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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Indexes

Two indexes are available. You may use the **Find** command under the **Tools** menu while viewing the PDF file for direct match searching on any text string. You may also view the indexes provided, for searching on *NASA Thesaurus* subject terms and author names.

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Select **Appendix** for important information about NASA Scientific and Technical Information (STI) Office products and services, including registration with the NASA Center for AeroSpace Information (CASI) for access to the NASA CASI TRS (Technical Report Server), and availability and pricing information for cited documents.

Typical Report Citation and Abstract

DOCUMENT ID NUMBER → **19960021053** NASA Langley Research Center, Hampton, VA USA. ← **CORPORATE SOURCE**

TITLE → **An Extended Compact Tension Specimen for Fatigue Crack Propagation and Fracture**

AUTHORS → Piascik, R. S., NASA Langley Research Center, USA; Newman, J. C., Jr., NASA Langley Research Center, USA; ← **AUTHORS' AFFILIATION**

PUBLICATION DATE → Mar. 1996, pp. 16; In English

CONTRACTS/GRANTS → Contract(s)/Grant(s): RTOP 538–02–10–01

REPORT NO.(S) → Report No.(s): NASA–TM–110243; NAS 1.15:110243; No Copyright; Avail: CASI A03, Hardcopy; A01, Microfiche ← **AVAILABILITY AND PRICE CODE**

ABSTRACT → An extended compact tension specimen, EC(T) has been developed for fatigue and fracture testing. Documented herein are stress-intensity factor and compliance expressions for the EC(T) specimen.

ABSTRACT AUTHOR → Author

SUBJECT TERMS → *Crack Propagation; Stress Intensity Factors; Fatigue (Materials)*

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 336)

NOVEMBER 1996

01
AERONAUTICS

19960038436 Institute for Human Factors TNO, Soesterberg, Netherlands

Aircraft engine maintenance F-16: Task and course design analysis ***Vliegtuigmotoronderhoud F-16: Taak- en opleidingsanalyse***

Schaafstal, A. M., Institute for Human Factors TNO, Netherlands; VanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Apr. 23, 1996; 25p; In Dutch

Contract(s)/Grant(s): A95/KLu/368

Report No.(s): RP 96-0153; TM-96-A019; Copyright; Avail: Issuing Activity (Technische Menskunde, Soesterberg,Netherlands), Hardcopy, Microfiche

The maintenance of the F-16 aircraft's engine warrants a specific training course. This study considers the current curriculum at the Royal Netherlands Airforce Electronics and Technical School and proposes a new and improved course design that makes up for the out-dated and non-existant instructional topics with regards to this engine.

CASI

Aircraft Engines; F-16 Aircraft; Aircraft Maintenance

19960041413 NASA Lewis Research Center, Cleveland, OH USA

Research and Technology 1995

Mar. 1996; 184p; In English

Report No.(s): NASA-TM-107111; NAS 1.15:107111; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report selectively summarizes the NASA Lewis Research Center's research and technology accomplishments for fiscal year 1995. It comprises over 150 short articles submitted by the staff members of the technical directorates. The report is organized into six major sections: aeronautics, aerospace technology, space flight systems, engineering support, Lewis Research Academy, and technology transfer. A table of contents, an author index, and a list of NASA Headquarters program offices have been included to assist the reader in finding articles of special interest. This report is not intended to be a comprehensive summary of all research and technology work done over the past fiscal year. Most of the work is reported in Lewis-published technical reports, journal articles, and presentations prepared by Lewis staff members and contractors (for abstracts of these Lewis-authored reports, visit the Lewis Technical Report Server (LETRS) on the World Wide Web-http://letrs.lerc.nasa.gov/LeTRS/). In addition, university grants have enabled faculty members and graduate students to engage in sponsored research that is reported at technical meetings or in journal articles. For each article in this report, a Lewis contact person has been identified, and where possible, reference documents are listed so that additional information can be easily obtained. The diversity of topics attests to the breadth of research and technology being pursued and to the skill mix of the staff that makes it possible. For more information about Lewis' research, visit us on the World Wide web-http://www.lerc.nasa.gov.

Author

Technology Transfer; Aerospace Engineering; Aerospace Sciences; Space Power Unit Reactors; Propulsion System Configurations; Research Facilities; Systems Engineering; Spaceborne Experiments; Fluid Mechanics; NASA Programs

19960045215 Galaxy Scientific Corp., Atlanta, GA USA

Human factors in aviation maintenance, Phase 5 ***Progress Report, Apr. 1994 - Mar. 1995***

Shepherd, William T., Galaxy Scientific Corp., USA; Jan. 1996; 285p; In English

Contract(s)/Grant(s): DTFA01-94-C-01013

Report No.(s): AD-A304585; DOT/FAA/AM-96/2; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The fifth phase of research on human factors in aviation maintenance continued to look at the human's role in the aviation maintenance system via investigations, demonstrations, and evaluations of the research program outputs. This report describes the following areas: (Ch. 2) PENS mobile computing software for FAA inspectors; (Ch. 3) STAR computer-based training for aviation regulations; (Ch. 4) HIS digital documentation systems, a hypertext multimedia software system; (Ch. 5) software/hardware distribution on the Internet; (Ch. 6) human factors program reviewing human performance issues associated with inspection; (Ch. 7) human factors audit program providing a valid tool for evaluating human factors in maintenance tasks; (Ch. 8) a study of how the design of workcards affects their use and the subsequent po-

tential for error; (Ch. 9) the process of visual inspection and evaluation measuring visual inspection performance; (Ch. 10) a battery of mechanical aptitude tests, a simulated NDI task, and the ability of the tests to predict performance; (Ch. 11) the results of a report on an evaluation of a teamwork training program in a FAR 147 school; and (Ch. 12) ARAC rule changes and impending rule changes.
DTIC
Computer Programs; Computer Techniques; Digital Systems; Electric Batteries; Human Factors Engineering; Psychological Tests; Training Evaluation

02
AERODYNAMICS

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

19960034382 National Renewable Energy Lab., Golden, CO USA
Effects of surface roughness and vortex generators on the NACA 4415 airfoil
Reuss, R. L., Ohio State Univ., USA; Hoffman, M. J., Ohio State Univ., USA; Gregorek, G. M., Ohio State Univ., USA; Dec. 1995; 106p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/TP-442-6472; DE96-000494; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Wind turbines in the field can be subjected to many and varying wind conditions, including high winds with rotor locked or with yaw excursions. In some cases the rotor blades may be subjected to unusually large angles of attack that possibly result in unexpected loads and deflections. to better understand loadings at unusual angles of attack, a wind tunnel test was performed. An 18-inch constant chord model of the NACA 4415 airfoil section was tested under two dimensional steady state conditions in the Ohio State University Aeronautical and Astronautical Research Laboratory (OSU/AARL) 7 x 10 Subsonic Wind Tunnel (7 x 10). The objective of these tests was to document section lift and moment characteristics under various model and air flow conditions. These included a normal angle of attack range of (minus)20(degree) to +40(degree), an extended angle of attack range of (minus)60(degree) to +230(degree), applications of leading edge grit roughness (LEGR), and use of vortex generators (VGs), all at chord Reynolds numbers as high as possible for the particular model configuration. to realistically satisfy these conditions the 7 x 10 offered a tunnel-height-to-model-chord ratio of 6.7, suggesting low interference effects even at the relatively high lift and drag conditions expected during the test. Significantly, it also provided chord Reynolds numbers up to 2.0 million.
DOE
Wind Tunnel Tests; Angle of Attack; Rotor Blades (Turbomachinery); Wind Turbines; Vortex Generators; Surface Roughness Effects; Grit; Leading Edges; Subsonic Wind Tunnels; Airfoils

19960036910 Flow Solutions Ltd., Bristol, UK
Directionality of Helicopter Noise and Its Exploitation ***Final Report, Aug. 1994 - Dec. 1995***
Lowson, Martin V., Flow Solutions Ltd., UK; Jan. 1996; 33p; In English
Contract(s)/Grant(s): N68171-94-C-9140
Report No.(s): AD-A304104; Rept-96-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work during the present contract has shown that helicopter BVI noise will have local region of focused propagation in which the decay rate is less than inverse square. This finding has significant consequences for helicopter detection. Instantaneous maximums in helicopter noise during flyby are frequently observed. These have normally been ascribed to non-uniform aerodynamic effects at the rotor. The present model shows that such peaks are a result of the detailed geometry and kinematics of the blade vortex interaction, and a fundamental feature the associated acoustic propagation. The model gives both a prediction of where the peaks will occur at any flight condition, and of the region of the rotor disc where the most acoustically important interactions are caused. The model also allows a search for flight conditions under which noise from rotor BVI will be minimized. The work has been summarized in a report presented to the European Rotorcraft forum, and a paper to be published in the Journal of Sound and Vibration. An extended version of the paper to be presented in the Journal of Sound Vibration, with the key diagrams in color, is attached.
DTIC
Blade-Vortex Interaction; Helicopters; Noise Propagation; Blade Slap Noise

19960038259 Clemson Univ., South Carolina Energy Research and Development Center., SC USA
Advanced multistage turbine blade aerodynamics, performance, cooling, and heat transfer
Fleeter, S., Purdue Univ., USA; Lawless, P. B., Purdue Univ., USA; 1995; 11p; In English; Advanced Turbine Systems (ATS) Annual Program Review, 17-18 Oct. 1995, Morgantown, WV, USA; Sponsored by Department of Energy, USA
Contract(s)/Grant(s): DE-FC21-92MC-29061; 94-01-SR019
Report No.(s): DOE/MC/29061-96/C0666; CONF- 9510109-34; DE96-008943; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The gas turbine has the potential for power production at the highest possible efficiency. The challenge is to ensure that gas turbines operate at the optimum efficiency so as to use the least fuel and produce minimum emissions. A key component to meeting this challenge is the turbine. Turbine performance,

both aerodynamics and heat transfer, is one of the barrier advanced gas turbine development technologies. This is a result of the complex, highly three-dimensional and unsteady flow phenomena in the turbine. Improved turbine aerodynamic performance has been achieved with three-dimensional highly-loaded airfoil designs, accomplished utilizing Euler or Navier-Stokes Computational Fluid Dynamics (CFD) codes. These design codes consider steady flow through isolated blade rows. Thus they do not account for unsteady flow effects. However, unsteady flow effects have a significant impact on performance. Also, CFD codes predict the complete flow field. The experimental verification of these codes has traditionally been accomplished with point data - not corresponding plane field measurements. Thus, although advanced CFD predictions of the highly complex and three-dimensional turbine flow fields are available, corresponding data are not. to improve the design capability for high temperature turbines, a detailed understanding of the highly unsteady and three-dimensional flow through multi-stage turbines is necessary. Thus, unique data are required which quantify the unsteady three-dimensional flow through multi-stage turbine blade rows, including the effect of the film coolant flow. Also, as design CFD codes do not account for unsteady flow effects, the next logical challenge and the current thrust in CFD code development is multiple-stage analyses that account for the interactions between neighboring blade rows. Again, to verify and or direct the development of these advanced codes, complete three-dimensional unsteady flow field data are needed.
DOE

Turbine Blades; Unsteady Flow; Steady Flow; Three Dimensional Flow; Navier-Stokes Equation; Gas Turbines; Aerodynamic Characteristics; Aerodynamic Coefficients; Cooling

19960038443 NASA Dryden Flight Research Center, Edwards, CA USA

Wind-tunnel development of an SR-71 aerospike rocket flight test configuration

Smith, Stephen C., National Aeronautics and Space Administration. Ames Research Center, USA; Shirakata, Norm, Lockheed Martin Corp., USA; Moes, Timothy R., NASA Dryden Flight Research Center, USA; Cobleigh, Brent R., NASA Dryden Flight Research Center, USA; Conners, Timothy H., NASA Dryden Flight Research Center, USA; Jun. 1996; 32p; In English

Contract(s)/Grant(s): RTOP 505-68-52

Report No.(s): NASA-TM-4749; NAS 1.15:4749; H-2108; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A flight experiment has been proposed to investigate the performance of an aerospike rocket motor installed in a lifting body configuration. An SR-71 airplane would be used to carry the aerospike configuration to the desired flight test conditions. Wind-tunnel tests were completed on a 4-percent scale SR-71 airplane with the aerospike pod mounted in various locations on the upper fuselage. Testing was accomplished using sting and blade mounts from Mach 0.6 to Mach 3.2. Initial test objectives included assessing transonic drag and supersonic lateral-directional stability and control. During these tests, flight simulations were run with wind-tunnel data to assess the acceptability of the configurations. Early testing demonstrated that the initial configuration with the aerospike pod near the SR-71 center of gravity was unsuitable because of large nosedown pitching moments at transonic speeds. The excessive trim drag resulting from accommodating this pitching moment far exceeded the excess thrust capability of the airplane. Wind-tunnel testing continued in an attempt to find a configuration suitable for flight test. Multiple configurations were tested. Results indicate that an aft-mounted model configuration possessed acceptable performance, stability, and control characteristics.
Author

Flight Tests; Afterbodies; Lateral Stability; Lifting Bodies; Mounting; Pitching Moments; Rocket Engines; Rocket Flight; SR-71 Aircraft; Wind Tunnels

19960038697 Naval Postgraduate School, Monterey, CA USA

Evaluation of the NASA-Ames Panel Method (PMARC) for Aerodynamic Missile Design

Lambert, Mark A., Naval Postgraduate School, USA; Sep. 1995; 85p; In English

Report No.(s): AD-A304927; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The NASA Ames Research Center developed panel code (PMARC) is investigated to explore its suitability for aerodynamic missile design. to this end, PMARC is first assessed by applying it to several problems for which other solutions and experimental data are available, i.e., steady flow past a wing-body configuration, delta wings, biplane wings, wings in ground effect, and unsteady flow of pitching and impulsively started wings. Good agreement is found in all cases. PMARC is then applied to two missile configurations. Again, encouraging agreement with available experimental data is found provided the wake shedding from the missile body is modeled properly.
DTIC

Aerodynamic Configurations; Missile Configurations; Body-Wing Configurations; Missile Bodies; Wakes; Panel Method (Fluid Dynamics); Aerodynamic Coefficients; Missile Design

19960039925 NASA Langley Research Center, Hampton, VA USA

Assessment of dual-point drag reduction for an executive-jet modified airfoil section

Allison, Dennis O., NASA Langley Research Center, USA; Mineck, Raymond E., NASA Langley Research Center, USA; Jul. 1996; 124p; In English

Contract(s)/Grant(s): RTOP 505-59-10-30

Report No.(s): NASA-TP-3579; NAS 1.60:3579; L-17500; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This paper presents aerodynamic characteristics and pressure distributions for an executive-jet modified airfoil and discusses drag reduction relative to a baseline airfoil for two cruise design points. A modified airfoil was tested in the adaptive-wall test section of the NASA Langley 0.3-Meter Transonic Cryogenic Tunnel (0.3-m TCT) for Mach numbers ranging from 0.250 to 0.780 and chord Reynolds numbers ranging from 3.0 x 10(exp 6) to 18.0 x 10(exp 6). The angle of attack was varied from minus 2 degrees to almost 10 degrees. Boundary-layer transition was fixed at 5 percent of chord on both the upper and lower surfaces of the model for most of the test. The two design Mach numbers were 0.654 and 0.735, chord Reynolds numbers were 4.5 x 10(exp 6) and 8.9 x 10(exp 6), and normal-force coefficients were 0.98 and 0.51. Test data are presented graphically as integrated force and moment coefficients and chordwise pressure distributions. The maximum normal-force coefficient decreases with increasing Mach number. At a constant normal-force coefficient in the linear region, as Mach number increases an increase occurs in the slope of normal-force coefficient versus angle of attack, negative pitching-moment coefficient, and drag coefficient. With increasing Reynolds number at a constant normal-force coefficient, the pitching-moment coefficient becomes more negative and the drag coefficient decreases. The pressure distributions reveal that when present, separation begins at the trailing edge as angle of attack is increased. The modified airfoil, which is designed with pitching moment and geometric constraints relative to the baseline airfoil, achieved drag reductions for both design points (12 and 22 counts). The drag reductions are associated with stronger suction pressures in the first 10 percent of the upper surface and weakened shock waves.

Author

Airfoil Profiles; Angle of Attack; Boundary Layer Transition; Drag Reduction; Force Distribution; Pitching Moments; Reynolds Number; Trailing Edges; Transonic Wind Tunnels; Aerodynamic Characteristics

19960039937 Tokyo Univ., Sagamihara, Japan

Adaptive balloon azimuth control using a simple DC motor actuator

Matko, Drago, Tokyo Univ., Japan; Yajima, Nobuyuki, Tokyo Univ., Japan; Hinada, Motoki, Tokyo Univ., Japan; Mar. 1996; ISSN 0285-6808; 58p; In English

Report No.(s): Report No. 665; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A control system for the azimuth control of the balloon gondola using a simple actuator (motor and coupling ring) is presented. Three mathematical models of the system are reviewed first. Classical continuous time compensators and robust optimal continuous time and discrete time controllers are designed and compared in frequency and time domain. The rejection of typical disturbances (a ramp type disturbance due to the turning of the entire balloon and a sinusoidal disturbance due to the pendulum motion of the suspended gondola) is investigated by simulations. A feedforward velocity controller applicable in scanning missions and a feedforward position controller for large changes of the azimuth are designed and tested by simulations. A selftuning procedure for the automatic adjustment of the parameters of the controller to the dominant dynamic characteristics of the gondola is given. Finally a comparison between the adaptive notch filter and adaptive Butterworth low pass filter with respect to the elimination of instabilities of pendulum motion around a horizontal axis is presented. The performances of the selftuning and adaptive algorithms are proven by simulations.

Author

Gondolas; Controllers; Mathematical Models; Actuators; Azimuth; Feedforward Control; Control Systems Design

19960041793

Analytical solutions for the actuator disk with variable radial distribution of load

Conway, John T., Agder Coll, Norway; Journal of Fluid Mechanics; August 25 1995; ISSN 0022-1120, pp. 327-355; In English; Copyright; Avail: Issuing Activity

An analytical method somewhat analogous to finite wing theory has been developed which enables the flow induced by a linearized propeller actuator disk with variable radial distribution of load to be solved in closed form for the first time. Analytical solutions are given for various load distributions including the case of an arbitrary polynomial loading. As in finite wing theory, the case of elliptic loading is exceptionally simple and the induced velocities and stream function are simple expressions of elementary functions. Results are also given for a practical propeller load distribution with finite hub. The method can also be used to solve a wide range of analogous electromagnetic problems.

