer. Rather, with the aid of an alternate kinematical definition, it is shown that aerodynamic jump for such a projectile is a localized redirection of the center-of-gravity motion, caused by the force of lift due to yaw over the relatively short region from entry into free flight until the yaw reaches its first maximum. A rigorous proof of this statement is provided, but the primary objective of this report is to provide answers to the questions: What is aerodynamic jump, what does it mean, and what aspects of the flight trajectory does it refer to, or account for?
DTIC
Aerodynamics; Free Flight; Jumpers; Flight Paths

19990027877 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
High Order Accuracy Computational Methods in Aerodynamics Using Parallel Architectures *Final Report, 15 Jun. 1995 - 14 Jun. 1998*
Gottlieb, David; Shu, Chi-Wang; Jun. 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0430; F49620-93-1-0090
Report No.(s): AD-A360518; TR-4; AFRL-SR-BL-TR-99-0068; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is an AASERT grant associated with AFOSR grant F49620-93-1-0090, with principal investigator David Gottlieb. This grant has supported one graduate student over three years. The research topic is parallel spectral methods for complex geometries. The Ph.D. thesis of Gerald W. Kruse was prepared under this grant. In the last year, after the graduation of Kruse, the work was continued by another graduate student, Henry Tufo. One conference proceeding and one journal article resulted from this work.
DTIC
Computational Fluid Dynamics; Aerodynamics; Accuracy; Computer Programs

19990028208 Illinois Univ., Urbana-Champaign, IL USA
[Low-Frequency Flow Oscillation *Final Report*
Bragg, Michael B., Illinois Univ., USA; Jul. 1997; 3p; In English
Contract(s)/Grant(s): NAG1-1374; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The results of the research conducted under this grant are presented in detail in three Master theses, by Heinrich, Balow, and Broeren. Additional analysis of the experimental data can be found in two AIAA Journal articles and two conference papers. Citations for all of the studies' publications can be found in the bibliography which is attached. The objective of Heinrich's study was to document the low-frequency flow oscillation on the LRN-1007 airfoil, which had been previously observed at low Reynolds number, to determine its origin, and explore the phenomenon at higher Reynolds number. Heinrich performed detailed flow visualization on the airfoil using surface fluorescent oil and laser-sheet off-body visualization. A large leading-edge separation bubble and trailing-edge separation was identified on the airfoil just prior to the onset of the unsteady stall flow oscillation. From the laser-sheet data, the unsteady flow appeared as a massive boundary-layer separation followed by flow reattachment. Hot-wire data were taken in the wake to identify the presence of the flow oscillation and the dominant frequency. The oscillation was found in the flow from a Reynolds number of 0.3 to 1.3 x 10 exp 6. The Strouhal number based on airfoil projected height was nominally 0.02 and increased slightly with increasing Reynolds number and significantly with increasing airfoil angle of attack. Balow focused his research on the leading-edge separation bubble which was hypothesized to be the origin of the low-frequency oscillation. Initially, experimental measurements in the bubble at the onset of the low-frequency oscillation were attempted to study the characteristics of the bubble and explain possible relationships to the shear-layer-flapping phenomena. Unfortunately, the bubble proved to be extremely sensitive to the probe interference and it drastically reduced the size of the bubble. These detailed measurements were then abandoned by Balow. However, this led to a series of tests where the leading-edge bubble and trailing-edge separation were altered and the affect on the flow-oscillation studied. Balow found that by tripping the airfoil boundary-layer with

”zigzag” tape ahead of bubble separation, the bubble was effectively eliminated mid the oscillation suppressed. Wake survey drag measurements showed a drastic reduction in airfoil drag when the bubble and oscillation were eliminated. Using the ”zigzag” tape, the trailing-edge separation was moved downstream approximately 5 percent chord. This was found to reduce the amplitude of the oscillation, particularly in the onset stage at low angle of attack (around 14 degrees). Through detailed analysis of the wake behind the airfoil during the unsteady flow oscillation, Balow provided a better understanding of the wake flowfield. Broeren studied the oscillating flowfield in detail at Reynolds number equal 3 x 10 exp 5 and an angle of attack of 15 degrees using laser Doppler velocimetry (LDV). Two-dimensional LDV data were acquired at 687 grid points above the model upper surface while hot-wire data were taken simultaneously in the wake. Using the hot-wire signal, the LDV data were phase averaged into 24 bins to represent a single ensemble average of one oscillation cycle. The velocity data showed a flowfield oscillation that could be divided into three flow regimes. In the first regime, the flow over the airfoil was completely separated initially, the flowfield reattached from the leading edge and the reattachment point moved downstream with increasing time or phase. Broeren referred to this as the reattachment regime. The bubble development regime followed, where a leading-edge separation bubble formed at the leading edge and grew with increasing time. During the initial part of this regime the trailing-edge separation continued to move downstream. However, during the last 30 degrees of phase the trailing-edge separation moved rapidly forward and appeared to merge with the leading-edge bubble. During the third regime, the separation regime, the flow was segmented from the airfoil leading edge and did not reattach to the airfoil surface. The reverse flow was seen to grow in vertical extent up from the model surface as the phase increased. Next reattachment began again at the leading edge signaling the start of the reattachment regime, and so the cycle continued. From Broeren’s work, the details of the unsteady flowfield over the airfoil were seen for the first time. From this research a great deal has been learned about the low-frequency flow oscillation which naturally occurs on the LRN-1007 airfoil near stall. The oscillation was seen to persist at higher Reynolds number, the dependence of the Strouhal number on angle of attack and Reynolds number were discovered, the critical role played by the laminar bubble was shown and the entire upper surface flowfield during a flow oscillation cycle was measured and analyzed. What still eludes understanding is the scaling of the flow oscillation and why certain airfoils, such as the LRN, have a very strong low-frequency mode and other airfoils exhibit no organized low-frequency oscillation at all.
Derived from text
Airfoils; Angle of Attack; Boundary Layer Separation; Bubbles; Flow Distribution; Leading Edges; Low Reynolds Number; Oscillating Flow; Shear Layers; Unsteady Flow; Wakes

03
AIR TRANSPORTATION AND SAFETY

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

19990026834 NASA Lewis Research Center, Cleveland, OH USA
[Tail Plane Icing]
1997; 16p; In English
Contract(s)/Grant(s): NCC3-624; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Aviation Safety Program initiated by NASA in 1997 has put greater emphasis in safety related research activities. Ice-contaminated-tailplane stall (ICTS) has been identified by the NASA Lewis Icing Technology Branch as an important activity for aircraft safety related research. The ICTS phenomenon is characterized as a sudden, often uncontrollable aircraft nose- down pitching moment, which occurs due to increased angle-of-attack of the horizontal tailplane resulting in tailplane stall. Typically, this phenomenon occurs when lowering the flaps during final approach while operating in or recently departing from icing conditions. Ice formation on the tailplane leading edge can reduce tailplane angle-of-attack range and cause flow separation resulting in a significant reduction or complete loss of aircraft pitch control. In 1993, the Federal Aviation Authority (FAA) and NASA embarked upon a four-year research program to address the problem of tailplane stall and to quantify the effect of tailplane ice accretion on aircraft performance and handling characteristics. The goals of this program, which was completed in March 1998, were to collect aerodynamic data for an aircraft tail with and without ice contamination and to develop analytical methods for predicting the effects of tailplane ice contamination. Extensive dry air and icing tunnel tests which resulted in a database of the aerodynamic effects associated with tailplane ice contamination. Although the FAA/NASA tailplane icing program generated some answers regarding ice-contaminated-tailplane stall (ICTS) phenomena, NASA researchers have found many open questions that warrant further investigation into ICTS. In addition, several aircraft manufacturers have expressed interest in a second research program to expand the database to other tail configurations and to develop experimental and computational methodologies for evaluating the ICTS phenomenon. In 1998, the icing branch at NASA Lewis initiated a second multi-phase research program for tailplane icing (TIP II) to develop test methodologies and tailplane performance and handling qualities evaluation tools.

The main objectives of this new NASA/Industry/Academia collaborative research programs were: (1) define and evaluate a sub-scale wind tunnel test methodology for determining tailplane performance degradation due to icing. (2) develop an experimental database of tailplane aerodynamic performance with and without ice contamination for a range of tailplane configurations. Wind tunnel tests were planned with representative general aviation aircraft, i.e., the Learjet 45, and a twin engine low speed aircraft. This report summarizes the research performed during the first year of the study, and outlines the work tasks for the second year.
Derived from text
Aircraft Control; Aircraft Safety; Angle of Attack; Horizontal Tail Surfaces; Ice Formation; Pitching Moments; Wind Tunnel Tests; Aerodynamic Stalling; Computational Fluid Dynamics; Reynolds Number; Navier-Stokes Equation; Lear Jet Aircraft; General Aviation Aircraft

19990026969 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Symbol Standardization in Airway Facilities
Ahlstrom, Vicki; Cranston, Robert L.; Mogford, Richard; Ramakrishnan, Arvind; Dec. 1998; 28p; In English
Report No.(s): AD-A359966; DOT/FAA/CT-TN98/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project was to develop and evaluate visual symbols for future Airway Facilities (AF) systems. A research team designed symbols, developed test software, and evaluated test procedures. A subsequent field evaluation of these symbols resulted in user assessment of two alternative visual symbols for 32 AF facilities and services. Two groups of 14 AF field subjects learned and evaluated alternative symbols. The report provides sufficient data to show the quality differences between the various symbols as judged by the user community. This report provides a recommended set of AF facility/service symbols for standardized use.
DTIC
Computer Programs; Air Traffic Control; Standardization; Symbols

19990027089 National Transportation Safety Board, Washington, DC USA
Aircraft Accident Report: In-Flight Fire/Emergency Landing, Federal Express Flight 1406, Douglas DC-10-10, N68055, Newburgh, New York, September 5, 1996
Jul. 22, 1998; 146p; In English
Report No.(s): AD-A359870; NTSB/AAR-98/03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report explains the accident involving Federal Express flight 1406, a Douglas DC-10-10, which made an emergency landing at Stewart International Airport on September 5, 1996, after the flightcrew determined that there was smoke in the cabin cargo compartment. Safety issues in the report include flightcrew performance of emergency procedures, undeclared hazardous materials in transportation, dissemination of hazardous materials information, airport emergency response, and adequacy of aircraft interior firefighting methods. Safety Recommendations concerning these issues were made to the Federal Aviation Administration, the Department of Transportation, and the Research and Special Programs Administration.
DTIC
Aircraft Accident Investigation; Douglas Aircraft; Aircraft Accidents; Flight Safety

19990027600 Nebraska Univ., Aviation Inst., Omaha, NE USA
The UNO Aviation Monograph Series: Aviation Security: An Annotated Bibliography of Responses to the Gore Commission
Carrico, John S., Nebraska Univ., USA; Schaaf, Michaela M., Nebraska Univ., USA; April 1998; 26p; In English
Contract(s)/Grant(s): NAGw-4414
Report No.(s): UNOAI-98-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This monograph is a companion to UNOAI Monograph 96-2, "The Image of Airport Security: An Annotated Bibliography," compiled in June 1996. The White House Commission on Aviation Safety and Security, headed by Vice President Al Gore, was formed as a result of the TWA Flight 800 crash in August 1996. The Commission's final report included 31 recommendations addressed toward aviation security. The recommendations were cause for security issues to be revisited in the media and by the aviation industry. These developments necessitated the need for an updated bibliography to review the resulting literature. Many of the articles were written in response to the recommendations made by the Gore Commission. "Aviation Security: An Annotated Bibliography of Responses to the Gore Commission" is the result of this need.
Author
Aircraft Safety; Airport Security; Flight Safety; Annotations

19990027849 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Jan. 15, 1998; 164p; In English
Report No.(s): AD-A359793; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This document contains safety recommendations regarding aircraft by the National Transportation Safety Board to the Federal Aviation Administration.

DTIC

Safety Management; Aircraft Safety

19990027974 Army Safety Center, Fort Rucker, AL USA
Flightfax: Army Aviation Risk-Management Information. February 1999, Volume 27, Number 2
Feb. 1999; 12p; In English
Report No.(s): AD-A360005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flightfax is published by the U.S. Army Safety Center, Fort Rucker, Alabama. Information included is for accident-prevention purposes only.

DTIC

Safety; Accidents; Accident Prevention

19990028197 NASA Lewis Research Center, Cleveland, OH USA
Ice Accretion Calculations for a Commercial Transport Using the LEWICE3D, ICEGRID3D and CMARC Programs
Bidwell, Colin S., NASA Lewis Research Center, USA; Pinella, David, AeroLogic, USA; Garrison, Peter, AeroLogic, USA; Jan. 1999; 30p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 548-20-23
Report No.(s): NASA/TM-1999-208895; E-11494; NAS 1.15:208895; AIAA Paper 99-0250; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Collection efficiency and ice accretion calculations were made for a commercial transport using the NASA Lewis LEWICE3D ice accretion code, the ICEGRID3D grid code and the CMARC panel code. All of the calculations were made on a Windows 95 based personal computer. The ice accretion calculations were made for the nose, wing, horizontal tail and vertical tail surfaces. Ice shapes typifying those of a 30 minute hold were generated. Collection efficiencies were also generated for the entire aircraft using the newly developed unstructured collection efficiency method. The calculations highlight the flexibility and cost effectiveness of the LEWICE3D, ICEGRID3D, CMARC combination.

Author

Ice Formation; Commercial Aircraft; Computer Programs; Computer Aided Design; Aircraft Structures; Aircraft Design; Structural Design

19990028245 Nebraska Univ., Aviation Inst., Omaha, NE USA
The UNO Aviation Monograph Series: The Airline Quality Rating 1998, *1998*
Bowen, Brent D., Nebraska Univ., USA; Headley, Dean E., Nebraska Univ., USA; April 1998; 52p; In English
Contract(s)/Grant(s): NAGw-4414
Report No.(s): UNOAI-98-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Airline Quality Rating (AQR) was developed and first announced in early 1991 as an objective method of comparing airline performance on combined multiple factors important to consumers. Development history and calculation details for the AQR rating system are detailed in The Airline Quality Rating 1991 issued in April, 1991, by the National Institute for Aviation Research at Wichita State University. This current report, Airline Quality Rating 1998, contains monthly Airline Quality Rating scores for 1997. Additional copies are available by contacting Wichita State University or University of Nebraska at Omaha. The Airline Quality Rating 1998 is a summary of month-by-month quality ratings for the ten major U.S. airlines operating during 1997. Using the Airline Quality Rating system and monthly performance data for each airline for the calendar year of 1997, individual and comparative ratings are reported. This research monograph contains a brief summary of the AQR methodology, detailed data and charts that track comparative quality for major airlines domestic operations for the 12 month period of 1997, and industry average results. Also, comparative Airline Quality Rating data for 1991 through 1996 are included to provide a longer term view of quality in the industry.

