NASA

Aeronautical Engineering
A Continuing Bibliography with Indexes

NASA SP-7037(162)
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STAR (N-10000 Series)	N83-18636 - N83-20893
IAA (A-10000 Series)	A83-23298 - A83-26971

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NASA SP-7037(162)

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 162)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in May 1983 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

NASA Scientific and Technical Information Branch 1983
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INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering. The first issue of this bibliography was published in September 1970 and the first supplement in January 1971.

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 464 reports, journal articles, and other documents originally announced in May 1983 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA).*

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by the first nine *STAR* specific categories and the remaining *STAR* major categories. This arrangement offers the user the most advantageous breakdown for individual objectives. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* and *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

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An annual cumulative index will be published.

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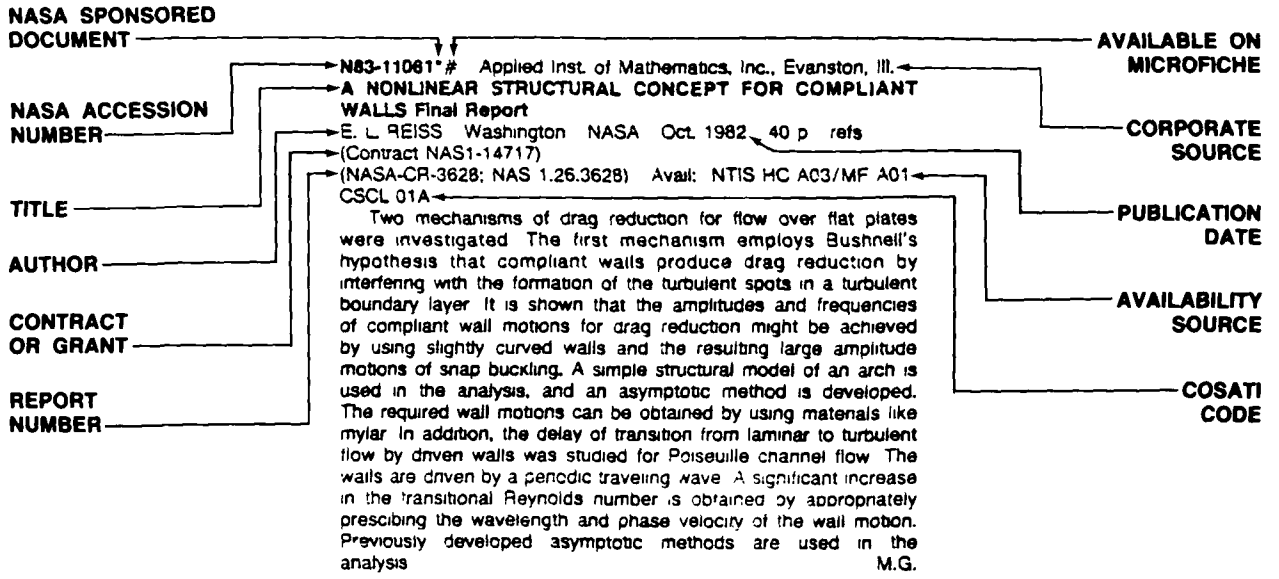

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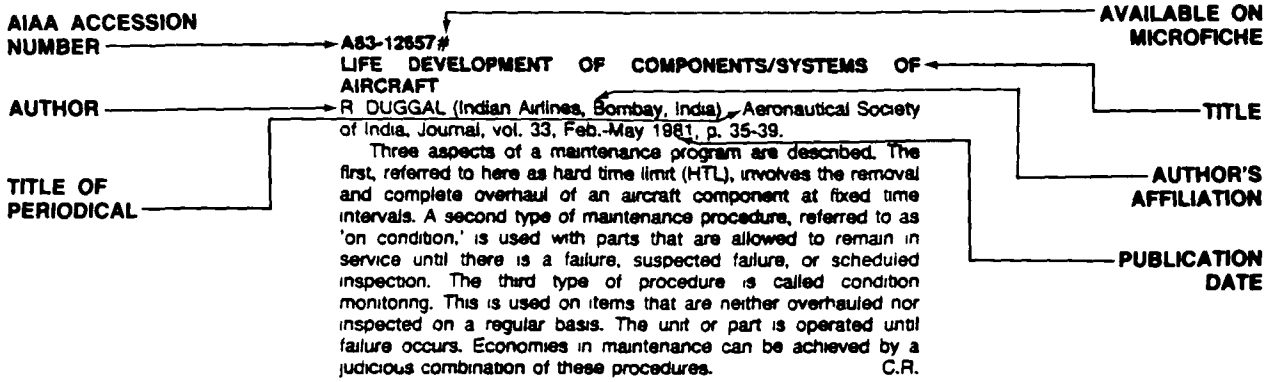