Author (EI)

Actuator Disks; Actuators; Electromagnetic Fields; Fluid Mechanics; Loads (Forces); Numerical Analysis; Radial Distribution; Rotating Disks; Velocity Distribution

19960042525 United Technologies Research Center, East Hartford, CT USA

A Three-Dimensional Linearized Unsteady Euler Analysis for Turbomachinery Blade Rows *Final Report*

Montgomery, Matthew D., United Technologies Research Center, USA; Verdon, Joseph M., United Technologies Research Center, USA; Jun.1996; 40p; In English

Contract(s)/Grant(s): NAS3-25425; RTOP 505-62-10

Report No.(s): NASA-CR-198494; NAS 1.26-198494; E-10299; R95-5.101.0003-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A three-dimensional, linearized, Euler analysis is being developed to provide an efficient unsteady aerodynamic analysis that can be used to predict the aeroelastic and aeroacoustic response characteristics of axial-flow turbomachinery blading. The field equations and boundary conditions needed to describe nonlinear and linearized inviscid unsteady flows through a blade row operating within a cylindrical annular duct are presented. In addition, a numerical model for linearized inviscid unsteady flow, which is based upon an existing nonlinear, implicit, wave-split, finite volume analysis, is described. These aerodynamic and numerical models have been implemented into an unsteady flow code, called LINFLUX. A preliminary version of the LINFLUX code is applied herein to selected, benchmark three-dimensional, subsonic, unsteady flows, to illustrate its current capabilities and to uncover existing problems and deficiencies. The numerical results indicate that good progress has been made toward developing a reliable and useful three-dimensional prediction capability. However, some problems, associated with the implementation of an unsteady displacement field and numerical errors near solid boundaries, still exist. Also, accurate far-field conditions must be incorporated into the FINFLUX analysis, so that this analysis can be applied to unsteady flows driven be external aerodynamic excitations.
Author
Three Dimensional Models; Unsteady Flow; Turbomachine Blades

19960042762 NASA Langley Research Center, Hampton, VA USA
An approach to the constrained design of natural laminar flow airfoils
Green, Bradford Earl, George washington Univ., USA; Jul. 1995; 116p; In English
Report No.(s): NASA-TM-111860; NAS 1.15:111860; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A design method has been developed by which an airfoil with a substantial amount of natural laminar flow can be designed, while maintaining other aerodynamic and geometric constraints. After obtaining the initial airfoil's pressure distribution at the design lift coefficient using an Euler solver coupled with an integml turbulent boundary layer method, the calculations from a laminar boundary layer solver are used by a stability analysis code to obtain estimates of the transition location (using N-Factors) for the starting airfoil. A new design method then calculates a target pressure distribution that will increase the larninar flow toward the desired amounl An airfoil design method is then iteratively used to design an airfoil that possesses that target pressure distribution. The new airfoil's boundary layer stability characteristics are determined, and this iterative process continues until an airfoil is designed that meets the laminar flow requirement and as many of the other constraints as possible.
Author
Aerodynamic Coefficients; Laminar Boundary Layer; Pressure Distribution; Turbulent Boundary Layer; Laminar Flow Airfoils; Boundary Layer Stability; Lift

19960043055 NASA Lewis Research Center, Cleveland, OH, USA
Inlet acoustic mode measurements using a continuously rotating rake
Heidelberg, Laurence J., NASA Lewis Research Cent, USA; Hall, David G., NASA Lewis Research Center, USA; Journal of Aircraft; July 1995; ISSN 0021-8669; vol. 32, no. 4 pp.761-767; In English; Copyright; Avail: Issuing Activity

Comprehensive measurements of the spinning acoustic mode structure in the inlet of the advanced ducted propeller were obtained using a unique method that was first proposed by Sofrin. A continuously rotating microphone system was employed. Three inlet configurations with cut-on as well as cut-off stator vane sets were tested. The cut-off stator was designed to suppress all modes at the blade passing frequency. Rotating rake measurements indicate that several extraneous circumferential modes, possibly due to the interaction between the rotor and small interruptions in the casing tip treatment, were present. The cut-on stator produced the expected circumferential modes plus higher levels of the unexpected modes seen with the cut-off stator.
Author (EI)
Acoustic Measurement; Intake Systems; Microphones; Propellers; Shrouded Propellers; Stators

19960044388 National Aerospace Lab., Tokyo, Japan
Application and Role of Numerical Simulation of Hypersonic Flow for the Development of HOPE (H-2 Orbiting Plane)
Yamamoto, Yukimitsu, National Aerospace Lab., Japan; Wada, Yashuhiro, National Aerospace Lab., Japan; Yoshioka, Minako, Fujitsu Ltd., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 17-22; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A numerical study of hypersonic flow around HOPE (H-2 orbiting plane) is performed using flux split and flux difference splitting upwind total variation diminishing (TVD) Navier-Stokes codes. New parametric computations are made to determine the basic configuration from two types of HOPE candidate geometry designs. One is the double delta type model (DD model) and the other is the power delta type (PD model). Also, in order to investigate real gas effects, numerical calculations corresponding to the flow conditions of high enthalpy wind tunnels of DLR, HEG, anc Caltech T-5 are made. In addition, hypersonic perfect gas flow calculations are made for comparison with experimental data of the AEDC and ONERA S4MA hypersonic wind tunnel and Calspan's

shock tunnel. Through the preset numerical analysis, detailed aerodynamic and aerothermodynamic characteristics of HOPE are investigated. These works have been done as joint research between the National Aerospace Laboratory (NAL) and the National Aerospace Development Agency (NASDA).
Author
Enthalpy; Computational Fluid Dynamics; Hypersonic Wind Tunnels; Wind Tunnel Tests; Navier-Stokes Equation; Shock Tunnels; TVD Schemes; Hope Aerospace Plane

19960044390 Tohoku Univ., Miyagi, Japan
Aerodynamic Inverse Optimization Method for Transonic Wings
Obayashi, Shigeru, Tohoku Univ., Japan; Takanashi, Susumu, National Aerospace Lab., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 29-34; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A genetic algorithm (GA) has been applied to optimize target pressure distribution for inverse design methods. Since GA's do not require any derivative information, the resulting aerodynamic optimization algorithm is robust. Once target pressure distributions are obtained, corresponding airfoil/wing geometries can be computed by an inverse design code coupled with a Navier-Stokes solver. Design examples indicate that the present optimization algorithm is efficient and that supercritical wing shapes are reproduced by the simulated evolution.
Author
Genetic Algorithms; Pressure Distribution; Supercritical Wings; Navier-Stokes Equation; Optimization; Transonic Flow; Computerized Simulation

19960044394 Daiko Denshi Tsushin Ltd., Tokyo, Japan
Parallel Computation of a Tip Vortex Induced by an Aircraft Wing
Ito, Ryozo, Daiko Denshi Tsushin Ltd., Japan; Takanashi, Susumu, National Aerospace Lab., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 53-57; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Three dimensional (3D) Navier-Stokes simulations about the wing of the Being 747-200 have been carried out using a parallel vector computer called 'NWT' (numerical wind tunnel) at the National Aerospace laboratory, Japan. The main objective of this study is to simulate the wing-tip vortex. The governing equations are 3D Reynolds-averaged thin-layer Navier-Stokes equations which are discretized by a finite volume method with a total variation diminishing (TVD) upwind scheme. The C-O type of grid around the wing has been decomposed equally into 24 subdomains. Parallelization has been done by means of sharing the computational load for each subdomain to each PE. Computation using a grid with 11 million grid points shows the existence of a strong tip vortex induced by the wing.
Author
Wing Tip Vortices; Computational Grids; Finite Volume Method; TVD Schemes; Upwind Schemes (Mathematics); Computerized Simulation; Boeing 747 Aircraft; Navier-Stokes Equation; Computational Fluid Dynamics

19960044402 Tokyo Univ., Inst. of Space and Aeronautical Science, Japan
Effect of the Engine Nacelle on the Flow Around the Spaceplane
Tamura, Yoshiaki, Tokyo Univ., Japan; Fujii, Kozo, Tokyo Univ., Japan; Kuroda, Shinichi, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 99-104; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The flows around a spaceplane with/without the engine nacelle were numerically simulated. The flow field was divided into six zones in the case with the engine and into two zones in the case without the engine and computed with a zonal method using the Fortified Solution Algorithm. The flow Mach numer is 2.75 and the angles-of-attack are 0, 5, and 10 degrees in both cases. The computer results were compared with an experiment and showed the reliability of the current computation though there was a small discrepancy of the lift coefficient in the case of the 5 and 10 degrees angles-of-attack with the engine. The effects of the engine on the upper surface of the wing is the enhancement of the leading edge vortex. The flow from the diverter pushes the flow along the cowl outward and the pushed flow rolls over the wing so that the leading edge vortex is enhanced. Under the wing, the flows from the diverter and the tips of the cowl form vortical flows and decrease the pressure on the lower surface of the wing. Utilization of a turbulence model, especially for the flow inside the duct, was suggested for further research.
Author
Aerospace Planes; Angle of Attack; Flow Distribution; Turbulence Models; Interference Lift; Pressure Distribution; Computerized Simulation; Wing Nacelle Configurations; Wing Loading; Vortices

19960044405 Mitsubishi Heavy Industries Ltd., Tokyo, Japan
Numerical Simulation of the Flowfield Around an Oscillating Wing in Transonic Range
Ishiguro, Mitsuo, Mitsubishi Heavy Industries Ltd., Japan; Tatsumi, Shigefumi, Mitsubishi Heavy Industries Ltd., Japan; Nakamichi, Jiro, National Aerospace Lab., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 115-120; In Japanese; Also

announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the field of aeroelasticity, inviscid unsteady aerodynamics have traditionally been used to predict aeroelastic phenomena. However, thanks to the recent advances in supercomputers, numerical simulation of an unsteady flow field around an oscillating wing based on Navier-Stokes equations has become popular. One of the authors recently developed a computer code which is capable of solving unsteady Navier-Stokes equations around oscillating wings. The code is based on the Beam-Warming alternating directin implicit (ADI) method combined with a dynamic grid system. This paper describes the formulation of he method together with the application of the code to an oscillating wing which as a low aspect ratio and low thickness ratio. Correlation of the computer results with wind tunnel test data obtained at the National Aerospace Laboratory 2m transonic wind tunnel is also presented.

Author

Alternating Direction Implicit Methods; Navier-Stokes Equation; Unsteady Aerodynamics; Thickness Ratio; Low Aspect Ratio; Wing Profiles; Oscillating Flow; Grid Generation (Mathematics)

19960044418 Science Univ. of Tokyo, Japan

Numerical Simulation on Ground Effect Using the Boundary Element Method

Kikuchi, Katsuhiro, Science Univ. of Tokyo, Japan; Motoe, Fuminori, Science Univ. of Tokyo, Japan; Fukuda, Hajime, Science Univ. of Tokyo, Japan; Mizuno, Tsuyoshi, Science Univ. of Tokyo, Japan; Yanagizawa, Mitsunori, Science Univ. of Tokyo, Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 193-198; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Owing to its special aerodynamic characteristics and applications the problem of ground effect has become increasingly common. A full investigation was conducted to calculate unsteady aerodynamic forces using small and large ground plates. In order to calculate pressure variation on a large ground plate the steady boundary element method was used. However, using a small ground plate the boundary element method was modified to treat the unsteady aerodynamic phenomena. At low angles of attack, the qualitative behavior of unsteady aerodynamic pressure on both ground plates were well predicted by these boundary element methods.

Author

Ground Effect (Aerodynamics); Unsteady Aerodynamics; Angle of Attack; Boundary Element Method; Pressure Distribution; Aerodynamic Coefficients; Lift

19960044419 Ship Research Inst., Tokyo, Japan

Numerical Simulation of Flow-Field Around Three Dimensional WIG Using Multi-Block Code

Hirata, Nobuyuki, Ship Research Inst., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 199-204; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A wing in ground effect (WIG) vehicle is expected to be one of the promising super high-speed craft in the next generation. A WIG is characterized by a high lift to drag ratio and a forward shift of center of pressure in close proximity to the ground, hence estimating their features accurately is very important in design and safety evaluations. In the present investigation, flows around a three dimensional wing with end plates in ground effect are computed by a Navier-Stokes solver. Because of the geometric complexity of the configuration, a multi-block technique is used. Results are compared with experimental data and the aerodynamic characteristics in ground effect are discussed.

Author

Ground Effect (Aerodynamics); Center of Pressure; Lift Drag Ratio; Navier-Stokes Equation; Wing Profiles; Flow Distribution; Safety Factors; Aerodynamic Characteristics

19960044420 Railway Technical Research Inst., Tokyo, Japan

Numerical Simulation of Aerodynamic Problems in High Speed Railways, Part 3

Iida, Masanobu, Railway Technical Research Inst., Japan; Yoshida, Yasuo, Railway Technical Research Inst., Japan; Maeda, Tatsuo, Railway Technical Research Inst., Japan; Wada, Yasuhiro, National Aerospace Lab., Japan; Ogawa, Satoru, National Aerospace Lab., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 205-210; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Pressure waves which are generated by a train entering or exiting a tunnel travel through the tunnel and reflect at the tunnel portals. Since the train in the tunnel meets the pressure waves repeatedly, the pressure field around it changes with time in a quite complicated manner. In this paper, one-dimensional flow simulation is performed to predict the pressure changes caused by the pressure waves which are usually considered to be plane waves. Three-dimensional flow simulation is also done to investigate the flow field around the head of the train in the tunnel.

Author

Tunnels; Rail Transportation; Flow Distribution; Plane Waves; Pressure Distribution; Three Dimensional Flow; Computerized Simulation

19960044628 NASA Langley Research Center, Hampton, VA USA

Rarefaction effects on Galileo probe aerodynamics

Moss, James N., NASA Langley Research Center, USA; Le-

Beau, Gerald J., NASA Langley Research Center, USA; Blanchard, Robert C., NASA Langley Research Center, USA; Price, Joseph M., NASA Langley Research Center, USA; Aug. 24, 1996; 6p; In English
Report No.(s): NASA-TM-111620; NAS 1.15:111620; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Solutions of aerodynamic characteristics are presented for the Galileo Probe entering Jupiter's hydrogen-helium atmosphere at a nominal relative velocity of 47.4 km/s. Focus is on predicting the aerodynamic drag coefficient during the transitional flow regime using the direct simulation Monte Carlo (DSMC) method. Accuracy of the probe's drag coefficient directly impacts the inferred atmospheric properties that are being extracted from the deceleration measurements made by onboard accelerometers as part of the Atmospheric Structure Experiment. The range of rarefaction considered in the present study extends from the free molecular limit to continuum conditions. Comparisons made with previous calculations and experimental measurements show the present results for drag to merge well with Navier-Stokes and experimental results for the least rarefied conditions considered.
Author
Rarefaction; Galileo Probe; Jupiter Atmosphere; Aerodynamic Coefficients; Aerodynamic Drag; Monte Carlo Method; Deceleration

19960045290 National Aeronautics and Space Administration. Langley Research Center, Hampton, VA USA
Aerodynamic Characteristics of Two Waverider-Derived Hypersonic Cruise Configurations
Cockrell, Charles E., Jr., National Aeronautics and Space Administration. Langley Research Center, USA; Huebner, Lawrence D., National Aeronautics and Space Administration. Langley Research Center, USA; Finley, Dennis B., Lockheed-Fort Worth Co., USA; Jul. 1996; 78p; In English
Contract(s)/Grant(s): RTOP 466-02-01-01
Report No.(s): NASA-TP-3559; NAS 1.60:3559; L-17479; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An evaluation was made on the effects of integrating the required aircraft components with hypersonic high-lift configurations known as waveriders to create hypersonic cruise vehicles. Previous studies suggest that waveriders offer advantages in aerodynamic performance and propulsion/airframe integration (PAI) characteristics over conventional non-waverider hypersonic shapes. A wind-tunnel model was developed that integrates vehicle components, including canopies, engine components, and control surfaces, with two pure waverider shapes, both conical-flow-derived waveriders for a design Mach number of 4.0. Experimental data and limited computational fluid dynamics (CFD) solutions were obtained over a Mach number range of 1.6 to 4.63. The experimental data show the component build-up effects and the aerodynamic characteristics of the fully integrated configurations, including control surface effectiveness. The aerodynamic performance of the fully integrated configurations is not comparable to that of the pure waverider shapes, but is comparable to previously tested hypersonic models. Both configurations exhibit good lateral-directional stability characteristics.
Author
Waveriders; Hypersonic Vehicles; Aerodynamic Characteristics; Wind Tunnel Models; Wind Tunnel Tests; Mach Number; Flow Distribution; Computational Fluid Dynamics

19960045440 National Aeronautics and Space Administration. Langley Research Center, Hampton, VA USA
Artificial Boundary Conditions Based on the Difference Potentials Method
Tsynkov, Semyon V., National Aeronautics and Space Administration. Langley Research Center, USA; Jul. 1996; 34p; In English
Contract(s)/Grant(s): RTOP 505-59-53-01
Report No.(s): NASA-TM-110265; NAS 1.15:110265; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

While numerically solving a problem initially formulated on an unbounded domain, one typically truncates this domain, which necessitates setting the artificial boundary conditions (ABC's) at the newly formed external boundary. The issue of setting the ABC's appears to be most significant in many areas of scientific computing, for example, in problems originating from acoustics, electrodynamics, solid mechanics, and fluid dynamics. In particular, in computational fluid dynamics (where external problems present a wide class of practically important formulations) the proper treatment of external boundaries may have a profound impact on the overall quality and performance of numerical algorithms. Most of the currently used techniques for setting the ABC's can basically be classified into two groups. The methods from the first group (global ABC's) usually provide high accuracy and robustness of the numerical procedure but often appear to be fairly cumbersome and (computationally) expensive. The methods from the second group (local ABC's) are, as a rule, algorithmically simple, numerically cheap, and geometrically universal; however, they usually lack accuracy of computations. In this paper we first present a survey and provide a comparative assessment of different existing methods for constructing the ABC's. Then, we describe a relatively new ABC's technique of ours and review the corresponding results. This new technique, in our opinion, is currently one of the most promising in the field. It enables one to construct such ABC's that combine the advantages relevant to the two aforementioned classes of existing methods. Our approach is based on application of the difference potentials method attributable to V. S. Ryaben'kii. This approach allows us to obtain highly accurate ABC's in the form of certain (nonlocal) boundary operator equations. The operators involved are analogous to the pseudodifferential boundary projections first

introduced by A. P. Calderon and then also studied by R. T. Seeley. The apparatus of the boundary pseudodifferential equations, which has formerly been used mostly in the qualitative theory of integral equations and PDE'S, is now effectively employed for developing numerical methods in the different fields of scientific computing.
Author
Boundary Conditions; Boundary Value Problems; Computational Fluid Dynamics; Navier-Stokes Equation

03
AIR TRANSPORTATION AND SAFETY

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

19960034218 Federal Aviation Administration, Airport and Aircraft Safety., Atlantic City, NJ USA
Performance of Improved Aerosol Cans Subjected to an Aircraft Fire
Hawthorne, Christopher, Federal Aviation Administration, USA; Blake, David, Federal Aviation Administration, USA; Dec. 1995; 14p; In English
Report No.(s): AD-A303805; DOT/FAA/AR-TN95/78; AAR-422; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study was undertaken following the completion of a Small Business Innovation Research (SBIR) Phase 2 contract involving the fire hazards of aerosol cans. Tests were conducted on a newly designed aerosol can developed during the SBIR Phase 2 contract as well as two types of currently produced cans. The purpose was to compare the hazards associated with typical aerosol cans versus the newly designed can when they are involved in an aircraft fire. The testing determined that the new can created the least hazard when involved in aircraft fire scenarios.
DTIC
Aerosols; Cans; Aircraft Safety; Fires

19960035821 NASA Ames Research Center, Moffett Field, CA USA
Ice Detector and Deicing Fluid Effectiveness Monitoring System
Seegmiller, H. Lee B., Inventor, NASA Ames Research Center, USA; Jun. 04, 1996; 18p; In English
Patent Info.: NASA-Case-ARC-12045-1-GE; US-Patent-5,523,959; US-Patent-Appl-SN-233676; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An ice detector and deicing fluid effectiveness monitoring system for an aircraft is disclosed. The ice detection portion is particularly suited for use in flight to notify the flight crew of an accumulation of ice on an aircraft lifting and control surfaces, or helicopter rotors, whereas the deicing fluid effectiveness monitoring portion is particularly suited for use on the ground to notify the flight crew of the possible loss of the effectiveness of the deicing fluid. The ice detection portion comprises a temperature sensor and a parallel arrangement of electrodes whose coefficient of coupling is indicative of the formation of the ice, as well as the thickness of the formed ice. The fluid effectiveness monitoring portion comprises a temperature sensor and an ionic-conduction cell array that measures the conductivity of the deicing fluid which is indicative of its concentration and, thus, its freezing point. By measuring the temperature and having knowledge of the freezing point of the deicing fluid, the fluid effectiveness monitoring portion predicts when the deicing fluid may lose its effectiveness because its freezing point may correspond to the temperature of the ambient.
NASA
Deicing; Deicers; Aircraft Structures; Detection; Temperature Sensors; Electrodes

19960035872 Princeton Univ., Dept. of Mechanical and Aerospace Engineering., NJ USA
A Program in Air Transportation Technology (Joint University Program) ***Final Report***
Stengel, Robert F., Princeton Univ., USA; May 02, 1996; 18p; In English
Contract(s)/Grant(s): NGL-31-001-252
Report No.(s): NASA-CR-201420; NAS 1.26:201420; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Joint University Program on Air Transportation Technology was conducted at Princeton University from 1971 to 1995. Our vision was to further understanding of the design and operation of transport aircraft, of the effects of atmospheric environment on aircraft flight, and of the development and utilization of the National Airspace System. As an adjunct, the program emphasized the independent research of both graduate and undergraduate students. Recent principal goals were to develop and verify new methods for design and analysis of intelligent flight control systems, aircraft guidance logic for recovery from wake vortex encounter, and robust flight control systems. Our research scope subsumed problems associated with multidisciplinary aircraft design synthesis and analysis based on flight physics, providing a theoretical basis for developing innovative control concepts that enhance aircraft performance and safety. Our research focus was of direct interest not only to NASA but to manufacturers of aircraft and their associated systems. Our approach, metrics, and future directions described in the remainder of the report.
Author
Air Transportation; University Program; Transport Aircraft; Flight Control; Aircraft Control; Research

19960036991 Civil Aeromedical Inst., Oklahoma City, OK USA

Aircraft Evacuations Onto Escape Slides and Platforms, 1, Effects of Passenger Motivation ***Final Report***

McLean, G. A., Civil Aeromedical Inst., USA; George, M. H., Civil Aeromedical Inst., USA; Funkhouser, G. E., Civil Aeromedical Inst., USA; Chittum, C. B., Civil Aeromedical Inst., USA; Jun. 1996; 24p; In English

Report No.(s): DOT/FAA/AM-96/18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental evaluations of passenger egress during simulated emergency evacuations have provided different results, depending on such variables as subject motivation level and escape route utilized in the particular study. The study reported here was conducted to compare competitive versus cooperative subject behavior within a single study using inflatable escape slides versus door sill-height platforms connected to rigid ramps as the escape routes. Four groups of subjects, ranging in age from 18 to 44, were employed in a 2 (motivation level) x 2 (egress route) x 2 (air quality) repeated-measures design. Motivation level was the between-groups factor; evacuation route and air quality (clear air versus smoke) were within-groups factors. Main effects on total egress time were found for motivation level (p less than .008) and egress route (p less than .012), as competitive behavior and platforms-with-ramps produced much faster evacuation times. Air quality effects on total egress times failed to achieve statistical significance; however, the combination of air quality with the other variables produced substantial interactions. These results indicate that findings derived from evacuation studies are very susceptible to nuances in individual subject behavior and experimental techniques/protocol. Combining previously studied independent variables may produce unexpected interactions that invalidate initial assumptions about the utility of those variables in answering specific research questions. Studies intended to assess the evacuation potential of aircraft designs, configurations, and operating procedures should tightly control such variables to prevent them from inadvertently confounding the experimental questions being addressed.