Author

Airline Operations; Commercial Aircraft; Civil Aviation; Quality Control

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

19990027164 Honeywell Technology Center, Minneapolis, MN USA
Weather Avoidance Using Route Optimization as a Decision Aid: An AWIN Topical Study, Phase 1
Dec. 30, 1998; 68p; In English
Contract(s)/Grant(s): NCC1-291; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The aviation community is faced with reducing the fatal aircraft accident rate by 80 percent within 10 years. This must be achieved even with ever increasing, traffic and a changing National Airspace System. This is not just an altruistic goal, but a real necessity, if our growing level of commerce is to continue. Honeywell Technology Center's topical study, "Weather Avoidance Using Route Optimization as a Decision Aid", addresses these pressing needs. The goal of this program is to use route optimization and user interface technologies to develop a prototype decision aid for dispatchers and pilots. This decision aid will suggest possible diversions through single or multiple weather hazards and present weather information with a human-centered design. At the conclusion of the program, we will have a laptop prototype decision aid that will be used to demonstrate concepts to industry for integration into commercialized products for dispatchers and/or pilots. With weather a factor in 30% of aircraft accidents, our program will prevent accidents by strategically avoiding weather hazards in flight. by supplying more relevant weather information in a human-centered format along with the tools to generate flight plans around weather, aircraft exposure to weather hazards can be reduced. Our program directly addresses the NASA's five year investment areas of Strategic Weather Information and Weather Operations (simulation/hazard characterization and crew/dispatch/ATChazard monitoring, display, and decision support) (NASA Aeronautics Safety Investment Strategy: Weather Investment Recommendations, April 15, 1997). This program is comprised of two phases, Phase I concluded December 31, 1998. This first phase defined weather data requirements, lateral routing algorithms, an conceptual displays for a user-centered design. Phase II runs from January 1999 through September 1999. The second phase integrates vertical routing into the lateral optimizer and combines the user interface into a prototype software testbed. Phase II concludes with a dispatcher and pilot evaluation of the route optimizer decision aid. This document describes work completed in Phase I in contract with NASA Langley August 1998 - December 1998. This report includes: (1) Discuss how weather hazards were identified in partnership with experts, and how weather hazards were prioritized; (2) Static representations of display layouts for integrated planning function (3) Cost function for the 2D route optimizer; (4) Discussion of the method for obtaining, access to raw data of, and the results of the flight deck user information requirements definition; (5) Itemized display format requirements identified for representing weather hazards in a route planning aid.
Derived from text
Aircraft Accidents; Aircraft Safety; Decision Support Systems; Flight Plans; Meteorological Parameters; Weather; National Airspace System; Flight Hazards; Avoidance

19990027260 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Study of the Algorithm for GPS Positioning and Velocity Measurement
Chang. Qing, Beijing Univ. of Aeronautics and Astronautics, China; Liu, Zhongkan, Beijing Univ. of Aeronautics and Astronautics, China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 510-513; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The mathematical models of the GPS positioning and velocity measurement are given. The iterative algorithm for GPS positioning and velocity measurement under normal conditions is discussed based on the Gauss-Newton method and the solution under the condition that there are only three visible satellites of G(sub DOP) is too large is given. Finally, a complete iteration algorithm for GPS positioning and velocity measurement is obtained. This algorithm consists of two parts. In the first part, the positioning solution is obtained iteratively and the satellite signal propagation time is renewed as the positioning solution is renewed in each iteration. In the second part, the velocity is obtained by using the satellite signal propagation time and the normal matrix obtained in the last iteration in the first part.
Author
Mathematical Models; Global Positioning System; Velocity Measurement; Newton Methods; Positioning; Algorithms

19990027261 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Study of Automatic Vehicle Location and Dispatching System
Wu, Shaochun, Beijing Univ. of Aeronautics and Astronautics, China; Xu, Ningshou, Beijing Polytechnic Univ., China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics;

October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 502-505; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Trunked mobile radio system has the capacity of dispatching through voice, but does not have the capacity of location and navigation. GPS (Global Positioning System) has the capacity of location and navigation but does not have communication links between users. So, it is of significance to realize automatic vehicle location and dispatching system, which remedy their defects and absorb their quintessence, by organically integrating trunked radio system with GPS . Based on the analysis about Motolora's SmartNet trunked radio system, the authors point out some key techniques to realize the system. Those are how to distinguish control signal and voice for establishing stable GPS data link and balance channel load etc. The experiment results have proved out our means.

Author

Position (Location); Global Positioning System; Communication Networks; Radio Communication; Systems Integration

19990027267 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

GPS C/A Code Search and Implement in GPS Receiver

Sun, Li, Beijing Univ. of Aeronautics and Astronautics, China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 506-509; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

From GPS signal characteristics, a time/frequency two dimension sequential search principle is introduced in this paper. Three basic sequential search techniques and an improved search technique are compared with performances of false alarm probability, detection probability and searching rate. A digital system based on a spread spectrum correlator is proposed and verified for GPS C/A code acquisition, while parameters are traded off for better performance. The improved search algorithm is adopted for shortening average acquisition time and improving acquiring reliability. It has been successfully used in a digital GPS receiver.

Author

Global Positioning System; Receivers; Search Profiles; Algorithms; Digital Systems; Satellite Navigation Systems

19990027422 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Development of a Method for Kinematic GPS Carrier-Phase Ambiguity Resolution Using Multiple Reference Receivers

Raquet, John F.; May 1998; 282p; In English

Report No.(s): AD-A359919; AFIT-FY99-62; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

To perform the most precise relative positioning using GPS, it is necessary to resolve the carrier-phase integer cycle ambiguities. This process becomes increasingly difficult as the distance between the mobile and reference GPS receivers increases, due to the decorrelation of the GPS errors with distance, resulting in a practical limit on the distance over which ambiguity resolution can be performed when using a single reference receiver. This thesis proposes a novel method, called NetAdjust, which uses multiple reference receivers to reduce code and carrier-phase differential measurement errors and improve the ability to resolve carrier-phase ambiguities. The NetAdjust method is based upon an optimal linear minimum error variance estimator, and it "encapsulates" all of the network information into the measurements of a single reference receiver, so standard single-reference differential GPS processing algorithms can be used. The geometry of the reference receiver network is embedded within the error covariance matrix, and a functional form of this covariance matrix is described. The NetAdjust method was tested using two different GPS networks, an 11-receiver network covering a 400 km x 600 km region in southern Norway, and a 4-receiver network covering a 50 km x 150 km region at Holloman AFB in New Mexico. The results for L1 code, L1 phase, and widelane phase measurements are analyzed in the measurement domain and the position domain, showing improvements in RMS errors of up to 50% when using NetAdjust. Significant improvements in the ability to resolve carrier-phase ambiguities are also demonstrated for the Holloman and Norway test networks. Issues relating to development of an operational, real-time NetAdjust system are discussed. Also, a covariance analysis method is developed which can be used to predict NetAdjust effectiveness under various conditions and network configurations.

DTIC

Global Positioning System; Signal Processing; Phase Error; Positioning; Real Time Operation; Statistical Analysis; Error Analysis

19990027965 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia

On-Line Estimation of Allan Variance Parameters

Ford, J. J., Defence Science and Technology Organisation, Australia; Evans, M. E., Defence Science and Technology Organisation, Australia; January 1999; 28p; In English

Report No.(s): AD-A360671; DSTO-RR-0141; DODA-AR-010-684; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new on-line method is presented for estimation of the angular random walk and rate random walk coefficients of IMU (Inertial Measurement Unit) gyros and accelerometers. The on-line method proposes a state space model and proposes parameter estimators for quantities previously measured from off-line data techniques such as the Allan variance graph. Allan variance graphs have large off-line computational effort and data storage requirements. The technique proposed here requires no data storage and computational effort of O(100) calculations per data sample.
DTIC
Angular Velocity; Statistical Analysis; Inertial Navigation; Random Walk; Data Storage; Gyroscopes

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19990026972 Naval Postgraduate School, Monterey, CA USA
Causes of EA-6B Cannibalizations
Griffea, Jimmie S.; Dec. 1998; 106p; In English
Report No.(s): AD-A360088; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Cannibalization of any system is defined as replacing a defective part or component of one system with an in-use part or component from another system. Cannibalizations are an integral part of high tempo operations where aircraft and weapon systems fail and must be repaired on the spot and immediately deployed. However, there has been an every increasing reliance on cannibalizations in some aviation communities over the past three years. Cannibalizations have several undesirable affects on a system for several reasons. First, they triple the work of maintenance personnel, due to switching parts with another aircraft, in essence impairing an aircraft and repairing both aircraft to complete a single maintenance action. Second, removing parts multiple times between aircraft while conducting cannibalizations reduces the reliability of parts. Third, improper or lack of documentation of cannibalizations underreports the severity of the problem and hides. inefficiencies. New innovative practices and techniques to improve the documentation of cannibalizations and reduce the total number of cannibalizations that occur are needed.
DTIC
Aircraft Maintenance; Aircraft Parts

19990027088 Department of the Air Force, Washington, DC USA
Flightfax: Army Aviation Risk-Management Information. Spotlight: CH-47 Safety Performance Review, Volume 26
Dec. 1998; 12p; In English
Report No.(s): AD-A359833; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The May 1998 issue of Flightfax contained the first-person accounts of the crew of a CH-47 that did a barrel roll. As a result of that incident, Aviation Safety Action Message CH-47-98-ASAM-Ol (151327Z Oct 98) requested information from users on uncommanded control inputs. Input from users confirmed that this was not the only incident of uncommanded flight-control input experienced in the CH-47 community in the last several years. According to the Analytical Investigation Branch at Corpus Christi Army Depot, 21 activities responded to the ASAM, reporting 27 AFCS/electrical malfunctions, 4 hydraulic-related malfunctions, 4 unknowncauses, and suspected ice-and-water contamination incidents.
DTIC
Flight Tests; CH-47 Helicopter; Flight Safety; Flight Control

19990027092 Kaman Aerospace Corp., Bloomfield, CT USA
Unit Maintenance Aerial Recovery Kit (UMARK) ***Final Report, 23 Sep. 1992 - 15 Dec. 1998***
Bielefield, Mike; Dec. 1998; 34p; In English
Contract(s)/Grant(s): DAAJ02-92-C-0048; DAAJ02-97-M-0004
Report No.(s): AD-A359915; R2206; USAAMCOM-TR-98-D-31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the activities performed under Contracts DAAJ02-92-C-0048 and DAAJ02-97-M-0004, to produce prototype UMARK kits. The objective of the program was to develop a means of aerial recovery of inoperative and lightly and heavily damaged helicopters using medium-lift and heavy-lift helicopters as the recovery vehicles. The UNMARK is the result of this work. UMARK can recover the following helicopters (and can easily accommodate others): AH-64, AH-64 Longbow,

CH-47, UH-60, AH-1 and UH-1 (all Army models), OH-58 (A/C and D), and RAH-66 Comanche. UMARK is lightweight, compact and can fit in a HMMWV, CUCV, van, pickup track, or helicopter. Three people can fully rig any helicopter in 15 minutes or less. It is adaptable to future requirements without extensive modifications or additions to the Kit. Kit complexity is minimized to reduce training, reduce rigging time, and heighten safety. UMARK is a major improvement over previous methods of aerial recovery. This report discusses all tasks performed under these contracts, including: Design and analysis, prototype fabrication, limit and ultimate strength testing, ground testing to develop and verify rigging procedures, and flight testing to fine-tune rigging procedures and verify Kit effectiveness.
DTIC
Aircraft Maintenance; Flight Tests; Heavy Lift Helicopters; Recovery Vehicles

19990027162 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Lessons Learned from Executing an ADS Air-to-Air Missile Test in Near Real Time
Sturgeon, Steven; Duffany, James P.; Mar. 1998; 20p; In English; Presented at the Simulation Interoperability Workshop, Mar 98, Orlando, FL.
Report No.(s): AD-A359416; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Live Fly Phase (LFP) of the Systems Integration Test (SIT) was executed by the Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) and the 46th Test Wing at Eglin AFB, FL during 1997. The purpose of the SIT is to evaluate the utility of using advanced distributed simulations (ADS) to support cost-effective testing of an integrated missile weapon/launch aircraft system in an operationally realistic scenario. The SIT missions simulate a single shooter aircraft launching an air-to-air missile against a single target aircraft. In the LFP, the shooter and target were represented by live aircraft and the missile by a simulator. ADS techniques were used to link two live F-16 fighter aircraft flying over the Eglin Gulf Test Range to the AMRAAM AIM-120 hardware-in-the-loop (HWIL) simulation facility at Eglin. In order to successfully integrate these assets for a near real-time test, the JADS team learned several lessons during the risk reduction and test execution phases. The lessons highlighted here concern test control aspects, computer processing, and telemetry issues. Control of a distributed test dealt with tactical aircraft control, scenario and data collection decisions, collocation of critical project personnel, and voice communications. Computer processing lessons dealt with simulated GPS data, pre-processing live GPS data from several aircraft pods, creation of an aircraft to HWIL-missile interface, and contingency planning for real-time malfunctions. Telemetry issues concerned aircraft and terrain shielding, and an implementation to handle random sensor dropouts. These lessons would be applicable for other projects when coupling live and virtual assets for evaluation of fire control radars or precision guided munitions. Many lessons on control and processing also apply to simulation tests which link distributed facilities.
DTIC
Air to Air Missiles; Aircraft Control; F-16 Aircraft; Flight Simulation; Distributed Interactive Simulation; Hardware-In-The-Loop Simulation; Missile Systems; Missile Tests; Real Time Operation

19990027246 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Applications of Inverse Flight Dynamics
Zhang, Shuguang, Beijing Univ. of Aeronautics and Astronautics, China; Fang, Zhenping, Beijing Univ. of Aeronautics and Astronautics, China; Wang, Yong; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 563-566; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Two computational techniques for inverse fight dynamics, namely derivation-iteration and integration-iteration techniques, are investigated. The application of inverse dynamics to determine control power requirements for post-stall maneuvering is researched, and a maneuvering flight trajectory based algorithm is provided, which lays a numerical foundation for simplifying design criteria for post-stall aircraft. With the model of inverse dynamics employed, a flight control mode for the outermost loop of the control system, named maneuver generator, is designed to follow desired complicated maneuvering flight trajectories. An example of rapid heading-reversal maneuver and other numerical simulations show the feasibility of the algorithm and the design idea.
Author
Flight Control; Aircraft Maneuvers; Controllability; Algorithms; Aerodynamic Stalling

19990027253 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Effect of Radar Cross Section on Aircraft Survivability
Ma, Dongli, Beijing Univ. of Aeronautics and Astronautics, China; Kao, Zhang, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp.