Author

Escape Systems; Human Performance; Routes; Inflatable Structures; Rigid Structures; Emergencies; Aircraft Accidents

19960039891 Johns Hopkins Univ., Centerr for Injury Research and Policy., Baltimore, MD USA

Crashes of Instructional Flights: Analysis of Cases and Remedial Approaches ***Final Report***

Baker, SUSAn P., Johns Hopkins Univ., USA; Lamb, Margaret W., Johns Hopkins Univ., USA; Li, Guohua, Johns Hopkins Univ., USA; Dobb, Robert S., Johns Hopkins Univ., USA; Feb. 1996; 56p; In English

Contract(s)/Grant(s): FAA-93-G-045

Report No.(s): AD-A304890; DOT/FAA/AM-96/3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Instructional flights experience more than 300 crashes annually and are involved in more than one-third of all midair collisions. Research was undertaken to identify the circumstances of instructional crashes and describe factors related to pilots, aircraft, and the environment. METHODS: NTSB data tapes were analyzed for crashes during 1989-1992 that involved a student pilot or a flight for instructional purposes. During 1989-1992, 1226 instructional airplanes were involved in crashes, resulting in 250 deaths and 128 serious injuries. Midair collisions during these four years involved 38 instructional airplanes (2.5%) and accounted for 20% of all deaths. Sixteen pilots in midair collisions were on solo flights; on average, they were younger but more experienced than trainees in other crashes on solo. Detailed review of crashes during 1989 and 1991 revealed that loss of control on landing characterized 227 of the 638 crashes, or 36%. Crosswinds contributed to 28% of all crashes. The 94 stalls were 15% of the series and 46% of all fatal crashes. Student solos were 51% of the series; 193 of the 360 students on solo foundered due to loss of control on landing or takeoff. Touch-and-go land ings accounted for 22% of all crashes on solo. Among the 84 crashes on cross-country solos, 26 (31%) were due to running out of fuel. Thirty-four (40%) of the trainees who crashed on cross-country solos had not filed flight plans. Twenty-three pilots flying with student licenses were illegally carrying one or more passengers. In 13 of the 25 crashes due to carburetor icing, the problem began during cruise phase. Instructors were present in 50% of crashes from stalls and 32% of crashes from fuel starvation. Simulated emergencies ended in 49 crashes.

DTIC

Aircraft Accidents; Flight Hazards; Flight Tests; Flight Safety; Pilot Training; Crashes

19960041235 NASA Ames Research Center, Moffett Field, CA USA

An analysis of landing rates and separations at the Dallas/ Fort Worth InterNational Airport

Ballin, Mark G., NASA Ames Research Center, USA; Erzberger, Heinz, NASA Ames Research Center, USA; Jul. 1996; 76p; In English

Contract(s)/Grant(s): RTOP 505-64-13

Report No.(s): NASA-TM-110397; NAS 1.26:110397; A-961649; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Advanced air traffic management systems such as the Center/TRACON Automation System (CTAS) should yield a wide range of benefits, including reduced aircraft delays and controller workload. to determine the traffic-flow benefits achievable from future terminal airspace automation, live radar information was used to perform an analysis of current aircraft landing rates and separations at the Dallas/Fort Worth InterNational Airport. Separation statistics that result when

controllers balance complex control procedural constraints in order to maintain high landing rates are presented. In addition, the analysis estimates the potential for airport capacity improvements by determining the unused landing opportunities that occur during rush traffic periods. Results suggest a large potential for improving the accuracy and consistency of spacing between arrivals on final approach, and they support earlier simulation findings that improved air traffic management would increase capacity and reduce delays.
NASA
Air Traffic Control; Aircraft Landing; Airports; Approach Control; Aircraft Approach Spacing; Instrument Approach; Landing Radar; Flight Management Systems; Air Traffic Controllers (Personnel); Runways

19960042496 NASA Langley Research Center, Hampton, VA USA
Uncertainties that flight crews and dispatchers must consider when calculating the fuel needed for a flight
Trujillo, Anna C., NASA Langley Research Center, USA; May 1996; 34p; In English
Contract(s)/Grant(s): RTOP 505-64-53-01
Report No.(s): NASA-TM-110240; NAS 1.15:110240; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1993, fuel accounted for approximately 15 percent of an airline's expenses. Fuel consumption increases as fuel reserves increase because of the added weight to the aircraft. Calculating fuel reserves is a function of Federal Aviation Regulations, airline company policy, and factors that impact or are impacted by fuel USAge enroute. This research studied how pilots and dispatchers determined the fuel needed for a flight and identified areas where improvements in methods may yield measurable fuel savings by (1) listing the uncertainties that contribute to adding contingency fuel, (2) obtaining the pilots' and dispatchers' perspective on how often each uncertainty occurred, and (3) obtaining pilots' and dispatchers' perspective on the fuel used for each occurrence. This study found that for the majority of the time, pilots felt that dispatchers included enough fuel. As for the uncertainties that flight crews and dispatchers account for, air traffic control accounts for 28% and weather uncertainties account for 58 percent. If improvements can be made in these two areas, a great potential exists to decrease the reserve required, and therefore, fuel USAge without jeopardizing safety.
Author
Airline Operations; Fuel Consumption; Flight Crews; Operating Costs; Cost Reduction; Contingency; Meteorological Parameters; Air Traffic Control; Flight Plans

19960042511 Brookhaven National Lab., Upton, NY USA
Relating aviation service difficulty reports to accident data for safety trend prediction
Fullwood, R., Brookhaven National Lab., USA; Hall, R., Brookhaven National Lab., USA; Martinez, G., Brookhaven National Lab., USA; Uryasev, S., Brookhaven National Lab., USA; Mar. 13, 1996; 58p; In English
Contract(s)/Grant(s): DE-AC02-76CH-00016; FAA-95- p-0056
Report No.(s): BNL-63018; DE96-010646; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This work explores the hypothesis that Service Difficulty Reports (SDR - primarily inspection reports) are related to Accident Incident Data System (AIDS - reports primarily compiled from National Transportation Safety Board (NTSB) accident investigations). This work sought and found relations between equipment operability reported in the SDR and aviation safety reported in AIDS. Equipment is not the only factor in aviation accidents, but it is the factor reported in the SDR. Two approaches to risk analysis were used: (1) The conventional method, in which reporting frequencies are taken from a data base (SDR), and used with an aircraft reliability block diagram model of the critical systems to predict aircraft failure, and (2) Shape analysis that uses the magnitude and shape of the SDR distribution compared with the AIDS distribution to predict aircraft failure.
DOE
Aircraft Accidents; Aircraft Safety; Aircraft Reliability; Failure Analysis; Flight Safety; Reliability Analysis

19960042887 San Jose State Univ., CA USA
Facilitation techniques as predictors of crew participation in LOFT debriefings
McDonnell, L. K., San Jose State Univ., USA; Jun. 1996; 44p; In English
Contract(s)/Grant(s): NCC2-798
Report No.(s): NASA-CR-196701; NAS 1.26:196701; A-961979; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Based on theories of adult learning and airline industry guidelines for Crew Resource Management (CRM), the stated objective during Line Oriented Flight Training (LOFT) debriefings is for instructor pilots (IP's) to facilitate crew self-analysis of performance. This study reviews 19 LOFT debriefings from two major U.S. airlines to examine the relationship between IP efforts at facilitation and associated characteristics of crew participation. A subjective rating scale called the Debriefing Assessment Battery was developed and utilized to evaluate the effectiveness of IP facilitation and the quality of crew participation. The results indicate that IP content, encouragement, and questioning techniques are highly and significantly correlated with, and can therefore predict, the degree and depth of crew participation.
Author
Flight Training; Instructors; Resources Management

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

19960034227 Federal Aviation Administration, Technical Center., Atlantic City, NJ USA

The Effects of Structured Arrival and Departure Procedures on TRACON Air Traffic Controller Memory and Situational Awareness

Sollenberger, Randy L., Federal Aviation Administration, USA; Stein, Earl S., Federal Aviation Administration, USA; Sep. 1995; 104p; In English

Report No.(s): AD-A303800; DOT/FAA/CT-TN95/27; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Air traffic control (ATC) is conducted by men and women of the Federal Aviation Administration's (FAA) air traffic service. Controllers do an excellent job of keeping aircraft separated and safe. However, they do make mistakes. Many of these errors are caused by the limitations of working memory, which controllers continuously use to maintain situational awareness (SA) An experiment was conducted at the FAA Technical Center Human Factors Laboratory to examine the potential benefits of a memory aiding concept on controller performance, SA, and workload. The advanced use of Standard Terminal Arrival Routes (STARs) and Standard Instrument Departures (SIDs) were selected as the memory aids for testing. These specially-designed STARs and SIDs were intended to simplify the controller's task and allow more time for planning and monitoring aircraft. A new high-fidelity ATC simulator was used which allowed controllers to work under extremely realistic conditions. Sixteen controllers from Atlantic City TRACON participated and worked scenarios consisting of low and high traffic volumes both with and without the memory aids. Controllers' actions and aircraft data were recorded during each scenario and used to evaluate ATC performance. Other evaluation methods included the Air Traffic Workload Input Technique and a modification of the Situational Awareness Global Assessment Technique. The results indicated that the memory aids decreased both the number of ground-to-air transmissions and handoff errors. Controller workload and SA were primarily determined by the traffic volume and were not affected by the memory aids. A final debriefing with controllers suggested several ways the memory aids and SA technique could be improved.

DTIC

Air Traffic Control; Air Traffic Controllers (Personnel); Workloads (Psychophysiology); Retention (Psychology)

19960034310 NASA Marshall Space Flight Center, Huntsville, AL USA

Global Positioning System Synchronized Active Light Autonomous Docking System

Howard, Richard T., Inventor, NASA Marshall Space Flight Center, USA; Book, Michael L., Inventor, NASA Marshall Space Flight Center, USA; Bryan, Thomas C., Inventor, NASA Marshall Space Flight Center, USA; Bell, Joseph L., Inventor, NASA Marshall Space Flight Center, USA; Feb. 06, 1996; 12p; In English; Also announced as 19940032318

Patent Info.: NASA-Case-MFS-28853-1; US-Patent-5,490,075; US-Patent-Appl-SN-283728

Report No.(s): US-Patent-Class-364-459; US-Patent-Class-364-424.02; Int-Patent-Class-B64G-1/64; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A Global Positioning System Synchronized Active Light Autonomous Docking System (GPSSALADS) for automatically docking a chase vehicle with a target vehicle comprising at least one active light emitting target which is operatively attached to the target vehicle. The target includes a three-dimensional array of concomitantly flashing lights which flash at a controlled common frequency. The GPSSALADS further comprises a visual tracking sensor operatively attached to the chase vehicle for detecting and tracking the target vehicle. Its performance is synchronized with the flash frequency of the lights by a synchronization means which is comprised of first and second internal clocks operatively connected to the active light target and visual tracking sensor, respectively, for providing timing control signals thereto, respectively. The synchronization means further includes first and second Global Positioning System receivers operatively connected to the first and second internal clocks, respectively, for repeatedly providing simultaneous synchronization pulses to the internal clocks, respectively. In addition, the GPSSALADS includes a docking process controller means which is operatively attached to the chase vehicle and is responsive to the visual tracking sensor for producing commands for the guidance and propulsion system of the chase vehicle.

Official Gazzette of the U.S. Patent and Trademark

Global Positioning System; Spacecraft Docking; Luminaires; Frequency Synchronization

19960039916 Massachusetts Inst. of Tech., Cambridge, MA USA

Error modeling for differential GPS

Bierman, Gregory S., Massachusetts Inst. of Tech., USA; Sep. 27, 1995; 101p; In English

Report No.(s): AD-A302794; AFIT-95-135; Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Differential GPS (DGPS) positioning is used to accurately locate a GPS receiver based upon the well-known position of a reference site. In utilizing this technique, several errors sources contribute to position inaccuracy. This thesis investigates the error in DGPS operation and attempts to develop a statistical model for the behavior of this error. The model for DGPS error is developed using GPS data collected by Draper

Laboratory. The Marquardt method for non-linear curve-fitting is used to find the parameters of a first order Markov process that models the average errors from the collected data. The results show that a first order Markov process can be used to model the DGPS error as a function of baseline distance and time delay. The model's time correlation constant is 3847.1 seconds (1.07 hours) for the mean square error. The distance correlation constant is 122.8 kilometers. The total process variance for the DGPS model is 3.73 meters square.
DTIC
Global Positioning System; Markov Processes; Mathematical Models; Position Errors; Nonlinearity; Time Lag; Time Constant

19960041252 NASA Ames Research Center, Moffett Field, CA USA
Effects of modeling errors on trajectory predictions in air traffic control automation
Jackson, Michael R. C., Minnesota Univ., USA; Zhao, Yiyuan, Minnesota Univ., USA; Slattery, Rhonda, NASA Ames Research Center, USA; Jul. 31, 1996; 12p; In English; AIAA Guidance 2 Control Conference, 29-31 Jul. 1996, USA
Contract(s)/Grant(s): NCC-868
Report No.(s): NASA-TM-111861; NAS 1.15:l11861; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Air traffic control automation synthesizes aircraft trajectories for the generation of advisories. Trajectory computation employs models of aircraft performances and weather conditions. In contrast, actual trajectories are flown in real aircraft under actual conditions. Since synthetic trajectories are used in landing scheduling and conflict probing, it is very important to understand the differences between computed trajectories and actual trajectories. This paper examines the effects of aircraft modeling errors on the accuracy of trajectory predictions in air traffic control automation. Three-dimensional point-mass aircraft equations of motion are assumed to be able to generate actual aircraft flight paths. Modeling errors are described as uncertain parameters or uncertain input functions. Pilot or autopilot feedback actions are expressed as equality constraints to satisfy control objectives. A typical trajectory is defined by a series of flight segments with different control objectives for each flight segment and conditions that define segment transitions. A constrained linearization approach is used to analyze trajectory differences caused by various modeling errors by developing a linear time varying system that describes the trajectory errors, with expressions to transfer the trajectory errors across moving segment transitions. A numerical example is presented for a complete commercial aircraft descent trajectory consisting of several flight segments.
Author
Air Traffic Control; Error Analysis; Mathematical Models; Flight Paths

19960041389 Department of Transportation, Volpe National Transportation Systems Center., Cambridge, MA USA
The Use of Analog Track Angle Error Display for Improving Simulated GPS Approach Performance *Final Report, Jun. 1994 - May 1995*
Oman, C. M., Massachusetts Inst. of Tech., USA; Rasmussen, S. A., Massachusetts Inst. of Tech., USA; Robinson, S. K., Massachusetts Inst. of Tech., USA; Huntley, M. S. Jr., Department of Transportation, USA; Aug. 1995; 49p; In English
Contract(s)/Grant(s): FA5E2/A5007
Report No.(s): AD-A304791; DOT-VNTSC-FAA-95-29; DOT/FAA/AR-95/104; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The effect of adding track angle error (TAE) information to general aviation aircraft cockpit displays used for GPS nonprecision instrument approaches was studied experimentally. Six pilots flew 120 approaches in a Frasca 242 light twin aircraft simulator using crosswind and turbulence. Twenty-five-mile-long approach geometries were used, with and without 45 degree dogleg turns on final approach. Performance and workload using three TAE display formats were compared against results with two control formats presenting cross track error (XTE) only. Pilots found that the TAE displays simplified determination of wind correction angle, and that they consistently chose to use analog rather than numeric TAE data. Statistically significant differences between display formats and between pilots were found. The largest average improvement in initial leg intercept and tracking performance resulted when the conventional 'ten dot' XTE display was supplemented with a sliding pointer display of TAE, moving in the same direction as aircraft bank. A second TAE format, a sliding/rotating pointer integrated display, yielded the greatest improvement (35%) in the width of the short final approach flight technical error envelope, but pilots reported occasional problems interpreting this display. Both of these TAE formats improved final approach intercept and tracking performance after 45 degree turning maneuvers. The addition of TAE information to the receiver display helped pilots create outer Loop Lead, and yielded approach performance improvements comparable to relocating XTE information to an HSI within the pilot's primary scan. Bedford workload scores were not significantly influenced by display format, but were found to depend on approach geometry and phase.
DTIC
Display Devices; Global Positioning System; Instrument Approach; Cockpit Simulators; Wind Direction; Workloads (Psychophysiology); Air Traffic Control; Pilot Performance; Aircraft Maneuvers; Landing Simulation

19960042617 Naval Research Lab., washington, DC USA
GPS Monitor Station Upgrade Program at the Naval Research Laboratory
Galysh, Ivan J., Naval Research Lab., USA; Craig, Dwin M.,

Naval Research Lab., USA; 27th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting; May 1996, pp. 35-49; In English; Also announced as 19960042616; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

One of the measurements made by the Global Positioning System (GPS) monitor stations is to measure the continuous pseudo-range of all the passing GPS satellites. The pseudo-range contains GPS and monitor station clock errors as well as GPS satellite navigation errors. Currently the time at the GPS monitor station is obtained from the GPS constellation and has an inherent inaccuracy as a result. Improved timing accuracy at the GPS monitoring stations will improve GPS performance. The US Naval Research Laboratory (NRL) is developing hardware and software for the GPS monitor station upgrade program to improve the monitor station clock accuracy. This upgrade will allow a method independent of the GPS satellite constellation of measuring and correcting monitor station time to US Naval Observatory (USNO) time. THe hardware consists of a high performance atomic cesium frequency standard (CFS) and a computer which is used to ensemble the CFS with the two CFS's currently located at the monitor station by use of a dual-mixer system. The dual-mixer system achieves phase measurements between the high-performance CFS and the existing monitor station CFS's to within 400 femtoseconds. Time transfer between USNO and a given monitor station is achieved via a two way satellite time transfer modem. The computer at the monitor station disciplines the CFS based on a comparison of one pulse per second sent from the master site at USNO. The monitor station computer is also used to perform housekeeping functions, as well as recording the health status of all three CFS's. This information is sent to the USNO through the time transfer modem. Laboratory time synchronization results in the sub nanosecond range have been observed and the ability to maintain the monitor station CFS frequency to within 3.0 x 10 (sup minus 14) of the master site at USNO.

Author

Global Positioning System; Atomic Clocks; Navigation Satellites; Satellite Constellations; Position Errors; Frequency Standards; Systems Health Monitoring; Accuracy; Time Signals; Synchronism

19960042619 Space Operations Squadron (2nd), Falcon AFB, CO USA

Ideas for Future GPS Timing Improvements

Hutsell, Steven T., Space Operations Squadron (2nd), USA; 27th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting; May 1996, pp. 63-74; In English; Also announced as 19960042616; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Having recently met stringent criteria for full operational capability (FOC) certification, the Global Positioning System (GPS) now has higher customer expectations than ever before. In order to maintain customer satisfaction, and the meet the even high customer demands of the future, the GPS Master Control Station (MCS) must play a critical role in the process of carefully refining the performance and integrity of the GPS constellation, particularly in the area of timing. This paper will present an operational perspective on several ideas for improving timing in GPS. These ideas include the desire for improving MCS - US Naval Observatory (USNO) data connectivity, an improved GPS-Coordinated Universal Time (UTC) prediction algorithm, a more robust Kalman Filter, and more features in the GPS reference time algorithm (the GPS composite clock), including frequency step resolution, a more explicit use of the basic time scale equation, and dynamic clock weighting. Current MCS software meets the exceptional challenge of managing an extremely complex constellation of 24 navigation satellites. The GPS community will, however, always seek to improve upon this performance and integrity.

Author

Global Positioning System; Navigation Satellites; Kalman Filters; Universal Time; Satellite Constellations; Time Signals; Atomic Clocks; User Requirements; Accuracy; Frequency Synchronization

19960042620 Naval Observatory, washington, DC USA

UTC Dissemination to the Real-Time User: The Role of USNO

Miranian, Mihran, Naval Observatory, USA; 27th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting; May 1996, pp. 75-85; In English; Also announced as 19960042616; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Coordinated Universal Time (UTC) is available worldwide via the Global Positioning System (GPS). The UTC disseminated by GPS is referenced to the US Naval Observatory Master Clock UTC(USNO) which is regularly steered and maintained as close as possible to UTC Bureau InterNational des Poids et Mesures (BIPM), the interNational time scale. This paper will describe the role of the USNO in monitoring the time disseminated by the GPS and the steps involved to ensure its accuracy to the user. The paper will also discuss the other sources of UTC(USNO) and the process by which UTC(USNO) is steered to UTC(BIPM).

Author

Global Positioning System; Universal Time; Time Measurement; Real Time Operation; Standards; Time Signals; Navigation Satellites; Accuracy; Hydrogen Masers; Atomic Clocks

19960042625 Naval Observatory, washington, DC USA

How Bad Receiver Coordinates Can Affect GPS Timing

Chadsey, H., Naval Observatory, USA; 27th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting; May 1996, pp. 135-143; In English; Also announced

as 19960042616; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Many sources of error are possible when the Global Positioning System (GPS) is used for time comparisons. Some of these errors have been listed by Lewandowski. Because of the complexity of the system, an error source could have more than one effect. This paper will present theoretical and observational results by offsetting a receiver's coordinates. The calculations show how an error as small as three meters in any direction can result in a timing error of more than 10 nanoseconds. The GPS receiver must be surveyed to better than 0.2 meter accuracy for the timing error to be sub-nanosecond.
Author

Global Positioning System; Time Measurement; Coordinates; Error Analysis; Position Errors; Receivers; Time Signals; Accuracy

19960042634 Space Operations Squadron (2nd), Falcon AFB, CO USA

Kalman Filtering USNO's GPS Observations for Improved Time Transfer Predictions

Hutsell, Steven T., Space Operations Squadron (2nd), USA; 27th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting; May 1996, pp. 269-277; In English; Also announced as 19960042616; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Global Positioning System (GPS) Master Control Station (MCS) performs the Coordinated Universal Time (UTC) time transfer mission by uploading and broadcasting predictions of the GPS-UTC offset in subframe 4 of the GS navigation message. These predictions are based on only two successive daily data points obtained from the US Naval Observatory (USNO). USNO produces these daily smoothed data points by performing a least-squares fit on roughly 38 hours worth of data from roughly 160 successive 13-minute tracks of GPS satellites. Though sufficient for helping to maintain a time transfer error specification of 28 ns (1 Sigma), the MCS's prediction algorithm does not make the best use of the available data from from USNO, and produces data that can degrade quickly over extended prediction spans. This paper investigates how, by applying Kalman filtering to the same available tracking data, the MCS could improve its estimate of GPS-UTC, and in particular, the GPS-UTC A(sub 1) term. by refining the A(sub 1) (frequency) estimate for GPS-UTC predictions, error in GPS time transfer could drop significantly. Additional, the risk of future spikes in GPS's time transfer error could similarly be minimized, by employing robust Kalman filtering for GPS-UTC predictions.
Author

Global Positioning System; Kalman Filters; Least Squares Method; Navigation Satellites; Time Measurement; Universal Time; Algorithms; Broadcasting; Frequency Stability; Error Analysis

19960042645 Naval Research Lab., washington, DC USA

GPS Moving Vehicle Experiment

Oaks, O. J., Naval Research Lab., USA; Reid, Wilson, Naval Research Lab., USA; Wright, James, Computer Sciences Corp., USA; Duffey, Christopher, Computer Sciences Corp., USA; Williams, Charles, Computer Sciences Corp., USA; Warren, Hugh, Sachs/Freeman Associates, Inc., USA; Zeh, Tom, Naval Undersea Warfare Center, USA; Buisson, James, Antoine Enterprises, USA; 27th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting; May 1996, pp. 397-408; In English; Also announced as 19960042616; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Naval Research Laboratory (NRL) in the development of timing systems for remote locations, had a technical requirement for a Y code (SA/AS) Global Positioning System (GPS) precise time transfer receiver (TTR) which could be used both in a stationary mode or mobile mode. A contract was awarded to the Stanford Telecommunication Corporation (STEL) to build such a device. The Eastern Range (ER) als had a requirement for such a receiver and entered into the contract with NRL for the procurement of additional receivers. The Moving Vehicle Experiment (MVE) described in this paper is the first in situ test of the STEL Model 5401C Time Transfer System in both stationary and mobile operations. The primary objective of the MVE was to test the timing accuracy of the newly developed GPS TTR aboard a moving vessel. to accomplish this objective, a joint experiment was performed with personnel from NRL and the er at the Atlantic Undersea Test and Evaluation Center (AUTEC) test range at Andros Island. Results and discussion of the test are presented in this paper.
Author

Global Positioning System; Position (Location); Time Measurement; Time Signals; Frequency Standards; Atomic Clocks; Mobile Communication Systems

19960042652 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Spacecraft Doppler Tracking as a Xylophone Detector

Tinto, Massimo, Jet Propulsion Lab., California Inst. of Tech., USA; 27th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting; May 1996, pp. 467-478; In English; Also announced as 19960042616; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We discuss spacecraft Doppler tracking in which Doppler data recorded on the ground are linearly combined with Doppler measurements made on board a spacecraft. by using the four-link radio system first proposed by Vessot and Levine, we derive a new method for removing from the combined data the frequency fluctuations due to the Earth troposphere, ionosphere, and mechanical vibrations of the antenna on the ground. Our method provides also for reducing by several orders of magnitude, at selected Fourier components, the fre-

quency fluctuations due to other noise sources, such as the clock on board the spacecraft or the antenna and buffeting of the probe by non-gravitational forces. In this respect spacecraft Doppler tracking can be regarded as a xylophone detector. Estimates of the sensitivities achievable by this xylophone are presented for two tests of Einstein's theory of relativity: searches for gravitational waves and measurements of the gravitational red shift. This experimental technique could be extended to other tests of the theory of relativity, and to radio science experiments that rely on high-precision Doppler measurements.
Author
Doppler Effect; Red Shift; Signal to Noise Ratios; Hydrogen Masers; Channel Noise; Frequency Standards; Gravitational Waves; Clocks; Time Lag; Time Signals

19960042824 Advisory Group for Aerospace Research and Development, Missions Systems Panel., Neuilly-Sur-Seine, France
System Implications and Innovative Applications of Satellite Navigation ***Les Applications Nouvelles Offertes par la Navigation par Satellite et Leurs Incidences au Niveau Systemes***
Jun. 1996; 168p; In English, 1-2 Jul. 1996, Paris, Rome, Madrid, Saint Petersburg, France, Italy, Spain, Russia; Also announced as 19960042825 through 19960042834
Report No.(s): AGARD-LS-207; ISBN-92-836-1038-5; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Global Positioning Satellite System (GPS) is now operational and GLONASS will soon be declared operational. Meanwhile, INMARSAT has announced its intent to expand its services to include navigation signals broadcast from geostationary satellites, and several industrial organizations plan to provide commercial, satellite-based, navigation services. With prospects for reliable worldwide service becoming a reality, the technical and financial barriers to innovative applications are being overcome. This Lecture Series will provide an appreciation of the technical, operational and performance features of satellite-based navigation including the signal-in-space and the user equipment for GPS, GLONASS, and integrated GPS/GLONASS implementations; assessment of the quality of service that has been achieved and an introduction to projected service enhancements. The introductory lecture will provide an overview of Satellite based navigation and some of the imaginative uses to which it has already been put. The application of satellite signals to precision approach and landing for civil aviation and for the determination of vehicle attitude (orientation) will be featured in the following lectures. Other topics include quality monitoring of user's navigation solutions, the integration of satellite navigation with inertial measurements and high-precision relative and differential positioning. This Lecture Series, sponsored by the Mission Systems Panel of AGARD, has been implemented by the Consultant and Exchange Program.
Author
Lectures; Global Positioning System; Glonass; Inmarsat Satellites; Geosynchronous Orbits; Satellite Constellations; Civil Aviation; Navigation Satellites; Accuracy; Position (Location)

19960042825 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA
Global Navigation Satellite Systems
Greenspan, Richard L., Draper (Charles Stark) Lab., Inc., USA; System Implications and Innovative Applications of Satellite Navigation; Jun. 1996; 10p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The Global Navigation Satellite System (GNSS) is the visionary goal for a world-wide utility that will ultimately provide reliable and dependable navigation and timing services to civil and National users. The enabling technology is firmly rooted in operational satellite navigation systems that have been developed for military use, including the Global Positioning Satellite System (GPS) and the Global Navigational Satellite System (Glonass) developed in the USA and Russia respectively. However, the rapid acceptance into operational use by the civil community of even the degraded performance levels that have already been made available has exposed the need for additional features of the existing signals to deliver improved services. Although these additional features will be provided initially as augmentations to the existing systems, the GNSS, in whatever form it eventually takes, remains the end point toward which governments, interNational service providers, industry and user groups are planning. This introductory lecture provides an overview of the means by which individual design features of satellite navigation systems are seen to satisfy the mission requirements for specific user groups, and it sets the context for the other presentations in this lecture series. This presentation is organized from the viewpoint of the users of the satellite navigation services; it also includes a review of some applications of theses services that were not even remotely anticipated by their original designers. Most of this discussion is based on the Global Positioning Satellite System.
Author
Global Positioning System; Glonass; Satellite Constellations; Navigation Satellites; InterNational Cooperation; Operating Costs; Position (Location); Position Sensing; Accuracy

19960042826 Ministry of Defence, State Scientific and Research Inst. for Navigation and Hydrography., Saint Petersburg, Russia
Introduction to Global Navigation Satellite System
Bazarov, Y., Ministry of Defence, Russia; Jun. 1996; 22p; In

English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The Russian Global Navigation Satellite System (GLONASS) is a space-based positioning, velocity and time system. In this lecture the evolution of GLONASS towards operational status is presented. The operational constellation, the constellation maintenance plan and relenishment policy, coverage and dilution of precision factors are described along with the Russian National policy for user access to the service. The lecture addresses the characteristics of GLONASS broadcast signals in space including modulation techniques, code structure, message content and formats, navigational accuracy achieved by GLONASS users, differential technique, user equipment performance, future GLONASS upgrades and applications of GLONASS in the Commonwealth of Independent States are described.

Author

Glonass; Navigation Satellites; Satellite Constellations; Accuracy; Frequency Modulation; Position (Location); Time Signals; Position Indicators

19960042827 Three-S Navigation, Laguna Hills, CA USA

Integrated GPS/GLONASS User Equipment

Beser, Jacques, Three-S Navigation, USA; Jun. 1996; 28p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Integrated Global Positioning System/Global Satellite Navigation Systems (GPS/GLONASS) receivers offer better availability, performance, and integrity than GPS only receivers. In this lecture, the GPS and GLONASS systems are compared and the advantages and difficulties associated with their combined use are discussed. The 3S Navigation R-100 series of receivers is used as a model to discuss the various receiver components and functions, including the antenna, RF/IF unit, tracking module, measurement generation and navigation solution generation. The R-100 architecture is described as well as that of the GNSS-200 which is more compact and the latest GPS/GLONASS receiver produced by 3S Navigation. Air, sea and ground results are presented. These include results for both the R-100 series as well as the GNSS-200. Stand-alone as well as differential performance are discussed.

Author

Global Positioning System; Glonass; Satellite Constellations; Accuracy; Position (Location); Position Indicators; Antenna Radiation Patterns

19960042828 Calgary Univ., Dept. of Geomatics Engineering., Alberta Canada

Navigation Accuracy for Absolute Positioning

Lachapelle, Gerard, Calgary Univ., Canada; Jun. 1996; 10p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The real-time absolute (i.e., single point, stand-alone) accuracy achievable with the Global Positioning System (GPS) is a function of the User Equivalent Range Error (UERE) and the Dilution of Precision (DOP). The later parameter is a function of satellite geometry. The various error components affecting the magnitude of the UERE are quantified. They include satellite, atmospheric, and receiver dependent errors. The DOP's expected under ideal operational conditions are a function of space and time. The absolute accuracies currently specified for the Standard Positioning Service (SPS) and the Precise Positioning Service (PPS) are described. Various experiments conducted in recent years show that he actual PPS accuracy performance usually exceeds the specified level. Potential PPS accuracy enhancements which comprise satellite clock and ephemeris error reduction, tropospheric error reduction and receiver noise and multipath reduction are described. Recent tests by the 50th Space Wing of the US Air Force to reduce satellite clock and ephemeris errors show an improvement of nearly 50% in absolute positioning accuracy using current Y-code receiver technology. As a military application example, a comparison of the NATO STANAG 2373 artillery survey requirements with PPS accuracies shows that the artillery positioning requirement can be met under ideal satellite geometry with the currently specified PPS accuracy. Future PPS accuracy enhancements show that the artillery positioning requirements could be met under severely degraded satellite geometry, which is a more realistic scenario, given the concealment requirements for artillery. Selected recommendations of an independent study mandated by the US Congress and conducted by the National Academy of Public Administration and the National Research Council pertaining to both PPS and SPS enhancements are presented. Finally, the impact of the worldwide civilian GPS tracking network deployed by the InterNational GPS Service for Geodynamics on post-mission absolute accuracy is discussed. The use of post-mission precise orbits and 30-second satellite clock corrections are resulting in absolute kinematic accuracies at the 1-3 m accuracy level using civilian receivers. The potential for this post-mission information to become available in real-time is mentioned.

Author

Global Positioning System; Multipath Transmission; Real Time Operation; Tracking Networks; Timing Devices; Accuracy; Position (Location); Position Indicators; Signal Encoding; Error Analysis; Positioning

19960042829 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA

Relative and Differential GPS

Phillips, Richard E., Draper (Charles Stark) Lab., Inc., USA; Schmidt, George T., Draper (Charles Stark) Lab., Inc., USA; Jun. 1996; 22p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Many aerospace vehicles will have an avionics suite that includes an integrated inertial navigation system/Global Positioning System (INS/GPS) set. This means of navigation motivates examination of whether high accuracy (approx. equals 10 ft Circle of Equal Probability (CEP)) may be obtainable using only this set of weapon avionics operating in a relative or differential GPS mode, rather than in an absolute GPS mode where CEP's of 30 to 40 feet would be expected. This paper will explain how 10 ft accuracy may be achieved and it will present several different concepts that exploit such a capability. Fundamentally, two problems must be solved to achieve an accuracy of 10 ft: (1) destination or 'target' location must be determined to better than 10 ft, and (2) the GPS/INS 'user vehicle' must be guided accurately to better than 10 ft. This paper will explain how the use of relative GPS can solve the guidance problem and how the use of relative targeting in a GPS based coordinate system can solve the target location problem. The use of differential GPS will also be discussed. The paper begins with a discussion of relative GPS and reports the results of actual experiments to determine accuracy degradation of relative GPS guidance systems as a function of baseline length and targeting latency. Various baseline lengths and latencies are considered showing that relative (or differential) GPS guidance may achieve high accuracy over baselines and latencies useful for various applications. Appendix A shows that to first order, relative and differential GPS systems give the same accuracy. Next, the target location part of the problem is addressed. There must be an accurate sensor that locates the target relative to the GPS reference receiver. The sensor may be either on the vehicle carrying the receiver or at a remote location. The reference receiver could either be on the surveillance aircraft or on the ground. If on the ground, both it and the target could have been located prior to the mission. Real-time target location concepts that will be explained include the use of aircraft equipped with an INS/GPS/Synthetic Aperture Radar (SAR) avionics suite to perform a real-time relative targeting function. The importance of reasonable aircraft maneuvers to enhance observability and speed up the three dimensional (3-D) target determination solution will also be addressed. Simulation results for several realistic scenarios will be presented. An example of an INS/GPS equipped guided parafoil for supply delivery will be discussed as one of the relative (or differential) GPS applications. Next, several concepts will be discussed that make use of highly accurate pre-mission relative target positioning, i.e., the ability to specify the 3-D location of two points, or localized areas, on the Earth relative to each other in a suitable reference frame such as WGS-84. It is of interest to speculate how such a capability could be exploited. Scenarios involving several existing or planned systems will be described. A detailed design example of an INS/GPS guidance system for a munition fired from a gun will then be presented. A final section will then discuss some of the practical issues in using relative (or differential) GPS.

Author

Avionics; Global Positioning System; Inertial Navigation; Position (Location); Positioning; Real Time Operation; Synthetic Aperture Radar; Accuracy; Tracking (Position)

19960042830 Ohio Univ., Avionics Engineering Center., Athens, OH USA

Requirements on GNSS for Civil Navigation

vanGraas, F., Ohio Univ., USA; Jun. 1996; 8p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The civil aviation community has had decades of experience in regulating the quality of land-based navigation aids and developing the procedures for their use that guarantee safe operation. The drafting of these principles and procedures into standards for satellite-based navigation aids has now been underway for more than a decade. This lecture will trace the evolution towards interNationally-accepted definitions of 'required navigation performance' including accuracy, integrity, continuity, and availability considerations. Inasmuch as this is an on-going activity, the lecture will include a road map for the completion of actions that are underway.

Author

Civil Aviation; Navigation Aids; Satellite Constellations; Satellite Navigation Systems; Standards; Air Navigation; Air Traffic Control; Aircraft Guidance; Accuracy; Approach Control; InterNational Cooperation

19960042831 Ohio Univ., Avionics Engineering Center., Athens, OH USA

Signals Integrity

vanGraas, F., Ohio Univ., USA; Jun. 1996; 12p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Providers of a global navigation satellite system (GNSS) service will be required to demonstrate that users of their service will be informed within a limited time (now set at ten seconds for terminal area navigation and non-precision approach) of any satellite that fails to operate within its range of acceptable signal quality The lecture will describe approaches to provide this 'integrity' feature including receiver autonomous integrity monitoring (RAIM) as well as systematic approaches that involve augmentations of the navigation satellite constellation. Prominent among these is the wide area augmentation system for the Global Positioning System (GPS).