538-541; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Radar cross section (RCS) of an aircraft is one of the important influences on aircraft survivability. A computational method for the probability that an aircraft survives hostile air-defense system consisting of early warning radar, interceptor and surface-to-air missile has been developed in this paper. The method includes calculation of the probability of detection, the probability of hit and the probability of kill. The influence of the pattern propagation factor and atmospheric loss and the influence of signal-to-noise ratio on miss distance are considered in calculating the probability of detection and the probability of hit, respectively. The effect of RCS on aircraft's survivability is analyzed by the calculation. The results show that reduction of aircraft's RCS can remarkably reduce the probability of detection, and decrease the maximum intercept distance when interceptor and surface-to-air missile intercept penetrating aircraft. In order to enhance the aircraft survivability, its RCS must be reduced.

Author

Radar Cross Sections; Aircraft Survivability; Antimissile Defense

19990027508 Royal Aeronautical Society, London, UK

Multidisciplinary Design and Optimisaton: Proceedings

Multidisciplinary Design and Optimisaton: Proceedings; 1998; In English; Multidisciplinary Design and Optimisaton, 26-27 Oct. 1998, London, UK; Sponsored by Royal Aeronautical Society, UK; See also 19990027509 through 19990027525; ISBN 1-85768-074-X; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

From the dawn of aviation up to the middle of the 20th century aircraft design was an art practiced by a few talented individuals. These individuals had a comprehensive understanding of the aeronautical sciences, and personal experience of the strengths and weaknesses of successive designs. With the increasing sophistication of the aeronautical technologies it became impossible for the designers to have all of the required personal expertise. The design of aircraft became a multidisciplinary enterprise. The economic pressures on the aircraft design industry required the use of optimization techniques, to assist in keeping the cost down. Papers presented in this conference discuss the use of multidisciplinary optimization techniques in the design of modern aircraft.

CASI

Aircraft Design; Conferences; Aeronautical Engineering; Computational Fluid Dynamics; Computer Aided Design; Finite Element Method; Multidisciplinary Design Optimization

19990027509 University Coll., London, UK

Pioneering Multidisciplinary Aircraft Design

Kirkpatrick, D. L. I., University Coll., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 1.1 - 1.8; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper describes the multivariate optimisation program for the preliminary design of subsonic transport aircraft which was developed at the Royal Aircraft Establishment nearly three decades ago. It also describes some of the earliest applications of the programs to illuminate contemporary issues of aircraft design and research planning. Many lessons from the development of that pioneering program remain relevant to the systems engineering of modern complex projects, in the defense of civilian sectors. Computer-based design and optimisation programs can play a valuable role in system design provided that the program has been properly validated, the system is optimized at the appropriate level and the objective function is valid.

Author

Multidisciplinary Design Optimization; Aircraft Design; Subsonic Speed; Systems Engineering; Computer Aided Design; Transport Aircraft

19990027510 British Aerospace Airbus Ltd., Woodford, UK

Multidisciplinary Design, Analysis and Optimisation of Aircraft: The "MDO Project"

Allwright, Steve E., British Aerospace Airbus Ltd., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 2.1 - 2.12; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper presents an overview of the multi-discipline design, analysis and optimization research and development work completed by the "MDO project". This major two year program spawned and focused research in a number of areas : (1) shape optimization, (2) Planform optimization, (3) structural design optimization, and (4) control system optimization. Integration of

methodology was a primary theme through the project and this paper in particular focuses on the integration aspects that are vital in securing the successful and accelerating industrial exploitation of MDO in aircraft design.
Author
Aircraft Design; Design Analysis; Structural Design; Aerodynamic Characteristics; Computer Systems Design; Algorithms; Aeroelasticity; Aerodynamics; Multidisciplinary Design Optimization

19990027511 British Aerospace Public Ltd. Co., Sowerby Research Centre, Bristol, UK
Automated Surface Shape Optimisation in the MDO Project
Gould, Alan R. B., British Aerospace Public Ltd. Co., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 3.1 - 3.12; In English; See also 19990027508
Contract(s)/Grant(s): CEC-BE95-2056; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Surface shape optimization was one of several topics researched under the multi-disciplinary Optimization (MDO) project. Several project partners participated in this activity which set out to develop validate and demonstrate a number of technical issues related to automated shape design. Each of the participants brought together in-house and/or commercial analysis tools, a variety of different modelling and optimization techniques, and common database and model generation methods. The objectives of this work were to validate the methodologies established in the preliminary MDO project phase and to demonstrate the optimization process when applied to a simplified civil aircraft wing design problem. Several issues were central to the investigation, including alternative means of parametric descriptions for the wing surface shape, alternative optimization strategies for wing MDO and impact of different levels of physical and geometrical modelling on MDO performance and resulting product optima. The outcomes of this work demonstrate the need for advanced analysis tools to be incorporated into aerospace vehicle design problems at a relatively early stage and highlight the dangers of over-simplification of the vehicle model.
Author
Aircraft Design; Design Analysis; Surface Properties; Wings; Grid Generation (Mathematics); Body-Wing Configurations; Twisted Wings; Multidisciplinary Design Optimization

19990027513 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Multidisciplinary Structural Design with Aeroelasticity Constraints in ARGON Software Package
Chedrik, V. V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Ishmuratov, F. Z., Tsentralni Aerogidrodinamicheskii Inst., Russia; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 5.1 - 5.12; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

A method for multidisciplinary design of airframes based on a two-level structural modeling (with a polynominal displacement field and a finite element model) is presented. Basic relations for computing the strength/stiffness/aeroelasticity constraints are shown. Particular attention is paid to the new option in the ARGON system - the allowance for aeroelastic constraints in optimization the nonlinear programming techniques are used. Two examples of sweptback and sweptforward wing optimization are reported; constraints on strength and aeroelasticity are imposed.
Author
Aeroelasticity; Finite Element Method; Mathematical Models; Nonlinearity; Structural Design; Sweptback Wings; Swept Forward Wings; Nonlinear Programming; Multidisciplinary Design Optimization

19990027515 Defence Evaluation Research Agency, Aero-Structures Dept., Farnborough, UK
The Application of Pareto Methods to Multidisciplinary Design Optimisation
Harris, J. C., Defence Evaluation Research Agency, UK; Fenwick, Steven V., Defence Evaluation Research Agency, UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 7.1 - 7.9; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Multidisciplinary Design Optimization (MDO) provides a framework for a timely exchange of data necessary to support the highly integrated tasks typical of aerospace design. This will help reduce the duration of the design cycle and improve efficiency of the final product. Well implemented MDO capabilities will play an increasingly important role in DERA's activities to support the definition of future system requirements and the assessment of new equipment. The framework in which an MDO approach is realized must be flexible and accommodate the diverse range of individual discipline-based tools that contribute to the overall process. This paper describes DERA's activity within the EC Framework IV 'FRONTIER' project to investigate the use of modern graphical user interface (GUI) methods, and genetic algorithms (GAs) for the combined aerodynamic and structural design of a modern combat aircraft. The application of the techniques to identify a Pareto frontier in high level design objective space that

represents the boundary beyond which improvements cannot be made without sacrificing one or other aspect of overall aircraft performance is described. The scope of the method as an aid during the definition of system requirements and for the evaluation of trade-offs during the concept assessment stage of a project is discussed.
Author
Fighter Aircraft; Genetic Algorithms; Graphical User Interface; Multidisciplinary Design Optimization; Structural Design; Aircraft Design; Computer Aided Design

19990027517 Southampton Univ., British Aerospace/Rolls Royce Univ. Technology Partnership for Design, UK
A Case for Multi-Level Optimisation in Aeronautical Design
Robinson, G. M., Southampton Univ., UK; Keane, A. J., Southampton Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 9.1 - 9.6; In English; See also 19990027508; Sponsored in part by Applied Computing and Engineering Ltd.; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper discusses how the inevitable limitations of computing power available to designers has restricted adoption of optimization as an essential design tool. It is argued that this situation will continue until optimization algorithms are developed which utilize the range of available analysis methods in a manner more like human designers. The concept of multi-level algorithms is introduced and a case made for their adoption as a way forward. The issues to be addressed in the development of multi-level algorithms are highlighted. This paper goes on to discuss a system developed at Southampton University to act as a test bed for multi-level algorithms deployed on a realistic design task. The Multi-level wing design environment integrates drag estimation algorithms ranging from an empirical code to an Euler CFD code. A simple multi-level optimization of a civil transport aircraft wing is presented.
Author
Aircraft Design; Algorithms; Euler Equations of Motion; Transport Aircraft; Wings; Computational Fluid Dynamics; Navier-Stokes Equation

19990027521 Greenwich Univ., Centre for Numerical Modelling and Process Analysis, London, UK
The Use of Multiphysics Modelling Technology in the Design of Aerospace Components
Cross, M., Greenwich Univ., UK; Bailey, C., Greenwich Univ., UK; Croft, T. N., Greenwich Univ., UK; McManus, K., Greenwich Univ., UK; Moran, G., Greenwich Univ., UK; Pericleous, K., Greenwich Univ., UK; Slone, A., Greenwich Univ., UK; Taylor, G., Greenwich Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 14.1 - 14.10; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The requirement for the capability to model closely coupled multiphysics phenomena in the context of aerospace design for both performance and manufacture is demonstrated. An approach to the design and implementation of an integrated multiphysics modeling software framework is described based upon finite volume methods using unstructured meshes. The framework is then applied to two transient problems: (1) shape casting in the context of design for manufacture and (2) dynamic fluid structure interaction in the context of aeroelasticity. Such software tools must play an increasingly significant role in the analysis of key problems in the assessment of aerospace design and manufacture.
Author
Finite Volume Method; Unstructured Grids (Mathematics); Finite Element Method; Thermal Energy; Casting; Aerospace Engineering; Structural Design

19990027522 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Structural Mechanics, Brunswick, Germany
Design Aspects of the Adaptive Wing: The Elastic Trailing Edge and the Local Spoiler Bump
Monner, H. P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Bein, T., Magdeburg Univ., Germany; Hanselka, H., Magdeburg Univ., Germany; Breitbach, E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 15.1 - 15.9; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Market research predicts for the aircraft industry a large growth in numbers of passengers as well as in airfreight rate. Leading to an increased competition for the European aircraft industry, the efficiency of new aircraft has to improved drastically. One approach among others is the aerodynamical optimization of the wing. The fixed wing is designed optimally only for one flight condition. This flight condition is described by the parameters altitude, mach number and aircraft weight which vary permanently during the mission of the aircraft. Therefore the aircraft is just periodically near chosen design point. To compensate for this major disadvantage an "adaptive wing" for optimal adaptation and variation fo the profile geometry to the actual flight conditions will

be developed. Work is being done on concepts for a variable camber and a local spoiler bump. In this paper structural concepts developed for both objectives will be presented. The concepts are designed under the aspect of adaptive structural systems and require a high integration of actuators sensor and controllers in the structure. Special aspects of the design will be discussed and first results analytical, numerical as well as experimental will be presented. Part of the concept design is also the development of new actuators optimized for the specific problem. A new actuator concept for the spoiler bump based on a cylindrical tube and activated either by pressure of multifunctional material (eg. shape memory alloys) will be shown.
Author
Research Aircraft; Shape Memory Alloys; Trailing Edges; Flexible Wings; Transonic Flow; Wing Camber

19990027525 Bath Univ., Dept. of Mechanical Engineering, Bath, UK
Sequential Use of Conceptual MDO and Panel Sizing Methods for Aircraft Wing Design
Butler, R., Bath Univ., UK; Lillico, M., Bath Univ., UK; Banerjee, J. R., City Univ., UK; Patel, M. H., City Univ., UK; Done, G. T. S., City Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 18.1 - 18.11; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The optimisation results for composite and metallic versions of a regional aircraft wing are compared using the multidisciplinary optimisation (MDO) program CALFUNOPT. The program has been developed for the conceptual design stage and models the wing using just 11 beam elements. The wing has been optimized for three combinations of the following constraint cases: (1) static strength; (2) aeroelastic roll efficiency and (3) aeroelastic divergence. As expected, comparison shows that the composite wing designs are significantly lighter than the metallic ones, due to the well-known tailoring of the composite material. However, the simple model reveals some insight that may be useful to the designer, and which could be lost within a more detailed Finite Element approach. The upper-skin compression panels produced by the conceptual MDO programs for both versions of the wing, have then been optimized using the more detailed and accurate panel sizing tool, VICONOPT, which takes buckling into account. Such optimization increases the panel mass by 5-10% and also provides a suitable ratio of stiffener to skin area for use in the conceptual MDO model.
Author
Composite Materials; Finite Element Method; Optimization; Wings; Multidisciplinary Design Optimization; Wing Panels; Metals; Computer Aided Design

19990027613 NASA Ames Research Center, Moffett Field, CA USA
Identification of 15-15 Aeroelastic Modes using Frequency-Domain Methods
Acree, C. W., Jr., NASA Ames Research Center, USA; Tischler, Mark B., Army Aviation Systems Command, USA; [1988]; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The XV-15 Tilt-Rotor wing has six major aeroelastic modes that are close in frequency. to precisely excite individual modes during flight test, dual flaperon exciters with automatic frequency-sweep controls were installed. The resulting structural data were analyzed in the frequency domain (Fourier-transformed). Modal frequencies and damping were determined by performing curve fits to frequency-response magnitude and phase data. Results are given for the XV-15 with its original metal rotor blades. Frequency and damping values are also compared with new predictions by two different programs, CAMRAD and ASAP.
Author
Aeroelasticity; Frequency Response; Frequency Control; XV-15 Aircraft; Tilt Rotor Aircraft

19990027732 Boeing Co., Saint Louis, MO USA
Aging Aircraft Structures Database *Final Report, Jan. 1997 - Jan. 1998*
Perez, Rigoberto; Mar. 1998; 31p; In English
Contract(s)/Grant(s): F33615-95-C-3213; AF Proj. 2401
Report No.(s): AD-A359969; AFRL-VA-WP-TR-1998-3022; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the work performed by the Boeing Company to develop an aging aircraft structures database to be used to aid in the verification of structural integrity analysis of aircraft structures. Sample data were collected for the C-30 EC-135, C-141, and F-15 aircraft in the areas of fatigue, corrosion, and structural repair. A user-friendly database was developed using Microsoft Visual Basic, which can be accessed by other windows based structural analysis software. The report also summarizes work performed to link the database to the existing Air Force crack growth life prediction program, AFGROW.
DTIC
Aircraft Structures; Structural Analysis; Data Bases; Structural Failure; Aircraft Maintenance; Aging (Materials)

19990027736 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Variational Bounds for the Equivalent Spring Constants for Bonded Repairs
Chalkley, Peter, Defence Science and Technology Organisation, Australia; Rose, L. R. F., Defence Science and Technology Organisation, Australia; Sep. 1998; 33p; In English; Original contains color illustrations
Contract(s)/Grant(s): RAAF-ASI-1A
Report No.(s): DSTO-RR-0139; DODA-AR-010-644; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Variational bounds, both upper and lower, are found for the equivalent spring constant of a double-strap joint which represents a sub-element of bonded repairs to cracked structure. Conservative estimates of the equivalent spring constant, needed for accurate design, are obtained from variational analyses of the joint. Estimates from various analytical models of varying level of approximation were obtained. Simpler expressions for the spring constant resulted from relaxing certain assumptions, however, the theoretical guarantee of a true upper or lower bound was lost. Spring constant estimates were compared with finite- element model results and so the fidelity of the variational bounds, specially for the simplified analyses, could be established. An improved formula is proposed for use in design procedures in RAAF C5033.
Author
Bonded Joints; Estimates; Structural Design; Crack Arrest