Author

Area Navigation; Global Positioning System; Satellite Constellations; Navigation Satellites; Integrity; Warning Systems; Air Traffic Control; Position Errors; Position (Location); Fault Detection

19960042832 Ohio Univ., Avionics Engineering Center., Athens, OH USA

GNSS Augmentation for High Precision Navigation Services

vanGraas, F., Ohio Univ., USA; Jun. 1996; 14p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The absolute positioning accuracy of current or planned global navigation satellite system (GNSS) services is not good enough to support Category 3 precision approach and landing requirements, nor is it good enough to support high precision survey applications. The leading solution to this problem is to augment the basic service. the survey community has developed relative positioning techniques based on continuously tracked carrier phase measurements. A static or dynamic user compares accumulated carrier phase measurements to a specific set of satellites with simultaneous measurements taken by a reference receiver at a well surveyed location. The civil aviation community is also exploring 'local area' differential (GPS) concepts in which one or more reference beacons augment the satellite beacons in the vicinity of an airport. The lecture will identify the leading candidates for these augmentations and will characterize predicted performance improvements, and will present results of recent flight tests.

Author

Accuracy; Beacons; Civil Aviation; Global Positioning System; Navigation Satellites; Position (Location); Position Errors; Position Sensing; Geodetic Surveys; Doppler Effect

19960042833 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA

GPS/INS Integration

Phillips, Richard E., Draper (Charles Stark) Lab., Inc., USA; Schmidt, George T., Draper (Charles Stark) Lab., Inc., USA; Jun. 1996; 18p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

An inertial navigation solution exhibits relatively low noise from second to second but tends to drift over time. Typical aircraft inertial navigation errors grow at rates between one and ten nautical miles per hour (1.8 to 18 km/hr) of operation. In contrast global navigation satellite system (GNSS) errors are relatively noisy from second to second but exhibit no long term drift. Using both os these sensors is superior to using either alone. Integrating the information from each sensor results in a navigation system which operates like a drift free INS. There are further benefits to be gained depending on the level at which the information is combined. This presentation will focus on integration architectures including 'loosely coupled ' and 'tightly coupled' configurations. The advantages and disadvantages of each level of integration is listed. Examples of current and future systems will be cited. A performance comparison of 'loosely coupled' and 'tightly coupled' systems will be made. Navigation applications for which integration is essential will be given.

Author

Inertial Navigation; Global Positioning System; Position Errors; Velocity Measurement; Signal to Noise Ratios; Doppler Effect; Systems Integration; Drift (Instrumentation); Multisensor Fusion

19960042834 Calgary Univ., Dept. of Geomatics Engineering., Alberta Canada

Attitude Determination

Lachapelle, Gerard, Calgary Univ., Canada; Jun. 1996; 16p; In English; Also announced as 19960042824; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The fundamental concept of precise attitude determination with multi-antenna Global Positioning System (GPS) receiver technology is described. The characteristics of the observable used for this purpose, namely the carrier phase, are summarized with emphasis on phase noise and multipath which constitute the major error sources. Given a multi-antenna configuration mounted on a rigid platform, the procedure to successively fix the double difference integer carrier phase ambiguity between the nearby antennas, obtain sub cm-level tri-dimensional relative position vectors and transform them into the attitude components, namely roll, pitch, and heading, is described. The two-antenna case, which allows pitch and heading determination, is presented as a special case. Integer ambiguity resolution between the antennas turns out to be relatively easy to achieve with single frequency (L sub 1) data because the differential orbital and atmospheric errors are negligible and the fixed distances can be used as constraints to speed up the ambiguity resolution process. The use of various antenna configurations to recover the carrier phase ambiguities instantaneously is mentioned. The attitude accuracy is a function of several parameters, namely satellite configuration, inter-antenna separation, phase noise and prevailing multipath conditions. Two multi-antenna hardware approaches to the problem of attitude determination are described using various case studies, namely a dedicated multi-antenna receiver approach which allows real-time operation and a multi-GPS sensor approach which can be used in real-time only if the data from each sensor is transferred to a central processor as the measurements are made. If post-mission results only are required, no data links involving the sensors are required since the phase measurements can be precisely synchronized using the time obtained from the code measurements. The effect of signal masking on attitude determination, which is relatively severe due to the carrier phase ambiguity problem is discussed. The effect of relative platform motion, e.g., wing flexure in the case of an aircraft, on attitude determination performance is discussed. The case studies used deal with shipborne, aircraft, and land cases. The

results with several multi-antenna systems deployed in various configurations are presented.
Author
Attitude (Inclination); Global Positioning System; Multipath Transmission; Real Time Operation; Receivers; Position Errors; Antenna Design; Ambiguity; Lateral Oscillation; Radio Antennas

19960043585
Global positioning system, opportunities and problems
Oman, Henry; IEEE Aerospace and Electronic Systems Magazine; July 1995; ISSN 0885-8985; vol. 10, no. 7, pp. 35-39; In English; Copyright; Avail: Issuing Activity

The Global Positioning Satellite System consists of satellites plus control and monitoring stations, opens navigation and positioning uses that were never dreamed of the USAF developers of the GPSS. A discussion of the problems and their solutions are presented in this paper. What this system can do and the improvements being done are discussed. Also presented are the applications of GPSS to civilian users.
Author (EI)
Global Positioning System; Mathematical Models; Satellite Communication; Systems Analysis; Tracking (Position)

19960045946 NASA Ames Research Center, Moffett Field, CA, USA
Development and flight test of terrain-referenced guidance with ladar forward sensor
Zelenka, Richard E., NASA Ames Research Cent, USA; Clark, Raymond F., NASA Ames Research Center, USA; Zirkler, Andre, NASA Ames Research Center, USA; Saari, Ron, NASA Ames Research Center, USA; Branigan, Robert G., NASA Ames Research Center, USA; Journal of Guidance, Control, and Dynamics; July 1996; ISSN 0731-5090; vol. 19, no. 4, pp. 823-828; In English; Copyright; Avail: Issuing Activity

Military aircraft regularly conduct missions that include low-altitude, near-terrain flight to increase covertness and payload effectiveness. Civilian aircraft operate in this regime during airborne fire fighting, police surveillance, search and rescue, and helicopter emergency medical service applications. Several fixed-wing aircraft now employ terrain elevation maps and forward-pointed radars to achieve automated terrain following or terrain avoidance flight. Similar systems specialized to helicopters and their flight regime have not received as much attention. A helicopter guidance system relying on digitized terrain elevation maps has been developed that employs airborne low-altitude trajectory between waypoints. The guidance trajectory is symbolically presented to the pilot on a helmet-mounted display. In this work, a wide field of view laser radar forward sensor has been incorporated into this guidance system to expand the system's operational flight envelope and to assist the pilot in obstacle detection and avoidance. The development and flight test results of this guidance system are presented. Missions to 75 ft altitude at 80 kn in the presence of unmapped natural and man-made obstacles were achieved while the pilot maintained situational awareness and tracking of the guidance trajectory.
Author (EI)
Aircraft Equipment; Flight Tests; Guidance (Motion); Helmet Mounted Displays; Laser Range Finders; Military Helicopters; Optical Radar; Radar Equipment; Sensors

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19960035601 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Rise an d Fall of Dyna-Soar: A History of Air Force Hypersonic R and D, 1944--1963
Houchin, Roy Franklin, II, Air Force Inst. of Tech., USA; Aug. 1995; 521p; In English
Report No.(s): AD-A303832; AFIT-95-016; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

After 8 years of gestation and 11 years of cultivation, the framework underlying the Johnson administration's decision to cancel Dyna-Soar, America's only hypersonic boost-glide program, in December 1963 illustrates the ebb and flow of an advanced technology program within the administrative and political context of modem American society. The decision to cancel Dyna-Soar had several significant consequences. Most important, it ended, at least temporarily, the Air Force's opportunity to use hypersonic flight for military missions. The Air Force's inability to persuade Secretary of Defense Robert S. McNamara and other Department of Defense officials of the wisdom of continuing to build and fly such an advanced transatmospheric vehicle represented the single most important reason for the program's cancellation, overshadowing 11 years of evolutionary development. The complex political-economic-administrative relationship between the Eisenhower and Kennedy administrations, the aerospace industry, NASA, and the Air Force in the late 1950s and early 1960s left NASA as the National leader for hypersonic R&D. Dyna-Soar was not a technological failure. It could have flown. On the other hand, Dyna-Soar's cancellation marked the collapse of the Air Force's political-economic efforts for a hypersonic boost-glider, illustrating the need for a rapid and clear consensus of purpose, single-minded and politically astute leadership, and the near-term attainment of advanced technology. Once Dyna-Soar was cancelled, NASA began to acquire an increasing amount of the Air Force's hypersonic research until its Space Shuttle offered the Air Force another chance for

a joint venture equal in scope to Dyna-Soar. However, this time NASA would be the lead organization.
DTIC
Hypersonic Aircraft; Boostglide Vehicles; Hypersonic Flight; Aerospace Planes; X-20 Aircraft

19960035831 Houston Univ., Dept. of Mechanical Engineering., TX USA
Nondestructive measurement of impact toughness of aircraft windshields ***Final Report, 15 Jul. 1994-15 Oct. 1995***
Ravi-Chandar, K., Houston Univ., USA; Dec. 15, 1995; 39p; In English
Contract(s)/Grant(s): F49620-94-1-0403; AF Proj. 2302
Report No.(s): AD-A303565; AFOSR-TR-96-0004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the results on the project obtained over the past fifteen months. With a view toward establishing a nondestructive procedure for evaluation - of the impact properties of polycarbonate windshield material, we have set up the following experiments (1) a split-Hopkinson bar apparatus for impact strength measurement, (2) an instrumented impact tester for impact toughness measurement and (3) a monochromator with a birefringence measuring Babinet-Soleil compensator for optical characterization. Some polycarbonate specimens have been identified as potential candidates for evaluation of the proposed method. A dynamic crack growth model based on an extension of the Dugdale-Barenblatt has been formulated and solved through a finite difference scheme. This model exhibits many of the features observed in dynamic fracture experiments.
DTIC
Aircraft Parts; Windshields; Monochromators; Impact Strength; Impact Resistance; Fracturing; Crack Propagation; Birefringence

19960038693 Cranfield Univ., College of Aeronautics., Bedford, UK
Design Synthesis for Swept-Wing Combat Aircraft Incorporating Stealth Technology
Siegers, Frank, Cranfield Univ., UK; Oct. 1994; 129p; In English
Contract(s)/Grant(s): FRN1c/405
Report No.(s): COA-9402; ISBN 1-871-564-76-X; Copyright; Avail: Issuing Activity (Defence Research Agency, Farnborough, UK), Hardcopy, Microfiche

Changes in the military procurement environment have meant that combat aircraft must often meet a much wider range of threats and requirements. Apart from the multi-mission role expected of them, stealth technology has become one of the more important drivers behind the aircraft design process. This raises the need for more up-to-date analysis tools which take into account the advanced features of such aircraft. As part of a wider-ranging investigation into the effects of stealth technology on aircraft characteristics, Cranfield University has developed a design synthesis tool which allows the incorporation and analysis of stealth features into aircraft design trade-off studies. A literature survey was conducted in order to select aircraft parameters related to stealth and to determine the feasibility of incorporating them into the preliminary design process. As a supporting measure, an analysis of an existing aircraft design tool was conducted, focusing primarily on the mass and aerodynamics estimation methods. A baseline aircraft was developed by recommending and implementing modifications to the original design synthesis tool.
Author
Aircraft Design; Fighter Aircraft; Swept Wings; Aerodynamics; Computer Aided Design

19960038707 Logistics Management Inst., McLean, VA USA
Demand Forecasting ***Final Report***
Slay, F. Michael, Logistics Management Inst., USA; Aug. 1995; 64p; In English
Contract(s)/Grant(s): DASW01-95-C-0019
Report No.(s): AD-A304813; LMI-AF401LN2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Although the USA Air Force, and other Military Services, forecast failures for many aircraft components on the basis of flying hours, it has long been recognized that the situation is not that simple. New war plans adopted by the Air Force in 1993 and reflecting Desert Storm experience and a regional contingency orientation made it crucial to improve forecasting methods. We examined data for over 200,000 sorties and show that failures for longer sorties are not strictly proportional to flying hours, and quantify the errors caused by assuring that they are. We demonstrate a method for correcting for this error and apply this correction to a number of fighter deployment spares packages. We compute the new costs and test the robustness of the new packages under various scenarios
DTIC
Robustness (Mathematics); Mathematical Models; Aircraft Maintenance; Logistics Management; Aircraft Performance; Prediction Analysis Techniques; Cost Analysis; Downtime; Military Operations; Error Analysis

19960038753 Society of Allied Weight Engineers, Inc., La Mesa, CA USA
Method for balancing VTOL/STOVL aircraft
Sanders, Karl L., Society of Allied Weight Engineers, Inc., USA; Jun. 05, 1996; 30p; In English; 55th; Annual Conference of the Society of Allied Weight Engineers, 3-5 Jun. 1996, Atlanta, GA, USA; Sponsored by Society of Allied Weight Engineers, Inc., USA
Report No.(s): SAWE-2329; Copyright; Avail: Issuing Activity (S.A.W.E. 5530 Aztec Dr., La Mesa, CA 91942), Hardcopy, Microfiche

A closed-solution balance procedure for the preliminary design of VTOL/STOVL aircraft is presented. The effects of various propulsion concepts on balance and aerodynamic configuration are discussed. It is shown that for a CG location, specified in percentage of MAC, the problem reduces to solving, two simultaneous linear equations for the required engine and wing locations, respectively. In contrast, when the CG location is implicitly expressed in terms of longitudinal stability and horizontal tail size parameters, the equations will be non-linear.
Author (revised)
STOVL Aircraft; Vertical Takeoff Aircraft; Aerodynamic Balance; Aircraft Design; Longitudinal Stability

19960041232 California Polytechnic State Univ., Aeronautical Engineering Dept., San Luis Obispo, CA USA
Utilization of an agility assessment module in analysis and optimization of preliminary fighter configuration
Ngan, Angelen, California Polytechnic State Univ., USA; Biezad, Daniel, California Polytechnic State Univ., USA; 1996; 12p; In English
Contract(s)/Grant(s): NCC2-834
Report No.(s): NASA-CR-201887; NAS 1.26:201887; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

A study has been conducted to develop and to analyze a FORTRAN computer code for performing agility analysis on fighter aircraft configurations. This program is one of the modules of the NASA Ames ACSYNT (AirCraft SYNThesis) design code. The background of the agility research in the aircraft industry and a survey of a few agility metrics are discussed. The methodology, techniques, and models developed for the code are presented. The validity of the existing code was evaluated by comparing with existing flight test data. A FORTRAN program was developed for a specific metric, PM (Pointing Margin), as part of the agility module. Example trade studies using the agility module along with ACSYNT were conducted using a McDonnell Douglas F/A-18 Hornet aircraft model. Tile sensitivity of thrust loading, wing loading, and thrust vectoring on agility criteria were investigated. The module can compare the agility potential between different configurations and has capability to optimize agility performance in the preliminary design process. This research provides a new and useful design tool for analyzing fighter performance during air combat engagements in the preliminary design.
Author
Aircraft Configurations; Fighter Aircraft; Aircraft Design; Design Analysis; Applications Programs (Computers); Structural Analysis

19960041233 NASA Dryden Flight Research Center, Edwards, CA USA
Methods for in-flight robustness evaluation
Brenner, Marty, NASA Dryden Flight Research Center, USA; Paduano, James D., Massachusetts Inst. of Tech., USA; Feron, Eric, Massachusetts Inst. of Tech., USA; Sep. 25, 1995; 26p; In English
Contract(s)/Grant(s): NCC2-5116
Report No.(s): NASA-CR-201886; NAS 1.26:201886; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this program was to combine modern control concepts with new identification techniques to develop a comprehensive package for estimation of 'robust flutter boundaries' based on experimental data. The goal was to use flight data, combined with a fundamental physical understanding of flutter dynamics, to generate a prediction of flutter speed and an estimate of the accuracy of the prediction. This report is organized as follows: the specific contributions of this project will be listed first. Then, the problem under study will be stated and the general approach will be outlined. Third, the specific system under study (F- 18 SRA) will be described and a preliminary data analysis will be performed. Then, the various steps of the flutter boundary determination will be outlined and applied to tile F-18 SRA data and others.
Derived from text
Robustness (Mathematics); Flight Control; Control Theory; Flutter; Prediction Analysis Techniques; Flutter Analysis; Applications Programs (Computers)

19960044378 NASA Ames Research Center, Moffett Field, CA USA
Aeroelastic Stability of a Full-Scale Hingeless Rotor
Peterson, Randall L., NASA Ames Research Center, USA; Nguyen, Khanh, NASA Ames Research Center, USA; Aug. 1996; 126p; In English
Contract(s)/Grant(s): RTOP 505-59-36
Report No.(s): NASA-TM-110417; A-962528; NAS 1.15: 110417; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A full-scale BO-105 hingeless rotor system was tested in the Ames 40- by 80-Foot Wind Tunnel on the rotor test apparatus. Rotor performance, blade and rotor hub loads, and aeroelastic stability as functions of rotor lift, tunnel velocity, and shaft angle were investigated. The primary objective of this test program was to create a data base for full-scale hingeless rotor performance, structural blade loads, and aeroelastic stability. A secondary objective was to investigate the ability to match flight test conditions in the wind tunnel. This data base can be used for the experimental and analytical studies of hingeless rotor systems over large variations in rotor thrust and tunnel velocity. Aeroelastic stability data and the corresponding rotor performance data and test conditions for tunnel velocities from hover to 140 knots and thrust coefficients (C(sub T)/sigma) from 0.0 to 0. 10 are presented in this report. The rotor was found to be stable at all conditions tested.
Author
Aeroelasticity; Aerodynamic Stability; Bo-105 Helicopter;

Hovering; Loads (Forces); Rigid Rotors; Rotor Lift; Shafts (Machine Elements); Rotary Wings

19960045612 Naval Postgraduate School, Monterey, CA USA

Development and Testing of a VTOL UAV

Cibula, Andrew L., Naval Postgraduate School, USA; Jun. 1995; 101p; In English

Report No.(s): AD-A304252; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The purpose of this project was to develop a testing platform to prepare a Vertical Takeoff and Landing Unmanned Air Vehicle (VTOL UAV) for fully independent flight tests. Other preparations for flight included extensive engine thrust and endurance testing to fully evaluate the capabilities of the engine used. Also, redesign of the fuel system all owed more efficient use of the fuel onboard. Commands for thrust and steering data were transmitted to the VTOL UAV via an RF uplink while UAV attitude and positional data were returned by means of an umbilical cable. Throttle settings, vane control, and a kill switch were incorporated in the RF uplink. The testing platform was developed to allow the VTOL UAV to hover in a confined area with limited movement in order to accurately monitor the effectiveness of the flight control system. In this regard, the vehicle was allowed only several feet of movement in any direction by fastening it in an aluminum cube frame designed for this purpose. This thesis was carried out in conjunction with another flight control project and was aimed at providing the vehicle a platform in which to operate within a constricted area.

DTIC

Attitude (Inclination); Vertical Takeoff Aircraft; Flight Control; Flight Tests; Fuel Systems; Hovering; Pilotless Aircraft

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19960039901 NASA Langley Research Center, Hampton,VA USA

Managing Approach Plate Information Study (MAPLIST): An Information Requirements Analysis of Approach Chart Use

Ricks, Wendell R., NASA Langley Research Center, USA; Jonnson, Jon E., McDonnell-Douglas Aerospace, USA; Barry, John S., Lockheed Engineering and Sciences Co., USA; Feb. 1996; 82p; In English

Contract(s)/Grant(s): RTOP 505-64-13-22

Report No.(s): NASA-TP-3561; L-17477; NAS 1.60:3561; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Adequately presenting all necessary information on an approach chart represents a challenge for cartographers. Since many tasks associated with using approach charts are cognitive (e.g., planning the approach and monitoring its progress), and since the characteristic of a successful interface is one that conforms to the users' mental models, understanding pilots' underlying models of approach chart information would greatly assist cartographers. to provide such information, a new methodology was developed for this study that enhances traditional information requirements analyses by combining psychometric scaling techniques with a simulation task to provide quantifiable links between pilots' cognitive representations of approach information and their use of approach information. Results of this study should augment previous information requirements analyses by identifying what information is acquired, when it is acquired, and what presentation concepts might facilitate its efficient use by better matching the pilots' cognitive model of the information. The primary finding in this study indicated that pilots mentally organize approach chart information into ten primary categories: communications, geography, validation, obstructions, navigation, missed approach, final items, other runways, visibility requirement, and navigation aids. These similarity categories were found to underlie the pilots' information acquisitions, other mental models, and higher level cognitive processes that are used to accomplish their approach and landing tasks.

Author

Information; Navigation Aids; Charts

19960042886 NASA Dryden Flight Research Center, Edwards, CA USA

Coherent Lidar Turbulence Measurement for Gust Load Alleviation

Bogue, Rodney K., NASA Dryden Flight Research Center, USA; Ehernberger, L. J., NASA Dryden Flight Research Center, USA; Soreide, David, Soreide (David), USA; Bagley, Hal, Coherent Technologies, Inc., USA; Aug. 1996; 22p; In English; SPIE 1996 InterNational Symposium on Optical Science, Engineering, and Instrumentation, 4-9 Aug. 1996, Denver, CO, USA

Contract(s)/Grant(s): RTOP 505-69-59

Report No.(s): NASA-TM-104318; NAS 1.15:104318; H-2117; SPIE Paper 2832-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Atmospheric turbulence adversely affects operation of commercial and military aircraft and is a design constraint. The airplane structure must be designed to survive the loads imposed by turbulence. Reducing these loads allows the airplane structure to be lighter, a substantial advantage for a commercial airplane. Gust alleviation systems based on accelerometers mounted in the airplane can reduce the maximum gust loads by a small fraction. These systems still represent an economic advantage. The ability to reduce the gust load increases tremendously if the turbulent gust can be mea-

sured before the airplane encounters it. A lidar system can make measurements of turbulent gusts ahead of the airplane, and the NASA Airborne Coherent Lidar for Advanced In-Flight Measurements (ACLAIM) program is developing such a lidar. The ACLAIM program is intended to develop a prototype lidar system for use in feasibility testing of gust load alleviation systems and other airborne lidar applications, to define applications of lidar with the potential for improving airplane performance, and to determine the feasibility and benefits of these applications. This paper gives an overview of the ACLAIM program, describes the lidar architecture for a gust alleviation system, and describes the prototype ACLAIM lidar system.
Author
Gusts; In-Flight Monitoring; Feasibility Analysis; Optical Radar; Charge Flow Devices

19960042940 Galaxy Scientific Corp., Mays Landing, NJ USA
Digital Systems Validation Handbook, Volume 3. Design, Test, and Certification Issues for Complex Integrated Circuits-Chapter 2 ***Final Report***
Harrison, L., Galaxy Scientific Corp., USA; Landell, B., Galaxy Scientific Corp., USA; Jul. 1996; 70p; In English
Contract(s)/Grant(s): DTFA03-89-C-00043
Report No.(s): DOT/FAA/AR-95/31; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This chapter provides an overview of complex integrated circuit technology, focusing particularly upon application specific integrated circuits. This report is intended to assist FAA certification engineers in making safety assessments of new technologies. It examines complex integrated circuit technology, focusing on three fields: design, test, and certification. It provides the reader with the background and a basic understanding of the fundamentals of these fields. Also included is material on the development environment, including languages and tools. Application specific integrated circuits are widely used in Boeing 777 fly-by-wire aircraft. Safety issues abound for these integrated circuits when they are used in safety-critical applications. Since control laws are now executed in silicon and transmitted from one integrated circuit to another, reliability issues for these integrated circuits take on a new importance. This report identifies certification risks relating to the use of complex integrated circuits in fly-by-wire applications.
Author
Application Specific Integrated Circuits; Certification; Handbooks; Fly by Wire Control; Circuit Reliability; Experiment Design; Electronic Equipment Tests

19960045986
Sensor developments
Trego, Linda; Aerospace Engineering (Warrendale, Pennsylvania); July 1996; ISSN 0736-2536; vol. 16, no. 7, pp. 13-15; In English; Copyright; Avail: Issuing Activity

The proper operation of many aircraft systems depends on the precise, rapid measurement of numerous parameters. to this end, sensors play a key role in ensuring that aircraft instrumentation systems operate properly and safely. At present, two types of sensors are being used; position sensors and condition sensors. Position sensors or proximity sensors are used to indicate when the component being measured is near a set position. Condition sensors on one hand, are used to measure air conditioning and heating system parameters.
Author (EI)
Actuators; Aerospace Engineering; Aircraft Instruments; Avionics; Computers; Measuring Instruments; Pressure Sensors; Proximity; Sensors

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.

19960035825 United Technologies Research Center, East Hartford, CT USA
Heat Transfer Experiments in the Internal Cooling Passages of a Cooled Radial Turbine Rotor
Johnson, B. V., United Technologies Research Center, USA; Wagner, J. H., United Technologies Research Center, USA; May 1996; 120p; In English
Contract(s)/Grant(s): NAS3-25952; RTOP 505-62-10
Report No.(s): NASA-CR-198492; E-10155; NAS 1.26: 198492; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

An experimental study was conducted (1) to experimentally measure, assess and analyze the heat transfer within the internal cooling configuration of a radial turbine rotor blade and (2) to obtain heat transfer data to evaluate and improve computational fluid dynamics (CFD) procedures and turbulent transport models of internal coolant flows. A 1.15 times scale model of the coolant passages within the NASA LERC High Temperature Radial Turbine was designed, fabricated of Lucite and instrumented for transient beat transfer tests using thin film surface thermocouples and liquid crystals to indicate temperatures. Transient heat transfer tests were conducted for Reynolds numbers of one-fourth, one-half, and equal to the operating Reynolds number for the NASA Turbine. Tests were conducted for stationary and rotating conditions with rotation numbers in the range occurring in the NASA Turbine. Results from the experiments showed the heat transfer characteristics within the coolant passage were affected by rotation. In general, the heat transfer increased and decreased on the sides of the straight radial passages with rotation as previously reported from NASA-HOST-sponsored experiments. The heat transfer in the tri-passage axial flow region adjacent to

the blade exit was relatively unaffected by rotation. However, the heat transfer on one surface, in the transitional region between the radial inflow passage and axial, constant radius passages, decreased to approximately 20 percent of the values without rotation. Comparisons with previous 3-D numerical studies indicated regions where the heat transfer characteristics agreed and disagreed with the present experiment.
Author
Turbine Blades; Internal Flow; Radial Flow; Thermocouples; Thin Films; Cooling; Transient Heating; Temperature Measurement; Turbulent Flow

19960038355 Allison Engine Co., Indianapolis, IN USA
Wave rotor demonstrator engine assessment
Snyder, Philip H., Allison Engine Co., USA; Jun. 1996; 76p; In English
Contract(s)/Grant(s): NAS3-25950; RTOP 505-62-10
Report No.(s): NASA-CR-198496; NAS 1.26:198496; E-10307; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The objective of the program was to determine a wave rotor demonstrator engine concept using the Allison 250 series engine. The results of the NASA LERC wave rotor effort were used as a basis for the wave rotor design. A wave rotor topped gas turbine engine was identified which incorporates five basic requirements of a successful demonstrator engine. Predicted performance maps of the wave rotor cycle were used along with maps of existing gas turbine hardware in a design point study. The effects of wave rotor topping on the engine cycle and the subsequent need to rematch compressor and turbine sections in the topped engine were addressed. Comparison of performance of the resulting engine is made on the basis of wave rotor topped engine versus an appropriate baseline engine using common shaft compressor hardware. The topped engine design clearly demonstrates an impressive improvement in shaft horsepower (+11.4%) and SFC (-22%). Off design part power engine performance for the wave rotor topped engine was similarly improved including that at engine idle conditions. Operation of the engine at off design was closely examined with wave rotor operation at less than design burner outlet temperatures and rotor speeds. Challenges identified in the development of a demonstrator engine are discussed. A preliminary design was made of the demonstrator engine including wave rotor to engine transition ducts. Program cost and schedule for a wave rotor demonstrator engine fabrication and test program were developed.
Author
Rotors; Turbines; Shafts (Machine Elements); Gas Turbine Engines; Engine Tests; Ducted Flow; Compressors

19960038735 Naval Postgraduate School, Monterey, CA USA
Investigation of Second Generation Controlled-Diffusion Compressor Blades in Cascade
Hansen, Dennis J., Naval Postgraduate School, USA; Sep. 1995; 146p; In English
Report No.(s): AD-A304897; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Detailed experimental investigation of second generation controlled-diffusion compressor stator blades at design inlet-flow angle was performed in a low-speed cascade wind tunnel using various experimental methods. Surface pressure measurements were obtained using three instrumented blades, from which coefficients of pressure were calculated. Laser-Doppler velocimetry was used to characterize the flow in the inlet, in the passage between two blades, in the boundary layer of the blades, and in the wake. A five-hole pressure probe was used to determine the loss coefficient and the axial-velocity-density ratio of the flow through the cascade. Although the blades produced significant lift, separated flow was discovered on the suction side of the blades at approximately fifty percent axial chord, which showed that the design was not totally successful. All the experimental measurements were performed at an inlet flow Mach number of 0.22 and a Reynolds number, based on chord length, of 640,000. Experimental blade-surface pressure coefficients were compared with values predicted using a computational fluid dynamics code. These initial predictions did not match well with the experimental results.
DTIC
Compressor Blades; Wind Tunnel Tests; Stator Blades; Wakes; Pressure Distribution; Aircraft Engines; Gas Turbine Engines; Inlet Flow; Turbine Blades

19960044396 Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo, Japan
Analysis of Mixing Flows for the Hyper-Supersonic Transport Propulsion System
Oishi, Tsutomu, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Hirai, Kenji, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Kodama, Hidekazu, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Miyagi, Hiroyuki, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Yamamoto, Makoto, Science Univ. of Tokyo, Japan; Tamura, Atsuhiro, National Aerospace Lab., Japan; Kikuchi, Kazuo, National Aerospace Lab., Japan; Nozaki, Osamu, National Aerospace Lab., Japan; Proceedings of the 13th NAL Symposium on Aircraft Computational Aerodynamics; Jan. 1996, pp. 65-68; In Japanese; Also announced as 19960044384; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

There are many mixing flows on a hyper-supersonic transport propulsion system. For instance, the mixing between the exhaust jet and the entrained flow in the mixer-ejector nozzle to reduce the noise level at takeoff and the mixing between the ram air and the turbo air in the front mixing compartment operating for the dual mode of the hyper-supersonic transport propulsion system. In the research and development of this system it is very useful to predict the mixing

characteristics for component design and to improve the performance of this system. In this paper the comparison between the analysis results and test results of the above mentioned two types of flow are reported.
Author
Supersonic Transports; Engine Design; Exhaust Nozzles; Exhaust Gases; Mixing Ratios; Hypersonic Aircraft; Propulsion System Performance; Multiphase Flow

08
AIRCRAFT STABILITY AND CONTROL

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

19960035442 Air Force Flight Test Center, Edwards AFB, CA USA
A Limited Evaluation of Predicting Pilot Opinion of Aircraft Handling Qualities in the Landing Phase of Flight Using the Control Anticipation Parameter and Bandwidth Criteria (HAVE CAP) ***Final Report, Jul. - Dec. 1995***
Kivioja, David A., Air Force Flight Test Center, USA; McCann, Christopher C., Air Force Flight Test Center, USA; Schaible, Mark R., Air Force Flight Test Center, USA; Larson, David N., Air Force Flight Test Center, USA; McEachen, James C., Air Force Flight Test Center, USA; Jan. 1996; 256p; In English
Report No.(s): AD-A303804; AFFTC-TR-95-78; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This technical report presents the results of a limited evaluation of predicting pilot opinion of aircraft handling qualities in the landing phase of flight using the control anticipation parameter (CAP) and bandwidth criteria. The objective of this flight-test was to evaluate the validity of predicting pilot opinion using the CAP and bandwidth criteria. The CAP was defined as in MIL-STD-1797A, Flying Qualities of Piloted Aircraft. The bandwidth criterion used the current definition in MIL-STD-1 797A along with a new dropback criterion. Actual pilot opinion was obtained by flying the Variable-Stability In-Flight Simulator Test Aircraft (VISTA) NF-1 6D in the approach and landing phase of flight. Testing was requested by the Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, and was conducted under the authority of the Commandant, USAF Test Pilot School. The results of this test will be used to revise the short-term pitch response requirements in MIL-STD- 1 797B. This flight-test complemented research done by the Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio (WL/FIGC), in predicting pilot opinion during the landing phase of flight.
DTIC
Controllability; Flight Characteristics; Aircraft Landing; Flight Simulators; Aircraft Control; Flight Control

19960035676 Air Force Inst. of Tech., School of Engineering., Wright-Patterson AFB, OH USA
Dynamic Transfer of Control Between Manned and Unmanned Simulation Actors
Schneider, Neal W., Air Force Inst. of Tech., USA; Dec. 1995; 68p; In English
Report No.(s): AD-A303553; AFIT/GE/ENG/95D-24; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis continues the ongoing research at the Air Force Institute of Technology's Virtual Environments Laboratory in the area of distributed simulation. As the relevance and interest of interactive simulation as a training medium continues to grow, there is a pressing need to provide more realistic and numerous intelligent autonomous agents for simulations. As those autonomous agents mature and become more realistic, the need exists to be able to handle individual agents by taking control of them and operating them as manned agents at certain points within the simulation. The author started with a protocol proposed in a working draft of the Distributed Interactive Simulation (DIS) Protocol Standard 2.1.1 (Draft). He demonstrates how this protocol can be improved by swapping control between two entities involved in a distributed simulation. The new protocol provides simultaneous transfer while being compatible with the one proposed in the draft standard. Th e protocol is implemented on two applications developed in the Virtual Environments Laboratory, the Virtual Cockpit (VC) and the Automated Wingman (AW). The anticipated flow of execution begins with the AW requesting assistance. The operator of the VC then can reply by assuming control of the AW. Once the required human operation has been performed, the operator may switch back to the lead aircraft, completing the full cycle of execution.
DTIC
Cockpits; Aircraft Pilots; Computerized Simulation; Dynamic Control; Education

19960036908 Defence Science and Technology Organisation, Canberra, Australia
An Operator's Perspective of RAAF Command and Support Systems
Clothier, J., Defence Science and Technology Organisation, Australia; O'Neill, J., Defence Science and Technology Organisation, Australia; Oct. 1995; 45p; In English
Report No.(s): AD-A304082; DSTO-CR-0005; DODA-AR-009-428; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

DSTO investigated future Command Support System requirements for the RAAF as part of Task Air 93/025 RAAF Command Support Working Group Study. This document demonstrates how a Command Support System can be used to support Air Command personnel performing their work. A Future Day in the Life of Air Command using these Command Support Systems is described. For each key event, an example is drawn from the prototypes to demonstrate how the event

was implemented, and the event is then linked back to the Organizational Analysis.
DTIC
Support Systems; Command and Control

19960038714 Naval Postgraduate School, Monterey, CA USA
A Comparison of Flight Input Techniques for Parameter Estimation of Highly-Augmented Aircraft
Gates, Russell J., Naval Postgraduate School, USA; Sep. 1995; 119p; In English
Report No.(s): AD-A304905; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Parameter estimation is an inverse process in which stability derivatives are determined from time history flight data by matching the aircraft mathematical model's computed response with the measured response of the aircraft. Accurate parameter estimation depends mainly on instrumentation and input technique. Input technique is the focus of this thesis in which both classical inputs and optimal inputs were applied under the same flight conditions to the High Angle of Attack Research Vehicle (HARV) at NASA Dryden Flight Research Center. Post flight parameter estimation was conducted in all cases using a maximum likelihood technique to determine estimated of stability and control derivatives and their respective Cramer-Rao bounds. The Cramer-Rao bound is the most useful measure of estimate accuracy when comparing results from different input techniques assuming the same mathematical model and minimization technique were used for the parameter estimates. Comparison of the Cramer-Rao bounds showed that of the four input techniques used for determining parameter estimates, the Dryden single-surface input technique yielded the most accurate parameters for 75 percent of the estimates in all cases. Application of these conclusions in further research can save time and costs.
DTIC
Parameter Identification; Maximum Likelihood Estimates; Mathematical Models; Aerodynamic Stability; Longitudinal Stability; Lateral Stability; Angle of Attack; Research Vehicles

19960041445 NASA Langley Research Center, Hampton, VA USA
Design of a mixer for the thrust-vectoring system on the high-alpha research vehicle
Pahle, Joseph W., NASA Dryden Flight Research Center, USA; Bundick, W. Thomas, NASA Langley Research Center, USA; Yeager, Jessie C., Lockheed Engineering and Sciences Co., USA; Beissner, Fred L., Jr., Lockheed Engineering and Sciences Co., USA; Jun. 1996; 44p; In English
Contract(s)/Grant(s): RTOP 505-68-30-05
Report No.(s): NASA-TM-110228; NAS 1.15:110228; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the advanced control concepts being investigated on the High-Alpha Research Vehicle (HARV) is multi-axis thrust vectoring using an experimental thrust-vectoring (TV) system consisting of three hydraulically actuated vanes per engine. A mixer is used to translate the pitch-, roll-, and yaw-TV commands into the appropriate TV-vane commands for distribution to the vane actuators. A computer-aided optimization process was developed to perform the inversion of the thrust-vectoring effectiveness data for use by the mixer in performing this command translation. Using this process a new mixer was designed for the HARV and evaluated in simulation and flight. An important element of the Mixer is the priority logic, which determines priority among the pitch-, roll-, and yaw-TV commands.
Author
Control Systems Design; Flight Simulation; Thrust Vector Control; Flight Control; Flight Tests; Vanes

19960042491 NASA Dryden Flight Research Center, Edwards, CA USA
Structural dynamic model obtained from flight use with piloted simulation and handling qualities analysis
Powers, Bruce G., Analytical Services and Materials, Inc., USA; Jun. 1996; 30p; In English
Contract(s)/Grant(s): RTOP 537-09-22
Report No.(s): NASA-TM-4747; NAS 1.15:4747; H-2075; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ability to use flight data to determine an aircraft model with structural dynamic effects suitable for piloted simulation. and handling qualities analysis has been developed. This technique was demonstrated using SR-71 flight test data. For the SR-71 aircraft, the most significant structural response is the longitudinal first-bending mode. This mode was modeled as a second-order system, and the other higher order modes were modeled as a time delay. The distribution of the modal response at various fuselage locations was developed using a uniform beam solution, which can be calibrated using flight data. This approach was compared to the mode shape obtained from the ground vibration test, and the general form of the uniform beam solution was found to be a good representation of the mode shape in the areas of interest. To calibrate the solution, pitch-rate and normal-acceleration instrumentation is required for at least two locations. With the resulting structural model incorporated into the simulation, a good representation of the flight characteristics was provided for handling qualities analysis and piloted simulation.
Author
Aircraft Models; SR-71 Aircraft; Flight Characteristics; Modal Response; Structural Design Criteria; Aircraft Design; Maneuverability; Dynamic Models; Vibration Simulators

19960042878 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics., Cambridge, MA USA

Evaluation for vibrotactile systems in helicopter hover and EVA environments ***Quarterly Report, 1 Sep. - 30 Nov. 1995***

Newman, Dava J., Massachusetts Inst. of Tech., USA; Dec. 18, 1995; 6p; In English

Contract(s)/Grant(s): N00014-95-1-1312

Report No.(s): AD-A303353; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The vibrotactile (VT) advanced technology demonstration (ATD) introduces a novel human-machine interface, namely, haptic stimulation through a VT suit to improve military personnel performance. The complete vibrotactile (VT) suit system will include three main components: a sensor package to acquire motion and orientation information, a control computer that will condition and convert the sensor information into output drive signals, and the VT suit for the test pilots. Design solutions for a navigation sensor package to be used in helicopter hover and extravehicular activity (EVA) environments is currently being undertaken. Integrating an Inertial Navigation System (INS) with the Global Positioning System (GPS) has provided numerous benefits, and with the recent advances in Kalman filtering techniques, the number continues to grow. In addition to increased navigation accuracy under dynamic conditions, tracking accuracy has improved, CPU time has decreased and crew workload has decreased. The dual IN/GP system has already proven its strength in a variety of capacities such as helicopter flight path control, flight path management, flight testing and helicopter approach. While research efforts continue to establish a portfolio for this dual system, much of the present attention had been given to reducing the development and acquisition costs. DTIC

Man Machine Systems; Global Positioning System; Flight Paths; Flight Tests; Helicopter Control; Hovering; Extravehicular Activity

19960042888 NASA Ames Research Center, Moffett Field, CA USA

Moving base simulation evaluation of translational rate command systems for STOVL aircraft in hover

Franklin, James A., NASA Ames Research Center, USA; Stortz, Michael W., NASA Ames Research Center, USA; Jun. 1996; 28p; In English

Contract(s)/Grant(s): RTOP 505-68-33

Report No.(s): NASA-TM-110399; NAS 1.15:110399; A-961718; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Using a generalized simulation model, a moving-base simulation of a lift-fan short takeoff/vertical landing fighter aircraft has been conducted on the Vertical Motion Simulator at Ames Research Center. Objectives of the experiment were to determine the influence of system bandwidth and phase delay on flying qualities for translational rate command and vertical velocity command systems. Assessments were made for precision hover control and for landings aboard an LPH type amphibious assault ship in the presence of winds and rough seas. Results obtained define the boundaries between satisfactory and adequate flying qualities for these design features for longitudinal and lateral translational rate command and for vertical velocity command.