19990028018 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
New Processing of Composite Grids for Aerospace Applications *Final Report, Nov. 1997 - Nov. 1998*
Tsai, Stephen W.; Liu, Kevin K.; Feb. 1999; 15p; In English
Contract(s)/Grant(s): F69620-98-1-0099
Report No.(s): AD-A360443; AFRL-SR-BL-TR-99-0052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Composite grids offer a unique combination of performance and cost for many aerospace structures. A particular process suitable for shells of revolution is discussed in detail. This process has been developed by Stanford University.
DTIC
Aerospace Systems; Composite Structures; Aerospace Engineering; Grids

19990028283 Lockheed Martin Corp., Information Systems, Orlando, FL USA
Advanced Distributed Simulation Technology 2 (ADSR 2). MODSAF Aviation Development: Conceptual Model for PWA Enhancements
May 01, 1998; 23p; In English
Report No.(s): AD-A360332; ADST-II-CDRL-MODSAF-9800123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

ModSAF was built for tank simulation, and the modeling architecture was built on this concept. This has resulted in low-fidelity rotary wing model based off of a tank model, which does not effectively portray RWA to the level needed by most ModSAF users. This effort concentrates on building a new RWA model that contains automated simulation of Army Aviation tactics. These tactics are in accordance with system capabilities described in the aviation flight manuals for AH-64, AH-64D Longbow, CH-47D, OH-58D, RAH-66, and the UH-60L.
DTIC
Flight Simulation; Rotary Wing Aircraft; Distributed Interactive Simulation; Computerized Simulation

19990028284 Dayton Univ. Research Inst., Structural Integrity Div., OH USA
Maintainability Improvement Through Corrosion Prediction *Final Report, 1 Mar. 1996 - 31 Dec. 1997*
Tritsch, D. E.; Konish, H. J.; Dec. 1997; 148p; In English
Contract(s)/Grant(s): F09603-95-D-0175; AF Proj. 4347
Report No.(s): AD-A360253; UDR-TR-1998-00093; AFRL-ML-WP-TR-1998-4187; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In 1994, the Scientific Advisory Board (SAB) reported that "Corrosion is the single most costly maintenance problem for USAF aging aircraft." In 1997, the National Materials Advisory Board (NMAB) investigated the aging of USAF aircraft and reported that "corrosion can progress significantly before being observed, leading to increased maintenance costs and time in PDM (Programmed Depot Maintenance)". These concerns are recognized by the USAF in having identified the C/KC-135 aircraft as being life limited by corrosion with respect to life cycle cost sustainment of the fleet (the first fleet identified in this manner). The NAMAB stated in its recommendations for the USAF, the "most important operational needs include...improved understanding of probable rates of corrosion and corrosion trends for specific operational aircraft for use in planning maintenance actions".

The overall objective of this effort was to assess the possibility of developing corrosion damage formation and growth models to assist in prediction corrosion maintenance actions (inspection and repair) on aluminum airframe structure. The assessment involved a review and evaluation of corrosion research and available data for the purpose of identifying or proposing corrosion formation and growth models. The corrosion research and available data considered under this effort included current research efforts directed at airframe corrosion damage formation and growth, USAF corrosion maintenance programs, aircraft basing history information, fleet maintenance data (inspection reports and repair orders), and airbase corrosion severity indices. Two model types emerged as possible frame works to predict the location and severity of corrosion occurrences. First, a model based on aircraft historical trends using statistical models of historical corrosion repair records to predict near term corrosion damage trends. Second, a model based on corrosion damage mechanics.
DTIC
Aircraft Maintenance; Aircraft Structures; Corrosion; Mathematical Models; Aging (Materials); Predictions

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.

19990027574 NASA Lewis Research Center, Cleveland, OH USA
Flashback Arrestor for LPP, Low NOx Combustors
Kraemer, Gil, Precision Combustion, Inc., USA; Lee, Chi-Ming, NASA Lewis Research Center, USA; 1998; 18p; In English; Turbo Expo '98 Congress and Exhibition, 2-5 Ju. 1998, Stockholm, Sweden; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 244-02-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Lean premixed, prevaporized (LPP) high temperature combustor designs as explored for the Advanced Subsonic Transport (AST) and High Speed Civil Transport (HSCT) combustors can achieve low NO(x), emission levels. An enabling device is needed to arrest flashback and inhibit preignition at high power conditions and during transients (surge and rapid spool down). A novel flashback arrestor design has demonstrated the ability to arrest flashback and inhibit preignition in a 4.6 cm diameter tubular reactor at full power inlet temperatures (725 C) using Jet-A fuel at 0.4 less than or equal to phi less than or equal to 3.5. Several low pressure loss (0.2 to 0.4% at 30 m/s) flashback arrestor designs were developed which arrested flashback at all of the test conditions. Flame holding was also inhibited off the flash arrestor face or within the downstream tube even velocities (less than or equal to 3 to 6 m/s), thus protecting the flashback arrestor and combustor components. Upstream flow conditions influence the specific configuration based on using either a 45% or 76% upstream geometric blockage. Stationary, lean premixed dry low NO(x) gas turbine combustors would also benefit from this low pressure drop flashback arrestor design which can be easily integrated into new and existing designs.
Author
Nitrogen Oxides; Jet Engine Fuels; Flashback; High Temperature; Supersonic Transports; Exhaust Gases; Exhaust Emission; Combustion Chambers

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.

19990026726 Royal Aeronautical Society, London, UK
The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings
1997; 100p; In English; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training, 5-6 Nov. 1997, London, UK; See also 19990026727 through 19990026738; ISBN 1-85768-009-X; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The international status of training devices for flight crews is examined in light of the Federal Aviation Authority (FAA) and the Joint Aviation Authorities (JAA) regulations. The many types of flight simulators used in training and retraining pilots are

reviewed. The need for further simulator development is examined. International cooperation in the development of standards, and approval of flight simulators for air carriers is urged.
CASI
Air Transportation; Conferences; Flight Simulators; International Cooperation; Regulations; Training Devices; Pilot Training

19990026727 Joint Aviation Authorities, Hoofddorp, Netherlands
The Joint Aviation Authorities and STD Standardisation
Yates, Richard G., Joint Aviation Authorities, Netherlands; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 2.1-2.3; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This Paper begins with a brief description of the European Joint Aviation Authorities (JAA) followed by an explanation of the JAA's standardization machinery that is to be put in place in the field of Synthetic Training Devices (STDs). This explanation covers the philosophy behind standardization in the JAA, what the standardization activity will actually involve and the follow-up to standardization visits.
Author
Standardization; Training Devices; Cockpit Simulators; Flight Simulators; Onboard Equipment; Pilot Training

19990026728 Federal Aviation Administration, National Simulator Program, Washington, DC USA
Regulatory Cooperation in Simulator Qualification Evaluations
Ray, Paul A., Federal Aviation Administration, USA; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 3.1-3.8; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

To an ever increasing degree, airlines and the aviation industry have departed from their traditional role as a national enterprise by their expansion into what is rapidly becoming a global industry. National aviation authorities, if they are to fulfill their mandate to uphold the highest levels of aviation safety, must adapt to the impact of the global nature of the aviation industry by increasing their partnerships with other regulatory authorities. This will provide the only effective and efficient global means to accomplish surveillance and foster safety in an era of diminishing resources. No where is this clearer than in the area of simulator qualification evaluations, where not only is the simulator required to undergo an evaluation by the regulatory authority of their own country, they must also endure such an evaluation by each of the regulatory authorities from each of the foreign countries whose airlines purchase time on the subject simulator. This makes for neither an efficient nor effective operation from either an operator's or regulator's standpoint. If even a portion of these multiple evaluations are able to be eliminated while safety is maintained, all will benefit. I will touch briefly on a few areas related to the development of an agreement covering simulator qualifications between the Federal Aviation Administration (FAA) and the European Joint Aviation Authorities (JAA). After sharing some background on harmonization in this area, I will provide some background on the development of the regulatory framework for our cooperation and how, in collaboration with our European colleagues, we are making a more efficient regulatory process a reality in Europe.
Derived from text
Airline Operations; Flight Safety; Regulators; Flight Simulators; Cockpit Simulators; International Cooperation

19990026729 Luftfahrt-Bundesamt, Brunswick, Germany
The Evaluation and Approval of Flight Simulations for German Air Carriers
Zimmermann, Karl, Luftfahrt-Bundesamt, Germany; Krueger, Jens, Luftfahrt-Bundesamt, Germany; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 4.1-4.11; In English; See also 19990026726; Copyright; Avail: Issuing Activity (Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The increasing transfer of pilots training and checking from the airplane to Flight Simulators up to 'Zero Flight Time' leads to a steadily increasing number of simulator approvals. to save costs and efforts for both Simulator Operators and Aviation Authorities there have been several initiatives where the (Federal Civil Aviation Authority) LBA has been participating to define a common standard for simulator evaluations and qualifications which now will be established in Europe by implementing the Joint Aviation Requirements (JARSTD). Based on ECAC agreements the LBA extended the period between Simulator inspections already years ago to 24 months for some European Countries and joint evaluations have been carried out together with European Authorities as well as with the US Federal Aviation Authority (FAA) for familiarization with the evaluation process of these Authorities. The LBA appreciates the aspired mutual acceptance of Simulator qualifications as well as the bilateral agreement

with the USA but it is at the same time aware of existing and appearing difficulties which have to be clarified on the way to a fully implementation and practical application.
Author
Flight Simulation; Flight Simulators; Inspection; Qualifications; International Cooperation

19990026730 Orbit Flight Training Ltd., Derby, UK
Reciprocal Simulator Approvals: A Frustrated Opportunity
Bryant, G. L., Orbit Flight Training Ltd., UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 6.1-6.3; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

My paper today is about reciprocal simulator approvals, and the sense of frustration I hope we all share regarding the rate of progress in this important area. Whilst Bilateral Aviation Safety Agreements (BASA), Simulator Implementation Procedures(SIP) and Joint Implementation Procedures (JIP) are all under way, I would suggest that time has not been of the essence. I will start by reviewing the expectations and then look at the current status to see how it matches, or has fallen short. I will follow this with a summary of the effort required to achieve simulator qualifications, and the challenges often associated with scheduling the time. The costs impact us all, whether we are training centre operators, regulators, airlines - or indeed the fare paying passenger. My conclusions will demonstrate what life could be like if reciprocal simulator approvals were a reality.
Derived from text
Aircraft Safety; Airline Operations; Commercial Aircraft; Flight Safety; Qualifications; Regulators; Flight Simulators; Cockpit Simulators; International Cooperation; Evaluation

19990026731 Mechtronix Systems, Inc., Dorval, Quebec Canada
What is Needed for Todays FNPT Requirements? Can PC Based Technology Meet the Challenge?
Petruzziello, Fernando, Mechtronix Systems, Inc., Canada; Herve, Xavier-Henri, Mechtronix Europe, France; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 7.1-7.7; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The past few years have witnessed a strong increase in the use of Personal Computer (PC) based training aids within the General Aviation (GA) training community. cost and safety benefits being the major contributing factors. Just as in the business world. as the first wave of PC applications conquered our offices. the very first use of PCs in the training community has mostly been limited to desktop environments for such tasks as Computer Based Training (CBT) or Instrument Flight Rules (IFR) training. The application of commonly used PC technology no longer satisfies the new and emerging needs of the GA training community. Tremendous growth in pilot demand is placing great strain on the community and new solutions must be found. In essence. the GA training community needs. but cannot afford the training features traditionally offered by full flight simulator technology. Mechtronix Systems Inc. (MSI) has used the latest generation of networking and distributed architectures centered on PC technologies to build a new generation of affordable flight training aids. MSI has applied this technology. and thus developed the ASCENT FULL FLIGHT TRAINER (FFT) concept. The following paper shall outline and define the FFT concept. Presented shall be the new training requirement. the product features needed to meet these needs. and an explanation of how the latest generation of PC technology has been used to build an affordable product. Also presented is a detailed description of the instructor station capabilities and the visual system requirements embedded within the FFT concept. Thus. finally making affordable training features traditionally reserved for the major airline operators available lo the GA community.
Author
Flight Simulators; Flight Training; Personal Computers; Training Devices; Computer Assisted Instruction; Commercial Aircraft; General Aviation Aircraft

19990026732 Oxford Air Training School, Oxford, UK
FNPT 1 and 2 Devices in Training Programmes
Barrell, G. R., Oxford Air Training School, UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 8.1-8.4; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The paper examines the new regulations for Synthetic Training of professional pilots as part of an approved training course. The types of synthetic trainers are briefly defined the paper then concentrates on the Flight Navigation Procedures Trainer (FNPT) specifications, and the training allowances and credits available. The equipment in use at Oxford is briefly mentioned with some

details of how it will be used for training towards the Joint Aviation Authorities (JAA) Airline Transport Pilot's Licence (ATPL), particular reference is made to the use of generic jet simulators for Multi Crew Conversion training.
Author
Airline Operations; Education; Pilot Training; Training Devices; Air Navigation; Flight Instruments; Flight Simulators; Cockpit Simulators

19990026733 CAE Electronics Ltd., Montreal, Quebec Canada
Implementation of JAA Level A and New FAA Level B Full Flight Simulators: A Manufacturers Perspective
Thompson, Ralph, CAE Electronics Ltd., Canada; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 9.1-9.8; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The new Federal Aviation Authority (FAA) and Joint Aviation Authorities (JAA) regulations on Flight Simulators open up opportunities for simulator manufacturers to develop creative and imaginative new concepts. They provide operators the opportunity to improve safety and reduce cost. Unfortunately, the Flight Simulator industry is not an exact science. In order to apply these regulations in practice, we must compare them to an established baseline. This baseline can only be the success and experience gained by the industry to date. The Simulator industry has evolved over many years into a sophisticated business. It is important that this experience is applied to the new regulations and that quality and high fidelity remain our trade marks. Terminology, common in the 70's and 80's such as reversal bump, Pilot Induced Oscillations (PIO), simulator sickness, "fudging the data" etc. are rarely heard today in reference to Qualified Full Flight Simulators. Above all, negative training characteristics have been all but eliminated. These detrimental characteristics must not be reintroduced.
Author
Flight Simulators; Safety; Cockpit Simulators; Standards