Author

Hovering; V/STOL Aircraft; STOVL Aircraft; Flight Control; Flight Characteristics; Vertical Motion Simulators; Command Guidance

19960043584

Features of active sidestick controllers

Hegg, Jeffrey W., Honeywell, Inc, USA; Smith, Marion P.; Yount, Larry; Todd, John; IEEE Aerospace and Electronic Systems Magazine; July 1995; ISSN 0885-8985; vol. 10, no. 7, pp. 31-34; In English; Copyright; Avail: Issuing Activity

This paper discusses the advantages of incorporating active sidesticks into a modern aircraft cockpit. Active sidestick controllers for manual pilot inputs in pitch and roll are examined for commercial transport aircraft. Options and requirements for sidesticks are reviewed. The recommendation of an active sidestick controller is developed providing both cross-cockpit coupling and autopilot backdrive capability. These characteristics provide pilot cues identical to traditional cable-linked column/yoke configurations.

Author (EI)

Automatic Pilots; Cockpits; Control Equipment; Cross Coupling; Servomechanisms; Transport Aircraft

19960044512 NASA Langley Research Center, Hampton, VA USA

Design Specification for a Thrust-Vectoring, Actuated-Nose-Strake Flight Control Law for the High-Alpha Research Vehicle

Bacon, Barton J., NASA Langley Research Center, USA; Carzoo, SUSAn W., NASA Langley Research Center, USA; Davidson, John B., NASA Langley Research Center, USA; Hoffler, Keith D., NASA Langley Research Center, USA; Lallman, Frederick J., NASA Langley Research Center, USA; Messina, Michael D., NASA Langley Research Center, USA; Murphy, Patrick C., NASA Langley Research Center, USA; Ostroff, Aaron J., NASA Langley Research Center, USA; Proffitt, Melissa S., NASA Langley Research Center, USA; Yeager, Jessie C., NASA Langley Research Center, USA; Foster, John V., NASA Langley Research Center, USA; Bundick, W. Thomas, NASA Langley Research Center, USA; Connelly, Patrick J., NASA Dryden Flight Research Center, USA; Kelly, John W., NASA Dryden Flight Research Center, USA; Pahle, Joseph W., NASA Dryden Flight Research Center, USA; Thomas, Michael, NASA Dryden Flight Research Center, USA; Wichman, Keith D., NASA Dryden Flight Re-

search Center, USA; Wilson, R. Joseph, NASA Dryden Flight Research Center, USA; May 1996; 122p; In English
Contract(s)/Grant(s): RTOP 505-68-30-05
Report No.(s): NASA-TM-110217; NAS 1.15:110217; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Specifications for a flight control law are delineated in sufficient detail to support coding the control law in flight software. This control law was designed for implementation and flight test on the High-Alpha Research Vehicle (HARV), which is an F/A-18 aircraft modified to include an experimental multi-axis thrust-vectoring system and actuated nose strakes for enhanced rolling (ANSER). The control law, known as the HARV ANSER Control Law, was designed to utilize a blend of conventional aerodynamic control effectors, thrust vectoring, and actuated nose strakes to provide increased agility and good handling qualities throughout the HARV flight envelope, including angles of attack up to 70 degrees.
Author
Flight Control; Thrust Vector Control; Applications Programs (Computers); Research Vehicles; Angle of Attack; Aircraft Control

19960045985
Design of CCV flight control system having adaptive observer
Uchikado, Shigeru, Tokyo Denki Univ, Japan; Osa, Yasuhiro; Kanai, Kimio; Transactions of the Japan Society for Aeronautical and Space Sciences; May 1996; ISSN 0549-3811; vol. 39, no. 123, pp. 74-86; In English; Copyright; Avail: Issuing Activity

In this paper we deal with a design of CCV adaptive flight control system having an adaptive observer under the microburst circumstances. First, a design of the adaptive observer is proposed where we make used of only the observability indices of the controlled system as a priori knowledge. Here, the system is a general multivariable one, that is, its observability indices are different from each other and it is not necessary that the system be cyclic. The unknown interactor matrix, which plays an important role in a design of the multivariable controller, can be estimated in terms of the identified parameters. Next, CCV adaptive flight control law is calculated based upon the estimated ones. The control law adopts a conventional servo mechanism so that this adaptive system can overcome the effects of disturbances. Finally, the proposed CCV adaptive flight controller is applied to STOL flying boat and numerical simulations under the microburst circumstances are shown to justify the proposed scheme.
Author (EI)
Adaptive Control; Control Systems Design; Flight Control; Multivariable Control; Observability (Systems)

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.

19960034219 Federal Aviation Administration, Aviation Security Research and Development Service., Atlantic City, NJ USA
Dupe Checklist System. Resolution Procedures Manual *Final Report*
Fobes, J. L., Federal Aviation Administration, USA; Dec. 1995; 30p; In English
Contract(s)/Grant(s): DTFA03-93-C-00042
Report No.(s): AD-A303791; DOT/FAA/AR-95/39; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Resolution Procedures Manual is one of five security reference handbooks providing background information, guidelines and procedures regarding passenger questioning and resolutions in conjunction with the Dupe Checklist (DCS) Program. It is intended to be used for operational guidance and/or training activities. A passenger may be duped into carrying a bomb on board an aircraft under the following circumstances: (1) A bomb is placed in an unsuspecting passenger's unattended baggage; (2) An unsuspecting passenger is given a bag to transport on his/her flight. A bomb is concealed inside the bag; (3) An unsuspecting passenger is given an item or a package to transport on his/her flight. The item/package contains a bomb: (4) An unsuspecting passenger is given a 'gift' just prior to the flight. The gift contains a bomb; (5) A passenger may believe that he/she is involved in some type of illegal activity. Such a passenger may believe that his/her bag contains contraband (e.g. drugs, gold, cash, or diamonds). The passenger is not aware of the true contents of his/her bag (a bomb); (6) A passenger who is a terrorist, or a terrorist group sympathizer, may believe he/she is transferring confidential material or an explosive to his/her destination. In reality the passenger is carrying a bomb setup to go off on his/her flight. DTIC
Airline Operations; Passengers; Security; Airport Security; Vulnerability; Handbooks; Passenger Aircraft; Drugs; Explosives Detection

19960034226 Federal Aviation Administration, Technical Center., Atlantic City, NJ USA
FAA K-9 Program Quality Control Aid Test and Evaluation Plan *Final Report*
Cormier, Stephen, Federal Aviation Administration, USA; Fobes, J. L., Federal Aviation Administration, USA; Hallowell, SUSAn F., Federal Aviation Administration, USA; Barrientos, J. M., Federal Aviation Administration, USA; Fischer, Douglas S., Galaxy Scientific Corp., USA; Dec. 1995; 63p; In English
Contract(s)/Grant(s): DTFA03-92-C-00035

Report No.(s): AD-A303798; DOT/FAA/AR-95/124; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document is a Test and Evaluation Plan for an operational test and evaluation of quality control aids (QCAs) for training and testing of the FAA sponsored K-9 teams. Actual explosives and QCAs will be operationally tested for three types of explosives: double-based smokeless powder, TNT, and C4. The three configurations of each QCA include a cloth patch treated with a pure solution, a cloth pouch treated with a granular composite mixture, and a non-hazardous explosive for security training and testing (NESTT) material. This total of nine QCAs will be evaluated to determine the optimal configuration for the QCAs. The results of the OT&E will be used to select leading candidate QCAs for further evaluation under field operational conditions.

DTIC

Airport Security; Commercial Aircraft; Explosives; Dogs

19960034243 Schofield (Andrew N.) and Associates Ltd., Cambridge, UK

Acceptance. phase 5. acutronic 684-1 centrifuge *Final Report*

Schofield, Andrew N., Principal Investigator, Schofield (Andrew N.) and Associates Ltd., UK; Steedman, R. S., Schofield (Andrew N.) and Associates Ltd., UK; Jan. 01, 1996; 9p; In English

Contract(s)/Grant(s): N68171-95-C-9146

Report No.(s): AD-A303531; Rept.-26-05-R-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report is one of a series of reports by ANS&A Ltd prepared as a part of ANS&A's research under their response to the BAA of December 1988, addressing the completion of the manufacture and assembly stage of the Acutronic 684-1 centrifuge in France during the summer of 1995. The completion of the centrifuge assembly and the Factory A cceptance procedures in France during 1995 was a critical period of intense activity during which ANS&A provided a close technical overview of the work of the Acutronic and TLM engineers. This was achieved through daily contact by ANS&A's Associate in France, and by regular visits from the UK. During this period the delivery of all component parts and available documentation to Acutronic's subcontractor TLM in Franconville was completed, final machining was undertaken, the centrifuge was assembled and subassemblies were tested where practicable. A second casting of the drive box was completed which did not show any internal defects on ultrasonic testing (surface defects were removed by machining). Other technical issues were relatively minor in nature; concerns were noted in relation to the mounting of the aerodynamic shrouds onto the platform, the tightness of fit of the counterweight geared screws and the manufacture of the instrumented spring supports. All of these were satisfactorily resolved. Packing and transportation of the centrifuge from the TLM plant to the docks at Antwerp, where the centrifuge was loaded on board ship for onward transport to the USA, proceeded without incident.

DTIC

Centrifuges; Surface Defects; Subassemblies; Ultrasonic Tests; Machining

19960034244 Dayton Univ. Research Inst., OH USA

Identification of environmental elements important for simulating visual low-altitude flight *Interim Report, Jun. 1988 - Mar. 1995*

Kleiss, James A., Dayton Univ. Research Inst., USA; Jun. 1995; 31p; In English

Contract(s)/Grant(s): F33615-90-C-0005; AF Proj.1123

Report No.(s): AD-A303546; AL/HR-TR-1995-0080; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Previous research has revealed that two properties of natural scenes dominate perception during low-altitude flight: (a) terrain shape and (b) object size. Experiments conducted in flight simulators reveal that these two properties can be rendered with sufficient perceptual fidelity in computer-generated scenes. In addition, a third property related to presence or absence of terrain texture becomes evident when using computer-generated scenes due to comparisons involving a control condition consi sting of scenes with completely textureless terrain. Laboratory experiments reveal that information for perceiving self-motion can be traced to fairly specific stimulus properties. The purpose of the present experiment was to identify specific components of natural scene elements that mediate perception during low-altitude flight. The stimulus set consisted of computer-generated scenes exhibiting both natural scene elements revealed to be important in previous experiments plus geometrically regular shapes and surfaces intended to represent components of natural scene elements. These stimuli served in a multidimensional scaling analysis which revealed that perception of terrain surface relief is based upon elevation differences in the vertical depth axis whereas perception of flat terrain is based upon a horizontal perspective gradient. Perception of large objects is based upon discrete shape in the vertical plane whereas perception of a second type of object is based upon discrete shape in the horizontal plane. This information provides a basis for designing simulated scenes which highlight specific relevant information.

DTIC

Space Perception; Vertical Perception; Visual Flight; Flight Simulators; Terrain; Shapes

19960034385 Tokyo Univ., Inst. of Space and Astronomical Science., Kanagawa, Japan

An Arc-Heated High Enthalpy Test Facility for Thermal Protection Studies

Hinada, Motoki, Tokyo Univ., Japan; Inatani, Yoshifumi, Tokyo Univ., Japan; Yamada, Tetsuya, Tokyo Univ., Japan; Hiraki, Koju, Tokyo Univ., Japan; Mar. 1996; ISSN 0285-6808;

34p; In English
Report No.(s): ISAS-RN-664; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A high enthalpy flow facility primarily for the high temperature resistant material research and for experimental studies on high temperature gas dynamics is built in ISAS, taking into account the demand for the application to the reentry vehicles. The facility is composed of Huels-type arc heater and necessary subsystems for power supply, water cooling, evacuation, and operation/control. After briefly describing the facility, characterized facility performance and flow conditions for the heating test purposes are presented. It demonstrates the planned simulation capability, in terms of heating and impact pressure, which ranges 0.1 to 5 MW/m(exp 2) of heat flux and 10 to 100 kPa of impact pressure by two operation configuration of vacuum and open-to-air condition. Equipped measurement instruments for various needs both for material testing and studies of aerothermodynamics including state-of-the-art optical and laser diagnostics are also outlined.
Author
Arc Heating; Enthalpy; Heating Equipment; Thermal Protection; Test Facilities; Gas Dynamics

19960034438 NASA Lewis Research Center, Cleveland, OH USA
An overview of aeropropulsion wind tunnel productivity improvements at the NASA Lewis Research Center
Klann, Gary, NASA Lewis Research Center, USA; Bencic, Timothy, NASA Lewis Research Center, USA; McCartney, Timothy, NASA Lewis Research Center, USA; Panek, Joe, NASA Lewis Research Center, USA; Rivera, Osvaldo, NASA Lewis Research Center, USA; Roeder, James, NASA Lewis Research Center, USA; Stark, David, NASA Lewis Research Center, USA; Becks, Edward, NYMA, Inc., USA; Arrington, Allen, NYMA, Inc., USA; Blumenthal, Philip, NYMA, Inc., USA; DeArmon, John, NYMA, Inc., USA; Jun. 1996; 20p; In English; 19th; Advanced Measurement and Ground Testing Technology Conference, 17-20 Jun. 1996, New Orleans, LA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 505-62-82
Report No.(s): NASA-TM-107208; NAS 1.15:107208; AIAA Paper 96-2261; E-10221; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Enhancing wind tunnel test productivity in terms of increased efficiency, reduced cost, and expanded flexibility is a high-priofity goal of the NASA Lewis Research Center's Aeropropulsion Facilities and Experiments Division. Over the past several years, several significant productivity improvements were implemented: test times were shortened by using facility and test article automation; additional flexibility was provided to the research customer by using the remote-access control room and by expanding facility operating envelopes; facility throughput was greatly increased and electric power cost for facility operation reduced by using the three-shift operation. One method being used to reduce electric power costs and expand the facility operating envelop in the 8- by 6-Foot Supersonic Wind Tunnel is operating the drive system with only one of the three drive motors. Metrics are being used to document several categories of facility utilization, which in turn allows tracking of test productivity. This paper provides an overview of the productivity improvements already in place in the large wind tunnels at NASA Lewis and presents plans for future improvements.
Author
Wind Tunnels; Productivity; Cost Reduction; Flexibility

19960035430 Naval Postgraduate School, Monterey, CA USA
Vertical Replenishment Airlift Platform for the 21st Century: An Analysis Using the Simulation Mobility Modeling and Analysis Toolbox (SMMAT)
Pyle, David C., Naval Postgraduate School, USA; Sep. 1995; 112p; In English; Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
Report No.(s): AD-A303855; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

This thesis documents the design and implementation of a vertical replenishment simulation using the object oriented programming language MODSIM 2. Using data generated by this simulation, performance parameters are evaluated for three candidate helicopters (the CH-46E, the CH-60, and the KMAX) under consideration to replace the CH-6D logistics support aircraft currently in use by the U.S. Navy. A quantitative and qualitative evaluation of the most promising helicopter follows this analysis.
DTIC
Helicopters; Computerized Simulation

19960035447 Crew System Ergonomics Information Analysis Center, Wright-Patterson AFB, OH USA
A Handbook of Flight Simulation Fidelity Requirements for Human Factors Research
Rehmann, Albert J., Crew System Ergonomics Information Analysis Center, USA; Mitman, Robert D., Crew System Ergonomics Information Analysis Center, USA; Reynolds, Michael C., Crew System Ergonomics Information Analysis Center, USA; Dec. 1995; 43p; In English
Contract(s)/Grant(s): DLA900-88-D-0393
Report No.(s): AD-A303799; DOT/FAA/CT-TN95/46; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report examines relevant literature for guidelines relative to the use of flight simulators, ranging from full mission to part-task trainers, in addition to requirements for flight crew experience and qualifications. Both sets of guidelines are established based on human factors research requirements, and are intended to match those requirements with the

level of effort in establishing a test bed. In particular, researchers are provided guidance in choosing the minimum required test bed sophistication to achieve the objectives of a research program.
DTIC
Human Factors Engineering; Flight Simulation; Qualifications

19960035610 Air Force Inst. of Tech., Dept. of the Air Force., Wright-Patterson AFB, OH USA
A Monte Carlo analysis of computerized tomography
Davis, Karyl J., Air Force Inst. of Tech., USA; Dec. 1995; 223p; In English
Report No.(s): AD-A303595; AFIT/ENP/GAP/95D-3; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The purpose of this thesis was to model a computerized tomography device (CT) using Monte Carlo methods to determine the scattered radiation spectrum inside and the dose outside the suite at Wright-Patterson Medical Center and at a generic suite to non-occupational personnel. This was driven by the recent inclusion of the most recent NCRP recommended dose limits into 10CFR20 of 50 mSv, occupational; 1 mSv; non-occupational continuous exposure; and 5 mSv, infrequent exposure. The rotating fan beam of the CT was modeled for MCNP, a general-purpose Monte Carlo n-particle transport modeL The CT target was a standard human phantom defined in MIRD Pamphlet 5. The source and phantom were rotated 270 with respect to the walls. A head scan and an abdomen scan were simulate% CT USAge factors were set equal to average WPMC values. The suite walls were modeled alternately with 1/16" and 1/8" lead shielding between gypsum drywall for the occupational and non-occupational dose, respectively. With CT isocenter as problem origin, test detectors were placed 30 cm outside the walls on two sets of axes defined by (a) the walls and (b)the source-body axes. Film badges placed in the CT suite at WPMC agreed with MCNP modeling results by a factor of two, vaiidnng the method. The analysis showed that outside both the WPMC CT suite and the generic room the continuous-exposure non-occupational dose limit was exceeded below the floor and above the ceiling; the infrequent exposure non-occupational dose limit was exceeded below the floor. Modeled results exceeded the occupational and non-occupational dose limits outside two walls of the generic suite. Modeled dose was below the occupational limit at all test locations. The scattered radiation spectrum is a softened source spectrum minus the 60 and 68 keV X-ray tube bremsstrahlung peaks.
DTIC
Computer Aided Tomography; Monte Carlo Method; Scanners; X Rays; Radiation Dosage; Radiation Measurement