19990026734 Thomson Training and Simulation Ltd., Crawley, UK
Do the New JAA and FAA Flight Simulator Regulations Address the Training Requirements?
Hartley, N. Ray, Thomson Training and Simulation Ltd., UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 10.1-10.4; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The focus of industry effort has been on equipment definitions - in particular, the harmonisation process which resulted in the International Qualification Test Guides (IQTG). This benchmark of activity has not been matched in training terms whilst there have been revisions to training requirements in JAR-FCL, and the Federal Aviation Authority's (FAA) Practical Test Standards, this work has followed a well worn path which has not significantly changed for several decades. This paper highlights the FAA's Human Factors Team report which identified the vulnerabilities in flight crew management of automation and situation awareness. A report recommendation suggested that industry investigated the use of innovative training tools and methods to expand pertinent safety related knowledge of flight crews on a continuing basis - with incentives to encourage training beyond the minimum required by current regulations. The paper notes that the findings of the FM report are potentially exacerbated by the planned progress towards transcontinental Free Flight in Europe and the USA. Given the long periods of gestation of the FAA and Joint Aviation Authorities (JAA) regulatory definition process how is the industry going to best equip itself to meet the challenges? Is the equipment available today sufficient and adequate? Is it readily available on sufficient scale to enable training on a continuing basis, as recommended by the FM? Should the equipment feature in the regulatory qualification process?
Author
Flight Crews; Flight Simulators; Qualifications; Training Simulators; Pilot Training; Airline Operations

19990026735 Federal Aviation Administration, Project Development Section, Washington, DC USA
Pilot Training and Checking in Flight Simulators: The New Standard, Not the Exception
Cook, Edward D., Federal Aviation Administration, USA; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 11.1-11.10; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

For years the purveyors and users of flight simulation have been extolling the virtues of flight simulation and its applicability to pilot training and testing. There is little doubt that using simulators instead of airplanes achieves fuel conservation. However, simulator use also reduces air traffic congestion, noise and air pollution, and direct training and other costs to the operator. Addi-

tionally true is the fact that flight simulators provide a safe flight training environment and would reduce the number of training accidents by allowing emergency situations to be encountered and resolved without jeopardizing safety. However, an even greater encouragement for the proper use of these simulators is that they allow more in-depth training, testing, and checking than can be accomplished in airplanes. The behavior learned, practiced, reinforced, and tested in the simulator is the behavior each pilot takes into the airplane and into operation " on the line." Included are those situations involving poor weather, malfunctioning systems on the airplane, challenging departures, rigorous arrivals, landings requiring tough, unyielding performance, and, if necessary, any emergency. This behavior is the correct behavior-- because it has been taught, practiced, and tested in realistic (although simulated) situations. As a result the pilot is more thoroughly trained and examined and is, therefore, more competent and more safe. Additionally, the regulatory authority (in the US, the Federal Aviation Administration, FAA) is to help ensure the safest possible operating environment in which airline passengers may be transported to their destinations. Allowing pilots to use training systems less than the safest possible would be questionable, at best. Accordingly, the FAA is preparing a regulation change that if adopted, will change the face of airplane training, testing. and checking applications in the US in several interesting and conceivably demanding ways.
Derived from text
Airline Operations; Flight Simulation; Flight Simulators; Flight Training; Pilot Training; Safety; Simulators; Cost Reduction; Flight Crews

19990026736 PARC Aviation, Dublin, Ireland
AQP: Q for Question?
Kane, R. F., PARC Aviation, Ireland; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 12.1-12.9; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The paper will contend that an increasing and troubling number of professional pilots are demonstrating serious deficiencies in both handling skills and technical knowledge. This situation is considered to arise not simply from the increased use of automation but also from changing perceptions in relation to training, changes frequently influenced by the current emphasis on Crew Resource Management (CRM). It will argue that the introduction of the Advanced Qualification Program (AQP) can only bring about a further dilution of skills by decreasing the total amount of time allocated to training and that the conclusion that AQP actually enhances performance is logically flawed.
Author
Education; Qualifications; Pilot Training; Flight Crews

19990026737 Thomson Training and Simulation Ltd., Crawley, UK
Innovation and the OTD: A Case of Chickens and Eggs
Ford, Keith, Thomson Training and Simulation Ltd., UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 13.1-13.9; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

A 'Chicken & Egg' situation can occur when introducing new technology to the flight training industry since it is not always clear what should come first, the innovation, or the regulation. The paper focuses on the issues associated with keeping regulations aligned with the innovative development of training equipment. It discusses how lack of regulation as well as over regulation can stifle innovation and its potential benefits. The absence of regulation Other Training Devices (OTDs) increases the risk when developing a new type of training device since under these circumstances, it may not be possible to guarantee exactly how it can be used in pilot training. This results in a Catch-22 situation since the operators are reluctant to buy anything unless they know it will be approved by the regulators; the manufacturers may not be prepared to take financial developing a new device which the regulators may not certify; and the regulators will not sanction the use of the device in an airlines training programme unless they have seen and understood how it will be used. by describing the development of a new type of training device, the paper challenges the current thinking concerning the use virtual controls for devices that may come under the OTD banner. It concludes by saying that in order to capitalize on recent advances in multimedia technology, the industry should expedite the process of defining regulations for OTDs and produce a unified international agreement as for Full Flight Simulators (FFSs) and Flight Training Devices (FTDs).
Author
Airline Operations; Commercial Aircraft; Flight Training; Pilot Training; Training Devices; Aircraft Pilots

19990026738 Gromov Flight Research Inst., Training Devices, CBT and the Human Factor Lab., Zhykovsky, Russia
The Development and Regulation of Training Devices in Russia: Conditions, Problems, Perspectives
Meerovitch, G., Gromov Flight Research Inst., Russia; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 14.1-14.5; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Russia has a great need for modern effective inexpensive Training Devices (TD), that are examined with strong Certification Procedures. This report analysed the following subjects which are very important for estimation of TD development and perspectives: (1) The modern situation in Russian Civil Aviation; (2) The state of Flight Safety; (3) The condition in the Training Area in the former time and today. (4) What TD are needing for modern Russian conditions? (5) Some principles of TD Regulation in Russia. A Rational Training Conception is formulated. The keystone principles of this Conception are as follows: (1) The TD level must be essentially increased without major financial expense; (2) For the new Aircraft generation with planes numbering more 20, high level Training Centers must be organized; (3) For the rest of the aircraft types the preference must be given to the "Low Cost - High Efficiency" Training Systems; (4) The Training profitability must be high. A modern TD Regulation System identical to the international level is absent in Russia currently and must be started. The propositions for it are given.
Author
Civil Aviation; Education; Flight Safety; Russian Federation; Training Devices; Low Cost; Aircraft Pilots

19990026967 Naval Research Lab., Washington, DC USA
Tests of Alternative Fire Protection Method for USAF Hangars
Hill, S. A.; Scheffey, J. L.; Walker, F.; Williams, F. W.; Feb. 08, 1999; 385p; In English
Report No.(s): AD-A359951; NRL/MR/6180--99-8337; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

The use of AFFF in overhead suppression systems in aircraft hangars continues to create problems as a result of false discharges and environmental concerns. Two replacement concepts are proposed: the use of water suppression systems to control JP-8 fires and limit fire growth to an acceptable level; and the use of a Mobile Compressed Air Foam Fire Suppression System (MCAFFSS) to protect aircraft in a hangar. Water suppression systems were tested to determine the impact on flame spread and fire growth of the spill fire. The variables investigated included sprinkler application rate and time of sprinkler water discharge. The results showed that the water sprinklers were not capable of preventing flame spread and fire growth on a JP-8 fuel spill. The MCAFFSS unit tested consisted of a premixed AFFF discharged through an oscillating monitor nozzle. Included was a combination UV/IR optical fire detector designed to sense a fuel fire when it is relatively small. Variables evaluated included actuation time, effect of foam aspiration, effect of discharge methods and effect of obstructions. The unit was able to detect and control/extinguish JP-8 spill fires. Tests conducted with obstructions, indicate that obstructions affect the performance of the unit. The technique of targeting the foam at an area in front of the hazard (aircraft) being protected and pushing the foam across the floor, was shown to be the most effective. Non-air aspirated foam was shown to be as effective as air aspirated foam. The location of the fire detector with respect to the fire and obstructions had an effect on detection time.
DTIC
Fire Prevention; Hangars; Foams; Extinguishing; Fires; Infrared Detectors

19990026995 Institute for Human Factors TNO, Soesterberg, Netherlands
Evaluation of the Training Value of Alternative Simulator Configurations for the Chinook and Cougar Transport Helicopters ***Final Report*** ***Evaluatie van de trainingswaarde van alternatieve simulator configuraties voor de Chinook en Cougar transporthelikopters***
vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; Boot, E. W., Institute for Human Factors TNO, Netherlands; deVries, S. C., Institute for Human Factors TNO, Netherlands; Kappe, B., Institute for Human Factors TNO, Netherlands; Ligthart, V. H. M., Institute for Human Factors TNO, Netherlands; Marsman, A. P. L. A., Institute for Human Factors TNO, Netherlands; Jul. 17, 1998; 70p; In Dutch
Contract(s)/Grant(s): A97/KLu/307; TNO Proj. 730.1
Report No.(s): TD98-0251; TM-98-A042; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

In the context of the procurement of simulator capacity for training pilots of Chinook CH-47D and Cougar MK2 cargo helicopters, in a previous study a global training analysis has been conducted. Also, requirements for different possible simulator configurations have been formulated. On the basis of these requirements the Royal Netherlands Air Force (RNLAF) has formulated and issued a Request for Information (RFI) to potential suppliers. The aim of the RFI is to gather information about the technical and financial feasibility of the proposed simulator configurations. In order to evaluate the responses to the RFI on basis of their training value, a more detailed training analysis has been conducted and is reported here. Within the context of this analysis the

minimally required level of simulator configuration and necessary training time for each training topic has been determined. On the basis of these results it is concluded that: 1 more than a quarter of all training hours can only be performed with the most advanced level of simulator configuration (about the same as FAA level D). These training hours are mostly concerned with training topics associated with flight safety (emergency procedures) and operating under maximum and special conditions; 2 given such a level of simulator configuration, the total training time for both helicopter types will be at least 1200 hours. If those training topics which could be trained in a helicopter are also trained on this simulator configuration, the total training time amount to 1660 hours for both types. There is reason to believe that these estimates are conservative. It is expected that once such a level of simulator configuration is available, the total training time for both types could exceed 2600 hours. to specify simulator requirements more accurately, training scenarios have been specified for each of the essential (level D) training topics. For each scenario, the minimum requirements have been determined. On the basis of these requirements RFI responses can be evaluated and compared. It appeared that a number of suppliers can meet the requirements. During subsequent phases of the procurement process, the training scenarios can be used to specify test scenario's for evaluating proposals. Ultimately the results reported can also be used for the development of the training programmes that are delivered on the simulator(s). The training analysis and the specification of the simulator requirements have been mainly focussed on the most important cost drivers, viz. the image systems and the moving base systems. It is recommended to pay also attention during subsequent phases to the requirements with respect to the instructional facilities. Although they are not the main cost drivers, they are Important benefit drivers, i.e. they are essential for effective and efficient use of the simulator facilities.
Author
Training Evaluation; Simulators; CH-47 Helicopter; Training Simulators; Estimates; Education

19990027153 Science Applications International Corp., Arlington, VA USA
Heliport Lighting: Configuration Research ***Final Report***
Fontaine, Scott A.; Cherry, Adina C.; McConkey, Edwin D.; Nov. 1998; 61p; In English
Report No.(s): AD-A359492; DTFA01-93-C-00030; DOT/FAA/ND-98/2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report develops a methodology for researching and designing heliport lighting systems with particular emphasis on lighting system configurations. The report also catalogs lighting system components, subsystems, and systems identified to date. The main objective of this effort is to develop a basis from which to form a more efficient lighting system for instrument approaches to heliports using the Global Positioning System (GPS). With the development of instrument approach procedures to heliports, the Federal Aviation Administration (FAA) is investigating the lighting requirements necessary to support these procedures. This report describes the initial efforts of this research and development activity.
DTIC
Heliports; Illuminating; Instrument Approach; Helicopters; Lighting Equipment; Instrument Landing Systems

19990027154 Science Applications International Corp., Arlington, VA USA
Heliport Lighting: US Park Police Demonstration ***Final Report***
Fontaine, Scott A.; McConkey, Edwin D.; Nov. 1998; 47p; In English
Contract(s)/Grant(s): DTFA01-93-C-00030
Report No.(s): AD-A359491; DOT/FAA/ND-98/4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This demonstration/evaluation of prototype heliport lighting system components was part of a larger effort to research the requirements for lighting systems to support precision approaches to heliports. Based on the success of a VFR prototype system demonstrated in conjunction with Operation Heli-STAR (DOT/FAA/AND-97/20), it was decided to continue the demonstration/evaluation at the USA (U.S.) Park Police Heliport in Washington D.C. The arrangement has proven to be extremely valuable, due in large part to the cooperation and assistance of the officers, pilots, and aircrew of the U.S. Park Police Aviation Section. This reports documents the initial evaluation of a laser diode localizer, a laser diode glideslope indicator, a light pipe, cold cathode line-up and landing system, and a light bar "alignment of elements" glideslope indicator. Some insights and lessons learned regarding the use of simulation in lighting system development are also presented.
DTIC
Lighting Equipment; Heliports; Fiber Optics; Illuminating; Landing Aids

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CHEMISTRY AND MATERIALS

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

19990026845 Advanced Fuel Research, Inc., East Hartford, CT USA
Thermal Stability Enhancement of JP-5 *Final Report, 28 Sep. 1997 - 26 Mar. 1998*
Serio, Michael A.; Kroo, Erik; Malhotra, Ripudaman; McMillen, Donald F.; Sep. 15, 1998; 38p; In English; Prepared in cooperation with SRI International, Menlo Park, CA.
Contract(s)/Grant(s): N68335-97-C-0324
Report No.(s): AD-A360085; AFR-531003-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this work was to determine if C60 or its derivatives could enhance the oxidative thermal stability of JP-5 and similar aviation fuels. Two derivatives of C60 were prepared, n-hexyl amine and di-isopropylamine. Several conventional thermal stressing experiments were also performed: oxygen overpressure (OOP), isothermal corrosion oxidation test (ICOT), quartz crystal microbalance (QCM), and hot liquid process simulator (HLPS). In addition, a fuel stability test system (FSTS) developed at Advanced Fuel Research, Inc. (AFR) was also used. The FSTS includes fiber optic infrared transmission cells to assess fuel thermal stability during thermal stressing up to 500 C. The low temperature data from OOP, ICOT, QCM and HPLS show that pure C60 generally reduces the deposit formation, although the amount of this reduction is only modest (between 5 and 30%). The beneficial effects are larger under more severe conditions (higher temperatures, longer oxidation times, higher oxygen concentrations). The FSTS results were consistent with this trend, although at the highest temperatures (425-500 C), some potentially deleterious effects of C60 also appear to be enhanced. The effects of reactor tube activation were important for the FSTS. Additional work is warranted on exploring the beneficial effects of C60 addition which could serve to extent the operating range of common jet fuels.
DTIC
Thermal Stability; Fuel Systems; JP-5 Jet Fuel; Fuel Tests

19990027136 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Microfabrication of membrane-based devices by HARSE and combined HARSE/wet etching
Manginell, R. P., Department of Energy, USA; Frye-Mason, G. C., Department of Energy, USA; Schubert, W. K., Department of Energy, USA; Shul, R. J., Department of Energy, USA; Willison, C. G., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Micromachining and Microfabrication, USA
Report No.(s): DE98-007249; SAND-98-1777C; CONF-980918; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Deep-reactive ion etching (DRIE) of silicon, also known as high-aspect-ratio silicon etching (HARSE), is distinguished by fast etch rates (approximately 3 (micro)m/min), crystal orientation independence, anisotropy, vertical sidewall profiles and CMOS compatibility. by using through-wafer HARSE and stopping on a dielectric film placed on the opposite side of the wafer, freestanding dielectric membranes were produced. Dielectric membrane-based sensors and actuators fabricated in this way include microhotplates, flow sensors, valves and magnetically-actuated flexural plate wave (FPW) devices. Unfortunately, low-stress silicon nitride, a common membrane material, has an appreciable DRI etch rate. to overcome this problem HARSE can be followed by a brief wet chemical etch. This approach has been demonstrated using KOH or HF/Nitric/Acetic etchants, both of which have significantly smaller etch rates on silicon nitride than does DRIE. Composite membranes consisting of silicon dioxide and silicon nitride layers are also under evaluation due to the higher DRIE selectivity to silicon dioxide.
NTIS
Fabrication; Membranes; Etching; High Aspect Ratio; Silicon

19990027467 NASA Lewis Research Center, Cleveland, OH USA
Diffusion Barriers to Increase the Oxidative Life of Overlay Coatings
Nesbitt, James A., NASA Lewis Research Center, USA; Lei, Jih-Fen, Army Research Lab., USA; 1999; 14p; In English; 3rd; High Temperature Coatings, 28 Feb. - 4 Mar. 1999, San Diego, CA, USA; Sponsored by Metallurgical Society, USA
Contract(s)/Grant(s): RTOP 523-21-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Currently, most blades and vanes in the hottest section of aero gas turbine engines require some type of coating for oxidation protection. Newly developed single crystal superalloys have the mechanical potential to operate at increasingly higher component temperatures. However, at these elevated temperatures, coating/substrate interdiffusion can shorten the protective life of the coating. Diffusion barriers between overlay coatings and substrates are being examined to extend the protective life of the coating.

A previously- developed finite-difference diffusion model has been modified to predict the oxidative life enhancement due to use of a diffusion barrier. The original diffusion model, designated COSIM, simulates Al diffusion in the coating to the growing oxide scale as well as Al diffusion into the substrate. The COSIM model incorporates an oxide growth and spalling model to provide the rate of Al consumption during cyclic oxidation. Coating failure is predicted when the Al concentration at the coating surface drops to a defined critical level. The modified COSIM model predicts the oxidative life of an overlay coating when a diffusion barrier is present eliminating diffusion of Al from the coating into the substrate. Both the original and the modified diffusion models have been used to predict the effectiveness of a diffusion barrier in extending the protective life of a NiCrAl overlay coating undergoing cyclic oxidation at 1100 C.
Author
Diffusion; Oxidation; Protective Coatings; Heat Resistant Alloys; Gas Turbine Engines

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ENGINEERING

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

19990026842 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Stability and Transition of Hypersonic Boundary-Layer Flows ***Final Report***
Reed, Helen L.; Dec. 1998; 12p; In English
Contract(s)/Grant(s): F49620-98-1-0205
Report No.(s): AD-A360211; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Transition location can be a significant source of uncertainty in high-speed vehicle drag and heating predictions. Also, the efficacy of transition control depends largely on where transition is predicted. Because of facility noise, transition measurements in ground-test facilities are generally not reliable predictors of flight performance and we must rely on computational approaches for design for flight. The program at Arizona State University to investigate stability and transition of hypersonic boundary-layer flows has been ongoing for several years. In this final report we compile the significant theoretical and computational results from this program. The research has progressed through several logical steps with increasing complexity: Linear stability theory with the effects of chemistry and bow shock on a sharp circular cone at zero incidence with a PNS basic state. Examine 3-D effects on a sharp elliptic cone at zero incidence with a PNS basic state. Include nose bluntness (entropy layer and curved shock) plus nonequilibrium chemistry on a circular cone in the nonlinear Parabolized Stability Equations with a Navier-Stokes basic state. Provide a new crossflow Reynolds number including compressibility and wall-temperature effects for use in conceptual design.
DTIC
Boundary Layer Transition; Hypersonic Flow; Nonequilibrium Flow; Shock Waves; Boundary Layer Flow; Cross Flow; Flight Characteristics; Navier-Stokes Equation; Slender Cones; Transition Flow

19990026970 Dayton Univ. Research Inst., Research Inst., OH USA
B-1 Aircraft Main Hydraulic Pump Tests With MIL-H-87257 Hydraulic Fluid ***Final Report, 1 Jun. 1992 - 30 Sep. 1993***
Sharma, Shashi K.; Gschwender, Lois J.; Snyder, Carl E., Jr; Cecere, Gregory J.; Jun. 1998; 70p; In English
Contract(s)/Grant(s): F33615-90-C-5963; AF Proj. 4347
Report No.(s): AD-A359968; AFRL-ML-WP-TR-1998-4212; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In an effort to convert the B-1 aircraft from MIL-H-5606 to M1-H-87257, the Air Force sponsored a study conducted by Rockwell International from April 1991 through June 1992, under contract F34601-89-C-0401. The results of this study are published in Rockwell Report NA-91-1598, dated 17 June 1992. As part of this study, two pump tests were conducted by Vickers using B-1 aircraft hydraulic pumps (Vickers PV3-300-7B) and MIL-H-872S7 (ROYCO 777) hydraulic fluid. During the first test, the pump failed prematurely. The second test was stopped before the scheduled test duration because some metal was observed in the filter patch-test. Due to lack of finding no additional pump tests were carried out to check the compatibility of MIL-H-87257 and B-1 hydraulic pumps. This being the only unresolved issue standing in the way of transitioning this fluid to the B-1 aircraft, the Non-structural Materials Branch of the Materials Directorate of Wright Laboratory (WL/MLBT) decided to conduct in-house pump tests with MIL-H-87257 and B-1 hydraulic pumps to provide the necessary data. The results of the two pump tests carried out at WL/MLBT are the subject of this report.
DTIC
B-1 Aircraft; Hydraulic Equipment; Pumps; Patch Tests

19990027074 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Partial oxidation for improved cold starts in alcohol-fueled engines, Phase 2
Apr. 30, 1998; 34p; In English
Report No.(s): DE98-004544; NREL/SR-540-23863; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Alcohol fuels exhibit poor cold-start performance because of their low volatility. Neat alcohol engines become difficult, if not impossible, to start at temperatures close to or below freezing. Improvements in the cold-start performance (both time to start and emissions) are essential to capture the full benefits of alcohols as an alternative transportation fuel. The objective of this project was to develop a neat alcohol partial oxidation (POX) reforming technology to improve an alcohol engine's ability to start at low temperatures (as low as (minus)30 C) and to reduce its cold-start emissions. The project emphasis was on fuel-grade ethanol (E95) but the technology can be easily extended to other alcohol fuels. Ultimately a compact, on-vehicle, ethanol POX reactor was developed as a fuel system component to produce a hydrogen-rich, fuel-gas mixture for cold starts. The POX reactor is an easily controllable combustion device that allows flexibility during engine startup even in the most extreme conditions. It is a small device that is mounted directly onto the engine intake manifold. The gaseous fuel products (or reformate) from the POX reactor exit the chamber and enter the intake manifold, either replacing or supplementing the standard ethanol fuel consumed during an engine start. The combustion of the reformate during startup can reduce engine start time and tail-pipe emissions.
NTIS
Internal Combustion Engines; Oxidation; Fuel Systems; Ethyl Alcohol; Engine Inlets; Engine Starters; Air Pollution

19990027252 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
RCS Analysis of Bomb-Fins
Li, Jing, Beijing Univ. of Aeronautics and Astronautics, China; Wu, Zhe, Beijing Univ. of Aeronautics and Astronautics, China; Li, Tian, Shenyang Aerodynamics Research Inst., China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 542-545; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

This paper analyzes the difference of corner reflection effect between bomb-fins and ordinary rectangular corner reflectors, and derives the formula of radar cross sections (RCS) of the corner reflection effect of bomb-fins for engineering calculation using equivalent-section-method, and the formula is verified by means of calculating the scatter property of bomb-fins synthetic model. The reflecting coefficient is induced to the RCS formula of polygon plate covered with radar absorption material (RAM), two coefficients are used to express the two times of absorption/reflection effect of the corner reflection, and finally the scatter property of the model covered with RAM is calculated with this reflection-coefficient-method.
Author
Radar Corner Reflectors; Radar Cross Sections; Bombs (Ordnance); Fins; Absorptivity

19990027512 National Aerospace Lab., Amsterdam, Netherlands
The Information and Communication Technology's Contribution to the MDO Project
Vogels, M. E. S., National Aerospace Lab., Netherlands; Allwright, Steve E., British Aerospace Airbus Ltd., UK; Stettner, M., Daimler-Benz Aerospace A.G., Germany; Sims, P., British Aerospace Public Ltd. Co., UK; Bartholomew, P., Defence Research Agency, UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 4.1 - 4.7; In English; See also 19990027508
Contract(s)/Grant(s): CEC-BE95-2056; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

When an enterprise embarks on an initiative to exploit multi-discipline analysis, design and optimization (MDO) the enterprise faces, next to the aeronautical challenge, challenges with respect to Information and Communication Technology (ICT) to support the aeronautics work. The experiences in the Brite-Euram MDO project executed by 14 european aeronautics companies, institutes and universities, have led to the identification of three key ICT areas. Firstly, the process followed by the MDO team being evolutionary by nature requires the MDO process to be documented and communicated in a manner understandable and accessible for the MDO team. MDO results can only be interpreted in relation to the process in which they were generated. Secondly, the specialists from the various disciplines need to work on the SAME design and within the SAME timeframe to bring together their results to come to a next design. Finally, the information, tools, and the operation of the computer network have to be arranged to form an effective and friendly environment for the MDO team to operate within. Highlights of the MDO project in the three key ICT areas are presented.
Author
Computer Networks; Aircraft Design; Multidisciplinary Design Optimization; Computer Aided Design

19990027418 Old Dominion Univ., Dept. of Computer Science, Norfolk, VA USA
Parallel Implicit Algorithms for CFD *Final Report, Period ending 30 Sep. 1998*
Keyes, David E., Old Dominion Univ., USA; December 1998; 7p; In English
Contract(s)/Grant(s): NAG1-1692
Report No.(s): ODURF-151671; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The main goal of this project was efficient distributed parallel and workstation cluster implementations of Newton-Krylov-Schwarz (NKS) solvers for implicit Computational Fluid Dynamics (CFD.) "Newton" refers to a quadratically convergent nonlinear iteration using gradient information based on the true residual, "Krylov" to an inner linear iteration that accesses the Jacobian matrix only through highly parallelizable sparse matrix-vector products, and "Schwarz" to a domain decomposition form of preconditioning the inner Krylov iterations with primarily neighbor-only exchange of data between the processors. Prior experience has established that Newton-Krylov methods are competitive solvers in the CFD context and that Krylov-Schwarz methods port well to distributed memory computers. The combination of the techniques into Newton-Krylov-Schwarz was implemented on 2D and 3D unstructured Euler codes on the parallel testbeds that used to be at LaRC and on several other parallel computers operated by other agencies or made available by the vendors. Early implementations were made directly in Massively Parallel Integration (MPI) with parallel solvers we adapted from legacy NASA codes and enhanced for full NKS functionality. Later implementations were made in the framework of the PETSC library from Argonne National Laboratory, which now includes pseudo-transient continuation Newton-Krylov-Schwarz solver capability (as a result of demands we made upon PETSC during our early porting experiences). A secondary project pursued with funding from this contract was parallel implicit solvers in acoustics, specifically in the Helmholtz formulation. A 2D acoustic inverse problem has been solved in parallel within the PETSC framework.
Derived from text
Algorithms; Computational Fluid Dynamics; Massively Parallel Processors; Nonlinearity; Parallel Processing (Computers); Wings; Incompressible Flow

19990027602 NASA Lewis Research Center, Cleveland, OH USA
Reversal in Spreading of a Tabbed Circular Jet Under Controlled Excitation
Zaman, K. B. M. Q., NASA Lewis Research Center, USA; Raman, G., NYMA, Inc., USA; Physics of Fluids; December 1997; Volume 9, No. 12, pp. 3733-3741; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Detailed flow field measurements have been carried out for a turbulent circular jet perturbed by tabs and artificial excitation. Two "delta tabs" were placed at the nozzle exit at diametrically opposite locations. The excitation condition involved subharmonic resonance that manifested in a periodic vortex pairing in the near flow field. While the excitation and the tabs independently increased jet spreading, a combination of the two diminished the effect. The jet spreading was most pronounced with the tabs but was reduced when excitation was applied to the tabbed jet. The tabs generated streamwise vortex pairs that caused a lateral spreading of the jet in a direction perpendicular to the plane containing the tabs. The excitation, on the other band, organized the azimuthal vorticity into coherent ring structures whose evolution and pairing also increased entrainment by the jet. In the tabbed case, the excitation produced coherent azimuthal structures that were distorted and asymmetric in shape. The self-induction of these structures produced an effect that opposed the tendency for the lateral spreading of the streamwise vortex pairs. The passage of the distorted vortices, and their pairing, also had a cancellation effect on the time-averaged streamwise vorticity field. These led to the reduction in jet spreading.
Author
Tabs (Control Surfaces); Turbulent Jets; Excitation; Flow Distribution; Thrust Vector Control

19990028250 NASA Lewis Research Center, Cleveland, OH USA
Inlet-Compressor Analysis Using Coupled CFD Codes
Cole, Gary, NASA Lewis Research Center, USA; Suresh, Ambady, DYNACS Engineering Co., Inc., USA; Townsend, Scott, DYNACS Engineering Co., Inc., USA; 1998; 6p; In English, 25-27 Aug. 1998, Brook Park, OH, USA; Sponsored by NASA Lewis Research Center, USA
Contract(s)/Grant(s): NAS3-98008; RTOP 509-10-11; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Propulsion performance and operability are key factors in the development of a successful aircraft. For high-speed supersonic aircraft, mixed-compression inlets offer high performance but are susceptible to an instability referred to as unstart. An unstart occurs when a disturbance originating in the atmosphere or the engine causes the shock system to be expelled from the inlet. This event can have adverse effects on control of the aircraft, which is unacceptable for a passenger plane such as the high speed civil transport (HSCT). The ability to predict the transient response of such inlets to flow perturbations is, therefore, important to the proper design of the inlet and the control measures used to prevent unstart. Computational fluid dynamics (CFD) is having an

increasing role in the analysis of individual propulsion components. isolated inlet studies are relatively easy to perform, but a major uncertainty is the boundary condition used at the inlet exit to represent the engine - the so-called compressor face boundary condition. A one-dimensional (I-D) Euler inlet simulation (ref. 1) showed that the predicted inlet unstart tolerance to free-stream pressure perturbations can vary by as much as a factor of about six, depending on the boundary condition used. Obviously, a thorough understanding of dynamic interactions between inlets and compressors/fans is required to provide the proper boundary condition.
Derived from text
Compressors; Computational Fluid Dynamics; Engine Inlets; Boundary Conditions; Supersonic Transports; Free Flow; Aircraft Control