19960035675 Princeton Univ., NJ USA
Student training program in advanced diagnostics for high-speed fluid mechanics ***Final Report, Sep. 1992 - Aug. 1995***
Miles, Richard B., Principal Investigator, Princeton Univ., USA; Sep. 14, 1995; 36p; In English
Contract(s)/Grant(s): F49620-92-J-0335
Report No.(s): AD-A303540; AFOSR-TR-96-0029; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As described in previous reports, this AASERT funding has provided support for graduate student training in high speed optical flow diagnostics. Funds were provided for the purchase of a 20 MHz rate framing camera (Hadland Imacon 792), which was used to capture a pair of rapidly sequenced Rayleigh scattering images, using a double pulsed Nd:YAG laser system purchased from parent grant AFOSR support. During the current reporting period, work has progressed on a synergistic program to develop a 'burst mode' laser system, which will, ultimately, provide the capability to obtain approximately 30 rapidly sequenced images.
DTIC
YAG Lasers; Rayleigh Scattering; Flow Visualization

19960035864 Oregon Univ., Dept. of Computer Science., Eugene, OR USA
Recommendations regarding the use of textures for cuing surface slant and shape in flight simulation ***Interim Report, Jan. 1992 - Dec. 1994***
Stevens, Kent A., Oregon Univ., USA; Jun. 1995; 46p; In English
Contract(s)/Grant(s): F33615-90-C-0005; AF Proj.1123
Report No.(s): AD-A303552; AL/HR-TR-1995-0081; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Most surface textures convey useful information about the slant curvature, and depth of the surface, as geometric consequences of perspective projection (primarily foreshortening and scaling). For the visual system to correctly interpret two-dimensional (2D) evidence of foreshortening and differential scaling as suggesting three-dimensional (3D) slant and depth, certain assumptions must hold regarding the regularity or homogeneity of the physical texture as well as its statistical isotropy. Recommendations are given regarding the selection of textures for flight simulation which match the perceptual assumptions and thereby permit 3D percepts.
DTIC
Surface Properties; Curvature; Flight Simulation; Depth; Cues

19960038231 New Mexico State Univ., Las Cruces, NM USA
Space protocol test and evaluation project
Lynde, William H., New Mexico State Univ., USA; Horan, Stephen, New Mexico State Univ., USA; .; Apr. 15, 1996; 71p; In English
Report No.(s): NASA-CR-201074; NAS 1.26:20174; NMSU-BECE-96-004; Copyright Waived (NASA); Avail: CASI; A04, Hardcopy; A01, Microfiche

This report details the development of the Satellite-to-Ground Link Simulator (SGLS) for the Space Protocol Test and Evaluation Project (SPTE). The purpose of the SPTE project is to evaluate the performance of proposed satellite communication protocols before their implementation. The SGLS corrupts user-supplied binary data formatted with the communications protocol to be tested with errors representative of a communications link between a Low-Earth Orbiting (LEO) spacecraft and a spacecraft in geosynchronous orbit (GEO). The SGLS is comprised of hardware and software designed to operate on a VME (Versa Module Eurocard) system with little user interaction. The SGLS software simulates the communications link between the LEO and GEO spacecrafts while managing the error data to be used to corrupt the incoming binary data. The SGLS hardware performs interrupt generation and handling, VMEbus actions, and corruption of the incoming binary data with the error data.
Author
Spacecraft Orbits; Data Links; Satellite Communication; Protocol (Computers); Signal Processing

19960038253 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Use of simulation in maritime operations and training
Richardson, D. D., Defence Science and Technology Organisation, Australia; Feb. 1996; 27p; In English
Report No.(s): DSTO-GD-0045; AR-009-214; Copyright; Avail: Issuing Activity (Defence Science and Technology Organisation; Melbourne, Austrlia), Hardcopy, Microfiche

The needs within the Royal Australian Navy for simulation and simulators is reviewed. These are being used increasingly for a wide variety of purposes, or are being considered for use. A summary of the interest within Navy on the subject is presented. In addition, an assessment has been made of those aspects in which Maritime Operations Division could provide a contribution, either through assessment, modification, or development of simulations. A list of recommendations for the way ahead for MOD activities in this area is provided.
Author
Simulators; Education; Simulation

19960038255 Pennsylvania State Univ., Dept. of Computer Science and Engineering., University Park, PA USA
Detection of obstacles on runway using Ego-Motion compensation and tracking of significant features ***Interim Report, 1 Aug. 1995 - 31 Jul. 1997***
Kasturi, Rangachar, Principal Investigator, Pennsylvania State Univ., USA; Camps, Octavia, Principal Investigator, Pennsylvania State Univ., USA; Gandhi, Tarak, Pennsylvania State Univ., USA; Devadiga, Sadashiva, Pennsylvania State Univ., USA; Jun. 14, 1996; 44p; In English
Contract(s)/Grant(s): NCC2-916
Report No.(s): NASA-CR-201531; NAS 1.26:201531; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes a method for obstacle detection on a runway for autonomous navigation and landing of an aircraft. Detection is done in the presence of extraneous features such as tiremarks. Suitable features are extracted from the image and warping using approximately known camera and plane parameters is performed in order to compensate ego-motion as far as possible. Residual disparity after warping is estimated using an optical flow algorithm. Features are tracked from frame to frame so as to obtain more reliable estimates of their motion. Corrections are made to motion parameters with the residual disparities using a robust method, and features having large residual disparities are signaled as obstacles. Sensitivity analysis of the procedure is also studied. Nelson's optical flow constraint is proposed to separate moving obstacles from stationary ones. A Bayesian framework is used at every stage so that the confidence in the estimates can be determined.
AIAA
Runways; Optical Tracking; Navigation Aids; Aircraft Landing; Autonomous Navigation; Pattern Recognition

19960038364 Stanford Univ., Dept. of Aeronautics and Astronautics., CA USA
Roll-yaw control at high angle of attack by forebody tangential blowing
Pedreiro, N., Stanford Univ., USA; Rock, S. M., Stanford Univ., USA; Celik, Z. Z., Stanford Univ., USA; Roberts, L., Stanford Univ., USA; Oct. 1995; 26p; In English
Contract(s)/Grant(s): NCC2-55
Report No.(s): NASA-CR-201481; NAS 1.26:201481; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The feasibility of using forebody tangential blowing to control the roll-yaw motion of a wind tunnel model is experimentally demonstrated. An unsteady model of the aerodynamics is developed based on the fundamental physics of the flow. Data from dynamic experiments is used to validate the aerodynamic model. A unique apparatus is designed and built that allows the wind tunnel model two degrees of freedom, roll and yaw. Dynamic experiments conducted at 45 degrees angle of attack reveal the system to be unstable. The natural motion is divergent. The aerodynamic model is incorporated into the equations of motion of the system and used for the design of closed loop control laws that make the system stable. These laws are proven through dynamic experiments in the wind tunnel using blowing as the only actuator. It is shown that asymmetric blowing is a highly non-linear effector that can be linearized by superimposing symmetric blowing. The effects of forebody tangential blowing and roll and yaw angles on the flow structure are determined through flow visualization experiments. The transient response of roll and yaw moments to a step input blowing are determined. Differences

on the roll and yaw moment dependence on blowing are explained based on the physics of the phenomena.
Author
Roll; Yaw; Wind Tunnel Tests; Directional Control; Lateral Control; Longitudinal Control; Yawing Moments; Rolling Moments; Forebodies; Body-Wing Configurations; Blowing; Feedback Control

19960038385 Naval Postgraduate School, Monterey, CA USA
Optimal Allocation of Air Services to the US Pacific Surface Forces
Druggan, P. Thomas, Naval Postgraduate School, USA; Sep. 21, 1995; 61p; In English
Report No.(s): AD-A303858; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Two integer programming models, called FLIGHT-HOURS I and II (or FR-I and FR-II), are developed to assist U.S. Pacific Fleet Air Services Planners in the allocation of air services to support basic and intermediate ship training requirements. Air services consist of aircraft towing air targets, radiating electronic signals, simulating cruise missile flight profiles, and following shipboard directions. FR-I maximizes the weighted average of fleet readiness discretely to mimic the Navy's mission rating scaling while FR-II does so continuously, reflecting percent of training requirements completed. FR-I executes slowly and produces allocations unsuitable for real-world execution. FR-II, however, quickly solves the air services allocation problem on a desktop computer, and achieves significantly higher readiness than a manually prepared allocation plan (72.1 percent of training requirements completed versus 61.8 percent).
DTIC
Logistics; Allocations; Management Planning; Antimissile Defense; Mathematical Models

19960038478 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
The Development of the RAN research laboratory
Hunter, W. F., Editor, Defence Science and Technology Organisation, Australia; Mar. 1996; 72p; In English
Report No.(s): DSTO-GD-0078; AR-009-626; Copyright; Avail: Issuing Activity (Aeronautical and Maritime Research Lab., Melbourne,Australia), Hardcopy, Microfiche

This is a history of the RAN Research Laboratory in Port Jackson, NSW, Australia. The lab has had strong western influences of the U.S. Navy. Specific projects are remembered, including EDMONDS which focussed on underwater submarine detection using hydrophone arrays.
CASI
Histories; Research Facilities; Underwater Acoustics; Calibrating

19960041471 Old Dominion Univ., College of Engineering and Technology. Dept. of Aerospace Engineering. Dept. of Mechanical Engineering., Norfolk, VA USA
Large angle magnetic suspension test fixture *Progress Report, 1 Nov. 1995 - 1 May 1996*
Britcher, Colin P., Principal Investigator, Old Dominion Univ., USA; Huang, Jen-Kuang, Principal Investigator, Old Dominion Univ., USA; Jul. 1996; 22p; In English
Contract(s)/Grant(s): NAG1-1056
Report No.(s): NASA-CR-201914; NAS 1.26:201914; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Good progress is being made in several major areas. These include eddy current modelling and analysis, design optimization methods, wind tunnel Magnetic Suspension and Balance Systems (MSBS), payload pointing and vibration isolation systems, and system identification. In addition, another successful InterNational Symposium has been completed, with the Proceedings being printed at the time of writing. These activities continue current work under this Grant and extend previous work on magnetic suspension systems and devices in the Guidance and Control Branch and will permit the demonstration of several new developments in the field of magnetic suspension technology.
Author
Design Analysis; Magnetic Suspension; Eddy Currents; Pointing Control Systems; Vibration Isolators; Applications Programs (Computers); System Identification; Fixtures

19960041472 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA
Results of tests performed on the Acoustic Quiet Flow Facility Three-Dimensional Model Tunnel: Report on the Modified D.S.M.A. Design *Final Report*
Barna, P. S., Lockheed Martin Engineering and Sciences Co., USA; Apr. 1996; 88p; In English
Contract(s)/Grant(s): NAS1-19000; RTOP 538-03-12-01
Report No.(s): NASA-CR-198312; NAS 1.26:198312; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Numerous tests were performed on the original Acoustic Quiet Flow Facility Three-Dimensional Model Tunnel, scaled down from the full-scale plans. Results of tests performed on the original scale model tunnel were reported in April 1995, which clearly showed that this model was lacking in performance. Subsequently this scale model was modified to attempt to possibly improve the tunnel performance. The modifications included: (a) redesigned diffuser; (b) addition of a collector; (c) addition of a Nozzle-Diffuser; (d) changes in location of vent-air. Tests performed on the modified tunnel showed a marked improvement in performance amounting to a nominal increase of pressure recovery in the diffuser from 34 percent to 54 percent. Results obtained in the tests have wider application. They may also be applied to other tunnels

operating with an open test section not necessarily having similar geometry as the model under consideration.
Author
Sound Waves; Three Dimensional Models; Wind Tunnel Models; Scale Models; Wind Tunnels; Nozzle Design; Wind Tunnel Nozzles

19960045342 Florida Agricultural and Mechanical Univ., Dept. of Mechanical Engineering., Tallahassee, FL USA
Active Control of Wind Tunnel Noise ***Final Report***
Hollis, Patrick, Principal Investigator, Florida Agricultural and Mechanical Univ., USA; Aug. 1991; 28p; In English
Contract(s)/Grant(s): NAG2-688
Report No.(s): NASA-CR-200998; NAS 1.26:200998; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The need for an adaptive active control system was realized, since a wind tunnel is subjected to variations in air velocity, temperature, air turbulence, and some other factors such as nonlinearity. Among many adaptive algorithms, the Least Mean Squares (LMS) algorithm, which is the simplest one, has been used in an Active Noise Control (ANC) system by some researchers. However, Eriksson's results, Eriksson (1985), showed instability in the ANC system with an ER filter for random noise input. The Restricted Least Squares (RLS) algorithm, although computationally more complex than the LMS algorithm, has better convergence and stability properties. The ANC system in the present work was simulated by using an FIR filter with an RLS algorithm for different inputs and for a number of plant models. Simulation results for the ANC system with acoustic feedback showed better robustness when used with the RLS algorithm than with the LMS algorithm for all types of inputs. Overall attenuation in the frequency domain was better in the case of the RLS adaptive algorithm. Simulation results with a more realistic plant model and an RLS adaptive algorithm showed a slower convergence rate than the case with an acoustic plant as a delay plant. However, the attenuation properties were satisfactory for the simulated system with the modified plant. The effect of filter length on the rate of convergence and attenuation was studied. It was found that the rate of convergence decreases with increase in filter length, whereas the attenuation increases with increase in filter length. The final design of the ANC system was simulated and found to have a reasonable convergence rate and good attenuation properties for an input containing discrete frequencies and random noise.
Derived from text
Active Control; Adaptive Control; Algorithms; Feedback; Noise Reduction; Wind Tunnels

19960045439 Physics and Electronics Lab. TNO, The Hague, Netherlands
Feasibility Study Stinger VE Trainer ***Final Report Onderzoek mogelijkheden Stinger VE trainer***
Kuiper, H., Physics and Electronics Lab. TNO, Netherlands; vanderHulst, A. H., Physics and Electronics Lab. TNO, Netherlands; Jense, G. J., Physics and Electronics Lab. TNO, Netherlands; Kuijper, F., Physics and Electronics Lab. TNO, Netherlands; Werkhoven, P. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Barnard, Y. F., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Kooi, F. L., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Riemersma, J. B. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; May 1996; 68p; In Dutch
Contract(s)/Grant(s): A95KLu778; OF95KLu4011
Report No.(s): FEL-96-A067; TD96-0065; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., P.O. Box 96864, 2509 JG The Hague, Netherlands), Hardcopy, Microfiche

The Royal Netherlands Airforce possesses a Stinger training simulation that is carried out in a virtual environment. The feasibility analysis of the simulator includes perceptual requirements, training analysis, functional analysis, and adequacy of the training facilities (potential bottle-necks include capacity, the current Stinger Trainer, and the availability of required equipment). A prototype is suggested for investigating high priority bottle-necks in a follow-on study.
Author
Feasibility; Training Analysis; Computerized Simulation; Virtual Reality; Training Simulators; Air Defense; Flight Simulators

19960045626 Air Force Center for Environmental Excellence, Brooks AFB, TX USA
Environmental Assessment: Beddown of the Northeast Tanker Task Force, Pease Air National Guard, New Hampshire
Nov. 1995; 41p; In English
Report No.(s): AD-A286849; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pursuant to the Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (40 Code of Federal Regulations 1500-1508), Air Force Instruction 32-7061, and Department of Defense (DOD) Directive 6050.1, the National Guard Bureau has conducted an assessment of the potential environmental consequences of the operational activities associated with the Northeast Tanker Task Force (NE TTF) at Pease Air National Guard Base (ANGB), New Hampshire. The Environmental Assessment considered all potential impacts of the Proposed Action and No-Action Alternative, both as solitary actions and in conjunction with other proposed activities. This finding of no significant impact summarizes the results of the evaluations of proposed operational activities of the NE TTF at Pease ANGB. The discussion focuses on activ-

ities which have the potential to change both the natural and human environments
DTIC
Environmental Quality; Regulations; Environment Effects; Armed Forces (USA); Air to Air Refueling; Tanker Aircraft; Fighter Aircraft; C-135 Aircraft

19960046698
High-performance magnetically shielded room
Kajiwara, G., Superconducting Sensor Lab, Japan; Harakawa, K.; Ogata, H.; Kado, H.; IEEE Transactions on Magnetics; July 1996; ISSN 0018-9464; vol. 32, no. 4, pt. 1, pp. 2582-2585; In English; Copyright; Avail: Issuing Activity

An ultrahigh-performance magnetically shielded room was completed as a part of a biomagnetic measuring system using superconducting quantum interference device. From the difference between environmental magnetic noise and a signal, necessary shielding factor was decided to be 1/100000 at low frequencies and 1/1000 at high frequencies. The soccer ball shaped room consists of four layers of permalloy and a layer of aluminum, and provides a space 4 meters in diameter in which magnetic fields are very weak. An independent base was built and the room was fixed rigidly to it. Because permalloy is very sensitive to shocks, the materials for the room were cut in the factory, carried with care, and assembled with screws on site. Xenon lamps supply light via optical fibers and the room is ventilated by way of many small holes in the floor. The door is equipped with the air pressure system.
Author (EI)
Magnetic Fields; Magnetic Shielding; Squid (Detectors)

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ASTRONAUTICS

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

19960035640 Amptek, Inc., Bedford, MA USA
Space Systems Environmental Interaction Studies *Topical Report no.4*
Morgan, M. A., Amptek, Inc., USA; Huber, Alan C., Amptek, Inc., USA; McGarity, John O., Amptek, Inc., USA; Sperry, David J., Amptek, Inc., USA; Moran, Scott J., Amptek, Inc., USA; Aug. 30, 1995; 15p; In English
Contract(s)/Grant(s): F19628-91-C-0112; AF Prog. 2822
Report No.(s): AD-A302525; PL-TR-95-2144; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effort expended on Task 1 (the Photovoltaic Array Space Power Plus Diagnostics PASP Plus experiment) during the report period, went into on-orbit support for the mission. Amptek, Inc. was called upon to assist in understanding some anomalous behavior in an instrument's performance. On Task 2, the Charging Hazards and Wake Studies (CHAW S) program, the Digital Ion Drift Meter (DIDM) instrument design and build process got underway. Company personnel also supported PL/GPSG at several meetings which were held to discuss spacecraft systems and/or instrument design issues. In addition, the preparation of SPREE hardware for the upcoming re-flight continued. This effort is now almost at an end. Under Task 3, (the Space Wave Interactions with Plasma as Experiment SWIPE) the hardware was subjected to flight environmental tests, which was successfully concluded, and then delivered to PL/GPSG. System integration testing at the payload integrator's facility was supported by company personnel.
DTIC
Diagnosis; Digital Systems; Payloads; Aircraft Instruments; Electromagnetic Interactions; Flight Tes

19960039606
Fluid force activated spacecraft dynamics driven by gravity gradient and jitter accelerations
Hung, R. J., Univ of Alabama in Huntsville, USA; Pan, H. L.; Journal of Guidance, Control, and Dynamics; September 1995; ISSN 0731-5090; vol. 18, no. 5, pp. 1190-1196; In English; Copyright; Avail: Issuing Activity

Using as an example the liquid helium dewar of the Gravity Probe-B spacecraft, the dynamics of liquid motions in a slowly rotating, partially liquid fill tank are investigated under the combined action of gravity gradients and g-jitter accelerations. The equilibrium configuration of the liquid interface, which is controlled by centripetal acceleration and surface tension, is a torus. Three different cases of liquid responses are examined: 1) when gravity gradient is the dominant driving acceleration, 2) when g jitter is the dominant acceleration, and 3) when g-jitter and gravity gradient accelerations are comparable. For case 1, the vapor bubble responds in an asymmetric oscillation in which the part of the bubble on one side of the centerline rises while the other side sinks (one-up, one-down oscillation). For case 2, the bubble responds in a combined up-and-down and side-to-side oscillation. The response for case 3 is a combination of the responses for cases 1 and 2. The motion-induced forces and torques are also computed for these cases to quantify the effects on spacecraft control.
Author (EI)
Acceleration (Physics); Aerodynamics; Fluid Dynamics; Gravitation; Interfacial Tension; Liquid Helium; Spacecraft

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