19990028281 Department of Defense, Washington, DC USA
Emerging NDE Technology for aging aircraft
Moore, D. G., Department of Defense, USA; Perry, R. L., Department of Defense, USA; Mar. 31, 1998; 6p; In English, USA; Sponsored by American Society for Nondestructive Testing, Inc., USA
Report No.(s): DE98-003380; SAND-98-0726C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents an overview of several emerging nondestructive evaluation technologies that are being employed or considered for use to inspect commercial transport, commuter aircraft and military aircraft. An overview of the Federal Aviation Administration (FAA) Airworthiness Assurance NDI Validation Center (AANC) is described and how AANC teams with industry, universities, and other federal entities to assess these technologies.
NTIS
Nondestructive Tests; Transport Aircraft

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GEOSCIENCES

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

19990026876 NASA Ames Research Center, Moffett Field, CA USA
Tropospheric- Stratospheric Measurement Studies Summary, *1998-1999*
Browen, Stuart W., NASA Ames Research Center, USA; May 05, 1998; 99p; In English
Contract(s)/Grant(s): NCC2-211; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The two high altitude aircraft, ER-2 NASA #706 and 709 and the DC-8 NASA #717 are in active use in several programs of upper atmospheric research to study polar ozone changes, stratospheric-tropospheric exchange processes and atmospheric effects of aviation aircraft. The ER-2 has participated in seven major missions which mainly concentrated on vortex dynamics and the large losses of Ozone in the Polar regions (Ozone hole) observed in the spring. One mission verified the complex dynamical chemical and physical processes that occur during sunrise and sunset. Stratospheric Tracers of Atmospheric Transport (STRAT) obtained background measurements using the full ER-2 suite of instruments. Photochemistry of Ozone Loss in the Arctic Region in Summer (POLARIS) in 1997 assisted in understanding the mid-latitude and Arctic Ozone losses during the Northern Summer. The DC-8 with the Meteorological Measurement System (MMS) has participated in the Subsonic Aircraft: Cloud and Contrail Effects Special Study (SUCCESS), in 1996 and the Subsonic assessment Ozone and Nitrogen oxide experiment (SONEX) in 1997 missions. The MMS with its sophisticated software accurately measures ground speed and attitude, in-situ static and dynamic pressure total temperature, which are used to calculate the three dimensional wind fields, static pressure, temperature and turbulence values to meteorological accuracy. The meteorological data is not only of interest for its own sake in atmospheric dynamical processes such as mountain waves and flux measurements; but is also required by other ER-2 experiments that simultaneously measure water vapor, O_3, aerosols, NO, HCl, CH_4, N_2O, ClO, BrO, CO_2, NOy, HOx and temperature gradients. MMS products are extensively used to assist in the interpretation of their results in understanding the importance of convective effects relative to in-situ chemical changes, as may be noted by examining the list of references attached. The MMS consists of three subsystems: (a) aircraft instrumentation, inertial navigation system (INS), static and dynamic pressure taps, (b) additional dedicated instrumentation measuring angle of attack, yaw, total temperature, and a GPS which on the DC-8 measures position, velocity and attitude (c) an on board data, storage and computing acquisition system. This instrumentation and the associated software requires both an on-going laboratory ground calibration procedure for the total air temperature, static and total pressure inputs, verification of the INS dynamic response and also extensive air measurements and intercomparisons which ultimately verify and calibrate the complete system and its software. More than the usual accuracy is required because of the near cancellation occurring in the difference between the ground speed and true airspeed vectors used to give the wind vector. In the past year we have rede-

signed, recalibrated and used the MMS system on the NASA DC-8 that was previously used in the SUCCESS mission for the SONEX mission. Two papers were co-authored based on SUCCESS flights. Several reports and handouts were written for SONEX. Calibrations of the DC-8 pressure transducer temperature measuring thermistors was completed and an extensive analysis spanning several years of data files of the DC-8 Rosemount pressure transducer calibrations was done.
Derived from text
Calibrating; Troposphere; Stratosphere; Ozone Depletion; Meteorological Instruments; Aircraft Maneuvers; Meteorological Parameters; Pressure Sensors; Turbulence; Wind Direction

19990027430 NASA Langley Research Center, Hampton,VA USA
Air Force F-16 Aircraft Engine Aerosol Emissions Under Cruise Altitude Conditions
Anderson, Bruce E., NASA Langley Research Center, USA; Cofer, W. Randy, III, NASA Langley Research Center, USA; McDougal, David S., NASA Langley Research Center, USA; Mar. 1999; 58p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 538-08-12-01
Report No.(s): NASA/TM-1999-209102; L-17804; NAS 1.15:209102; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Selected results from the June 1997 Third Subsonic Assessment Near-Field Interactions Flight (SNIF-III) Experiment are documented. The primary objectives of the SNIF-III experiment were to determine the partitioning and abundance of sulfur species and to examine the formation and growth of aerosol particles in the exhaust of F-16 aircraft as a function of atmospheric and aircraft operating conditions and fuel sulfur concentration. This information is, in turn, being used to address questions regarding the fate of aircraft fuel sulfur impurities and to evaluate the potential of their oxidation products to perturb aerosol concentrations and surface areas in the upper troposphere. SNIF-III included participation of the Vermont and New Jersey Air National Guard F-16's as source aircraft and the Wallops Flight Facility T-39 Sabreliner as the sampling platform. F-16's were chosen as a source aircraft because they are powered by the modern F-100 Series 220 engine which is projected to be representative of future commercial aircraft engine technology. The T-39 instrument suite included sensors for measuring volatile and non-volatile condensation nuclei (CN), aerosol size distributions over the range from 0.1 to 3.0 (micro)m, 3-D winds, temperature, dewpoint, carbon dioxide (CO2), sulfur dioxide (SO2), sulfuric acid (H2SO4), and nitric acid (HNO3).
Derived from text
F-16 Aircraft; Aerosols; Aircraft Engines; Exhaust Emission; Commercial Aircraft; Exhaust Gases; Particle Emission; Flight Altitude

19990027626 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Aeroelastic tailoring in wind-turbine blade applications
Veers, P., Department of Energy, USA; Lobitz, D., Department of Energy, USA; Bir, G., Department of Energy, USA; Apr. 30, 1998; 15p; In English; Windpower '98, 1998, USA
Report No.(s): DE98-005540; SAND-98-1208C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper reviews issues related to the use of aeroelastic tailoring as a cost-effective, passive means to shape the power curve and reduce loads. Wind turbine blades bend and twist during operation, effectively altering the angle of attack, which in turn affects loads and energy production. There are blades now in use that have significant aeroelastic couplings, either on purpose or because of flexible and light-weight designs. Since aeroelastic effects are almost unavoidable in flexible blade designs, it may be desirable to tailor these effects to the authors advantage. Efforts have been directed at adding flexible devices to a blade, or blade tip, to passively regulate power (or speed) in high winds. It is also possible to build a small amount of desirable twisting into the load response of a blade with proper asymmetric fiber lay up in the blade skin. (Such coupling is akin to distributed (delta)(sub 3) without mechanical hinges.) The tailored twisting can create an aeroelastic effect that has payoff in either better power production or in vibration alleviation, or both. Several research efforts have addressed different parts of this issue. Research and development in the use of aeroelastic tailoring on helicopter rotors is reviewed. Potential energy gains as a function of twist coupling are reviewed. The effects of such coupling on rotor stability have been studied and are presented here. The ability to design in twist coupling with either stretching or bending loads is examined also.
NTIS
Wind Turbines; Aeroelasticity; Turbine Blades; Potential Energy; Loads (Forces); Blade Tips; Angle of Attack

19990027669 NASA Goddard Space Flight Center, Greenbelt, MD USA
On-Orbit Performance of the TRMM Mission Mode
Robertson, Brent, NASA Goddard Space Flight Center, USA; Placanica, Sam, NASA Goddard Space Flight Center, USA; Morgenstern, Wendy, NASA Goddard Space Flight Center, USA; Hashmall, Joseph A., Computer Sciences Corp., USA; Glickman,

Jonathan, Computer Sciences Corp., USA; Natanson, Gregory, Computer Sciences Corp., USA; 1999; 9p; In English; 14th; Space Flight Dynamics, 8 Feb. - Dec. 1999, Brazil; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents an overview of the Tropical Rainfall Measuring Mission (TRMM) Attitude Control System along with detailed in-flight performance results of the TRMM Mission mode. The TRMM spacecraft is an Earth-pointed, zero momentum bias satellite launched on November 27, 1997 from Tanegashima Space Center, Japan. TRMM is a joint mission between NASA and the National Space Development Agency of Japan designed to monitor and study tropical rainfall and the associated release of energy. Prior to calibration, the spacecraft attitude showed larger Sun sensor yaw updates than expected. This was traced to not just sensor misalignment but also to a misalignment between the two heads within each Sun sensor. In order to avoid alteration of the flight software, Sun sensor transfer function coefficients were determined to minimize the error due to head misalignment. This paper describes the design, on-orbit checkout, calibration and performance of the TRMM Mission Mode with respect to the mission level requirements.
Author
Attitude Control; Calibrating; Checkout; Flight Control; Yaw; Self Tests; Trmm Satellite; Spacecraft Control; Stationkeeping

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LIFE SCIENCES

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

19990027068 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Testing and Evaluation of the Stoeckert Shiley Multiflow Roller Pump Module, 10H Series, Model 10-10-00 *Final Report*
Jones, Allen E.; Dec. 15, 1998; 18p; In English
Contract(s)/Grant(s): Proj-R184
Report No.(s): AD-A359614; AFRL-HE-BR-TR-1998-0080; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Stockert-Shiley, Multiflow Roller Pump is a precision peristaltic pump. It is an integral component of the Neonatal/Pediatric ECMO Transport System. The roller pump is plugged into a series bladder box, then into a modified Tripplite Isobar, then into a Topaz uninterruptible power supply (UPS), then into 115 VAC/60 Hz aircraft power. The roller pump accommodates a wide range of flow rates using different tubing diameters together with the different size tubing inserts available for the monitor. The roller pump is capable of displaying both revolutions per minute (RPM) and flow rates in liters per minute (LPM). Only LPM's should be displayed during an aeromedical evacuation ECMO Transport. The roller pump is 46.6 cm (18.3 inches) D X 18 cm (7.1 inches) W X 28.7 cm (11.3 inches) H, and weighs 25.1 Kg (55 lbs).
DTIC
Pumps; Medical Equipment; Evacuating (Transportation); Air Transportation

19990027069 Army Aeromedical Research Lab., Fort Rucker, AL USA
Helmet-Mounted Displays and Facial Injury in U.S. Army AH-64A Apache Accidents *Final Report*
Crowley, John S.; Jan. 1999; 7p; In English
Contract(s)/Grant(s): Proj-3O162787A878
Report No.(s): AD-A359606; USAARL-99-03; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

There is concern that the helmet display unit (HDU) used by AH-64 Apache helicopter pilots might contribute to facial injury in a crash. The U.S. Army accident database was searched for HDU-related injuries in survivable Apache accidents 1985-1995. Four aviators in three crashes sustained HDU-related injury. These involved three periorbital contusions and two minor eye injuries. There were no sequalae. This equates to an incidence of 0.57 injured individuals per 100,000 flying hours or 8.0 injured aviators per 100 survivable Class A-C accidents in which the HDU was worn. Applying these data to the projected UK Army Apache flying hour programme suggests that one HDU-related injury might be encountered approximately every 10.1 years. This estimate should be interpreted with caution. Serious injury remains a possibility due to the proximity of the HDU to the eye and face.
DTIC
Helmet Mounted Displays; Accidents; Aircraft Pilots; AH-64 Helicopter; Crashes

19990027083 Institute for Human Factors TNO, Soesterberg, Netherlands
Effects of Three-Dimensional and Mono Auditory Information on Flight Performance *Final Report Het effect van drie-dimensional en mono geluidsinformatie op de vliegprestatie*
Veltman, J. A., Institute for Human Factors TNO, Netherlands; Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Oving, A. B., Institute for Human Factors TNO, Netherlands; Sep. 17, 1998; 20p; In English; Original contains color illustrations

Contract(s)/Grant(s): A97/KLu/308; TNO Proj. 788.1
Report No.(s): TD98-0262; TM-98-A052; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy, Microfiche

It is possible to present auditory information in ear phones in such a manner that the spatial position of the sound source appears to remain fixed in external space, irrespective of how the listener moves his or her head. In the present experiment it was investigated whether such a virtual spatial sound presentation in a cockpit has advantages over the traditional mono sound presentation. The experiment concerned auditory presentation of directional information, related to anti collision radar (TCAS) or to mechanical failures in either one of the two engines or wings. This information was presented in addition to the standard displays on which these warnings appeared. Subjects (student pilots) had to react to the warnings while flying a civil aeroplane in a flight simulator with a wide field outside image. The experiment was carried out in two flight conditions, differing with respect to visual load. The results showed that 3D warnings, added to already present visual warning messages, yielded faster reaction times in the more visually loaded flying conditions. The effects were not as obvious in error rates, in flying performance, or in measures of subjective task load. A follow up experiment is proposed in which the flying task is made more demanding and in which the visual display on which the mechanical failure warnings are presented is placed in a more peripheral position (as is the case in actual cockpits). It is expected that in such conditions advantages of 3D audio information presentation will become more pronounced.
Author
Display Devices; Three Dimensional Models; Flight Characteristics; Failure; Ear

19990027095 Institute for Human Factors TNO, Technische Menskunde, Soesterberg, Netherlands
Evaluation of the Clothing and Equipment of the Royal Netherlands Air Force ***Final Report Evaluatie PSU Koninklijke Luchtmacht***
Kistemaker, J. A., Institute for Human Factors TNO, Netherlands; Krul, A. J., Institute for Human Factors TNO, Netherlands; Heus, R., Institute for Human Factors TNO, Netherlands; Nov. 19, 1998; 65p; In Dutch
Contract(s)/Grant(s): A97/KLu/322; TNO Proj. 789.2
Report No.(s): TD98-0273; TM-98-A061; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

The Royal Netherlands Air Force and the TNO Human Factors Research Institute developed three questionnaires to evaluate the clothing and equipment of the Royal Netherlands Air Force and to make an inventory of new clothing needs. A representative part of the wearers filled in a questionnaire on location under the supervision of the Royal Netherlands Air Force. The questionnaires were obtained from December '97 until March '98. One questionnaire dealt with the Personal Clothing & Equipment 'blauw", one questionnaire dealt with the Personal Clothing & Equipment 'woodland' and one questionnaire dealt with the functional clothing. The persons were asked to choose the questionnaire that dealt most with the clothing they usually wear. The subjects had to rate usability, size and fit, functionality, quality and comfort of the clothing. The major results are: (1) the wearers showed a general positive opinion about their clothing and equipment; (2) there are several wishes that mainly refer to poor fit for women and poor comfort in the summer; (3) 7 articles show poor results and can be considered for discarding or complete redesign (f.i. underwear, hats); (4) 14 articles show poor results, but can be improved (f.i. important articles from the DT 'blauw" and the "woodland" clothing); and(5) 3 articles are reasonably good and 10 articles are good.
Author
Clothing; Evaluation; Armed Forces (Foreign); Aircraft Equipment

19990027096 Institute for Human Factors TNO, Research Inst., Soesterberg, Netherlands
Effect of Three-Dimensional and Mono Auditory Information on Performance in Cockpit Warning Tasks ***Interim Report Effecten van Drie-Dimensionaal en Mono Geluidsinformatie op de Prestatie ten Aanzien vanWaarschuwingen in de Cockpit***
Oving, A. B., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Sep. 21, 1998; 27p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KLu/307; TNO Proj. 788.1
Report No.(s): TD98-0264; TM-98-A054; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

The potential benefits of a three-dimensional (3D) auditory display in conveying directional information were investigated in a flight simulation experiment. The study was aimed at the application of 3D audio in the cockpit of civil aircraft. Participants were required to follow a specific flight path in a runway approach. Standard cockpit information was available on a set of visual displays, i.e., primary flight information, flight path and tracking information, traffic alert and collision avoidance information (TCAS) and on-board systems status information. In the experiment, additional auditory directional information was presented

for TCAS-warnings or for warnings of system failures in the aircraft. In case of a TCAS-warning, participants were required to identify the specific orientation of the target aircraft with respect to the outside world. In case of a failure warning, participants had to indicate the location of the failure in the aircraft itself. Warnings were always presented both aurally and visually. There were four conditions for the presentation of directional information in the aural warnings: mono-sound with or without verbal directional statements and 3D-sound with or without verbal directional statements. The verbal directional statements in the TCAS-warning referred to a specific quadrant of the outside world in the TCAS task (e.g., lower quadrant left) and to the specific side of the aircraft for system failures (e.g., left-hand or right-hand side). The 3D auditory display used a head-track ng device to make the external position of the source invariant under head movements. In all conditions, directional information for the warnings was presented on a visual display as well. Results showed that for the TCAS task and the failure task, addition of directional information (i.e., 3D-sound or verbal directional information) resulted in significantly reduced response times. The response times were shortest when both types of directional information were combined in the TCAS-warning. For the system failure task, only the differences between the response times in the mono-without condition and the three other conditions proved to be significant.
Author
Cockpits; Three Dimensional Models; Performance Prediction; Display Devices; Research; System Failures; Failure; Warning Systems

19990027735 Illinois Univ., Aviation Research Lab., Savoy, IL USA
Allocation of Attention with Head-Up Displays ***Final Report***
Wickens, C. D., Illinois Univ., USA; Ververs, P. M., Illinois Univ., USA; Nov. 1998; 22p; In English
Contract(s)/Grant(s): DTFA-95-G-049
Report No.(s): DOT/FAA/AM-98/28; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two experiments examined the effects of display location (head up vs. head down) and image intensity/clutter on flight path performance and mid-air target detection in a general aviation cruise flight environment. In Experiment 1, a low-Fidelity simulation, both near-domain and far-domain instrumentation were presented at the same optical distance. Detection of commanded flight changes and maintenance of desired flight path flight were generally better in the head-down condition, an advantage attributed to the superior image contrast ratios in that condition. In contrast, target detection was superior with the head-up display, reflecting an attentional tradeoff, Experiment 2 was performed with pilots viewing far-domain imagery (and airborne targets) on an Evans and Sutherland display positioned near optical infinity, head-up display (HUD) imagery at the same optical distance, and head-down imagery at a near distance typical of the instrument panel. The degree of clutter was also varied and image contrast ratios were equated between head-up and head-down viewing conditions. Flight performance was equivalent between the HUD and head-down locations. However, detection of both near-domain events (commanded changes) and far-domain targets was better in the HUD condition, revealing the HUD benefit of reduced scanning. Adding extra information (clutter) to the HUD inhibited detection of both events in both head-up and head-down locations. However, this clutter cost was diminished for far-domain target detection if the added information was "low-lighted." Flight performance was superior in clear weather, when the true horizon was available for viewing. The data provided little evidence that attention was modulated in depth (near vs. far domains), but rather suggested that attention was modulated between tasks (flight control and detection).
Author
Attention; Head-Up Displays; Target Acquisition; Flight Instruments; Human Factors Engineering; Pilot Performance

19990027921 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
Alternative Control Technologies ***Technologies de Controle Non Conventionnelles***
Hudgins, Bernard, New Brunswick Univ., Canada; Leger, Alain, Sextant Avionique, France; Dauchy, Pierre, Institut de Medicine Aerospatiale Armee, France; Pastor, Dominique, Sextant Avionique, France; Pongratz, Hans, Flugmedizinisches Inst. der Luftwaffe, Germany; Rood, Graham, Defence Evaluation Research Agency, UK; South, Alan, Defence Evaluation Research Agency, UK; Carr, Karen, British Aerospace Public Ltd. Co., UK; Jarrett, Don, Defence Evaluation Research Agency, UK; McMillan, Grant, Armstrong Lab., USA; Anderson, Timothy, Armstrong Lab., USA; Borah, Joshua, Applied Science Labs., USA; December 1998; 148p; In English
Report No.(s): RTO-TR-7; AC/323(HFM)TP/3; ISBN 92-837-1009-6; Copyright Waived; Avail: CASI; A07, Hardcopy; A02, Microfiche

In January 1996, the Working Group 25 of the former AGARD Aerospace Medical Panel began to evaluate the potential of alternative (new and emerging) control technologies for future aerospace systems. The present report summarizes the findings of this group. Through different chapters, the various human factors issues related to the introduction of alternative control

technologies into military cockpits are reviewed, in conjunction with more technical considerations of the state of the art of the enabling technologies. Cockpit integration issues are emphasized in regard to both human factors and engineering constraints. Several specific applications of these new technologies in the aerospace environment are considered. Challenges for further developments are identified and recommendations issued. Globally, based upon operational considerations and currently recognized limitations of the Hands on Throttle and Stick (HOTAS) concept, the conclusion is that Alternative Control Technology should now be progressively introduced into the cockpit, as a function of degree of maturity of the various techniques.
Author
Aerospace Environments; Aerospace Systems; Cockpits; Human Factors Engineering; Aircraft Instruments; Adaptive Control; Automatic Flight Control; Artificial Intelligence; Fighter Aircraft; Tracking (Position); Pilots (Personnel); Human-Computer Interface

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.

19990026992 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
Intelligent Agent Feasibility Study Volume 2:, Volume 2, Aircraft Mission Capable Parts (MICAP) Process *Final Report, Nov. 1997 - Feb. 1998*
Vincent, Patrick J.; Tenney, Yvette J.; Feb. 1998; 36p; In English; Prepared in collaboration with Analytic Sciences Corp., Fairborn, OH. ADA359612
Contract(s)/Grant(s): F41624-97-D-5002; AF Proj. 1710
Report No.(s): AD-A359613; BBN-8216-Vol-2; AFRL-HE-WP-TR-1998-0007-Vol-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research on software agents and agent-based systems has now been underway for more than twenty years. Within the last few years interest in agents and agent-based systems has spread to include the active involvement of the broader commercial software community. In Volume 1 of this study we traced these developments in the academic, commercial, and government arenas. In this volume, Volume 2, we provide an examination of the Mission Capable Parts (MICAP) maintenance process as it is conducted today and outline recommendations for employing agent-based system capabilities to improve the process in the future.
DTIC
Software Engineering; Aircraft Maintenance; Distributed Processing; Object-Oriented Programming

19990027151 Science Applications International Corp., Albuquerque, NM USA
Air-to-Air Missile T and E Using Live Aircraft Linked to a Missile HWIL Simulation
McKee, Larry; Jan. 1998; 7p; In English
Report No.(s): AD-A359504; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Live Fly Phase (LFP) of the Systems Integration Test (SIT) was executed by the Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) and the 46th Test Wing at Eglin AFB, FL during 1997. The purpose of the SIT was to evaluate the utility of using advanced distributed simulations (ADS) to support cost-effective testing of an integrated missile weapon/launch aircraft system in an operationally realistic scenario. The SIT missions simulated a single shooter aircraft launching an air-to-air missile against a single target aircraft. In the LFP, the shooter and target were represented by live aircraft and the missile by a simulator. ADS techniques were used to link two live F-16 fighter aircraft flying over the Eglin Gulf Test Range to the Advanced Medium Range Air-to-Air Missile (AMRAAM) AIM-120 hardware-in-the-loop (HWIL) simulation facility at Eglin. This configuration had both DT and OT characteristics. There was a DT flavor because an HWIL facility was used to simulate the missile. This allowed the detailed performance of missile subsystems to be monitored, typical of a DT test. The OT characteristics of the LFP resulted from the use of aircraft performing operationally realistic engagements. Two baseline scenarios were selected from the AMRAAM FOT&E(2) live fire test series and modified for replication in the LFP trials. There were four major test objectives of the LFP: (1) Assess the validity of AMRAAM data generated in the LFP ADS configuration. (2) Assess the ability of the LFP ADS configuration to perform AMRAAM testing. (3) Assess the ability to link live aircraft to a missile HWIL simulation. (4) Evaluate the ability of the LFP ADS configuration to support distributed missile testing. This paper describes the LFP testing that

was conducted during 1997, presents the results from evaluating the test objectives, and summarizes the utility of the LFP ADS configuration for air-to-air missile T&E.
DTIC
Air to Air Missiles; F-16 Aircraft; Missile Systems; Hardware-In-The-Loop Simulation

19990027514 British Aerospace Aircraft Group, Military Aircraft and Aerostructures, Warton, UK
FRONTIER: Open System for Collaborative Design Using Pareto Frontiers
Spicer, Dave, British Aerospace Aircraft Group, UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 6.1 - 6.10; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

FRONTIER is an ESPIRIT IV project on design optimization. It addresses problems which are both multidisciplinary and multiobjective. As industrial optimization moves from being applied to particular systems or structures towards addressing the total scope of a design, there is a need for capability to express and deal with tradeoffs of conflicting objectives which measure a design's merit in a number of business senses. There is a need for : (1) a structured set of business metrics; (2) an organization which is adapted to address shared responsibilities for design choices across disciplines and companies where necessary; and (3) design evaluation tools to address all, not just some of these metrics. This paper outlines the Frontier capability and then goes on to consider the metrics, organization and design evaluation aspects of its use in military aircraft design.
Author (revised)
Aircraft Design; Design Analysis; Systems Engineering; Computer Aided Design; Genetic Algorithms; Multidisciplinary Design Optimization

19990027562 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
The Air Operations Simulation Centre Audio System
Worl, Reg, Defence Science and Technology Organisation, Australia; Apr. 1998; 37p; In English
Report No.(s): DSTO-GS-0172; DODA-AR-010-512; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The Air Operations Division at the Aeronautical and Maritime Research Laboratory has established the Air Operations Simulation Centre for conduct of manned aircraft flight simulations. An audio system has been developed to deliver sound effects during simulations and to provide audio communications between manned stations. This report describes the hardware and software components of the audio system.
Author
Flight Simulation; Stations; Audio Equipment

19990027618 NASA Lewis Research Center, Cleveland, OH USA
Development of a Multi-Disciplinary Computing Environment (MDICE)
Kingsley, Gerry, CFD Research Corp., USA; Siegel, John M., Jr., CFD Research Corp., USA; Harrand, Vincent J., CFD Research Corp., USA; Lawrence, Charles, NASA Lewis Research Center, USA; Luker, Joel J., Air Force Research Lab., USA; 1998; 12p; In English, 2-4 Sep. 1998, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-27751; RTOP 509-10-31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The growing need for and importance of multi-component and multi-disciplinary engineering analysis has been understood for many years. For many applications, loose (or semi-implicit) coupling is optimal, and allows the use of various legacy codes without requiring major modifications. For this purpose, CFDRC and NASA LeRC have developed a computational environment to enable coupling between various flow analysis codes at several levels of fidelity. This has been referred to as the Visual Computing Environment (VCE), and is being successfully applied to the analysis of several aircraft engine components. Recently, CFDRC and AFRL/VAAC (WL) have extended the framework and scope of VCE to enable complex multi-disciplinary simulations. The chosen initial focus is on aeroelastic aircraft applications. The developed software is referred to as MDICE-AE, an extensible system suitable for integration of several engineering analysis disciplines. This paper describes the methodology, basic architecture, chosen software technologies, salient library modules, and the current status of and plans for MDICE. A fluid-structure interaction application is described in a separate companion paper.
Author
Architecture (Computers); Software Engineering; Aeroelasticity; Simulation

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PHYSICS

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

19990027524 Italian Aerospace Research Center, C.I.R.A. S.c.p.A., Capua, Italy
Number and Placement Optimisation of Active Devices in a Noise Active Control System
Concilio, A., Italian Aerospace Research Center, Italy; DeVivo, L., Italian Aerospace Research Center, Italy; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 17.1 - 17.12; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Active sound control systems have been recently used, aimed at noise suppression inside turboprop aircraft. The final aim is to substitute or integrate the classical passive methods, inside a novel design philosophy able to consider the problems related to noise aspects, especially the design to noise approach. Recent studies have demonstrated the non-direct correlation between the vibration and the sound field. As a consequence a system referring to sound figures and structural actuators, should be implemented according to the well-known Acoustostructural active control strategy (ASAC). Acoustic fields may be taken into account as suggested by the Control of sound by vibration suppression (CONVIS) approach. Whatever is the method, the performance of the active control arrangement is strictly related to the placement of the selected actuators and sensors. The work presented deals with a multi-tonal attenuation problem in a typical bare propeller aircraft fuselage: three different frequencies, corresponding to the Blade Passage Frequencies and its first two harmonics; a two-dimensional Finite Element representation of the fuselage section has been investigated. A standard feed forward non-adaptive algorithm is used. Piezoceramic actuators and microphones are implemented as active devices. The best placement of both the actuators and the sensors is derived by means of GENALG a numerical code, genetic algorithm based program. Its peculiarities and ability in solving the optimization problem for a very high number of discrete possible solutions, leads to the possibility of performing a parametric analysis aimed at pointing out the best number of both actuators and sensors.
Author
Acoustics; Active Control; Finite Element Method; Genetic Algorithms; Noise Reduction; Propellers; Turboprop Aircraft; Aerodynamic Noise; Computer Aided Design; Optimization

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