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 162)

JUNE 1983

01

AERONAUTICS (GENERAL)

A83-23602
FABRICATION OF AIRCRAFT COMPONENTS USING PREPLIED BROADGOODS LAYED-UP IN THE FLAT AND SUBSEQUENTLY FORMED - COST BENEFITS AND RESOURCE UTILIZATION ENHANCEMENTS
T J. BETTNER (Northrop Corp., Aircraft Div., Hawthorne, CA) In Material and process advances '82, Proceedings of the Fourteenth National SAMPE Technical Conference, Atlanta, GA, October 12-14, 1982 Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 1-11

A83-23685
MICROLIGHTS -THE STATE OF THE ART
A. WELCH Aerospace (UK), vol 10, Feb 1983, p 14-18.

The history and state-of-the-art of microlights is surveyed The advent of lightweight, aluminum pole structures and synthetic fiber sheets for hang glider wings was followed by mounting small engines on the hang gliders Redesign was necessary to stabilize the resulting ultralight aircraft. Snowmobile engines were found to be well suited for microlight applications Two divisions of ultralights have evolved, i.e., trikes, controlled by weightshift and configured so the actual hang glider can be detached and flown, and airplane microlights, which have aerodynamic controls Design and engineering deficiencies in commercial microlights are explored. Most microlights can only be flown in calm weather, weigh from 100-120 kg, have a maximum airspeed of 50-60 kt, and have only one seat, which causes training difficulties The use of regulatory funds for establishing microlight pilot training course, rather than legislating an activity that is basically a sport, is recommended D H.K.

A83-23686
PUTTING THE MICROLIGHT TO WORK
C. CARR Aerospace (UK), vol 10, Feb. 1983, p. 20, 21.

Research into using ultralight aircraft for practical purposes is described. Some efforts are being extended to develop computer simulations to match application with type of aircraft, i.e., general aviation aircraft, helicopters, and microlights. A private farmer in England has been experimenting with a microlight equipped with a crop-spraying system. If successful, the operation of an ultralight will permit a farmer to spray crops as needed. Additional applications of the microlight for police patrols, military reconnaissance, and to carry antitank weapons are being investigated. D.H.K.

A83-23850#
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, ANNUAL REPORT 1981 [DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, JAHRESBERICHT 1981]
Cologne, Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, 1982. 152 p In German

The German Research and Experimental Institute for Aeronautics and Astronautics has the objective to conduct research mainly in the area of aeronautics and astronautics, to participate in the planning and implementation of projects, and to establish and operate large-scale experimental installations Key research objectives are related to the enhancement of the efficiency and safety of transportation and communication systems, advances concerning aircraft technology, the improvement of space flight technology, the use of remote sensing technology, a participation in the Spacelab utilization program, projects in energy and propulsion technology, and the promotion of new technologies Attention is given to results obtained in connection with the pursuit of these key research objectives, questions of institute organization and structure, developments related to aspects of management of the organization, and information regarding the work conducted in the individual divisions of the Institute. G.R.

A83-24151#
AIR TRAFFIC AND REQUIREMENTS FOR FUTURE PASSENGER AIRCRAFT [DER LUFTVERKEHR UND SEINE ANFORDERUNGEN AN ZUKUENFTIGE VERKEHRSFLUGZEUGE]
R. STUESSEL (Deutsche Lufthansa AG, Cologne, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 33 p. In German.
(DGLR PAPER 82-024)

The reasons for the recent decline in profitability of international air transport are briefly reviewed and the developing trends to which air transport companies must adjust their plans and policy decisions are presented. Success in dealing with the energy problem and the excessive economic liberalization of U S. policy tend to drive costs and prices apart. Air transport companies are forced to develop strategies to increase the productivity and load of their aircraft and hold down costs The challenge can be met by a fleet policy built on a cost-saving aircraft. The possibilities for technological improvement are briefly treated and the significance of a market-oriented strategy is examined. Technological progress must be matched with concrete market demands in a timely way and subject to strict economicality criteria. A brief situational analysis from the point of view of Lufthansa is presented. C.D.

A83-24152
AVIATION SYSTEM TECHNOLOGY FROM THE POINT OF VIEW OF THE AIRCRAFT MANUFACTURER [LUFTFAHRTSYSTEMTECHNIK AUS DER SICHT DES FLUGZEUGHERSTELLERS]
K. KNAUER (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) Deutsche Gesellscahft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 57 p. In German.
(DGLR PAPER 82-025)

It is found that system technology in the area of aircraft construction is vitally affected by developments in the field of electronics. These developments make it possible to optimize aircraft more and more exclusively in accordance with aspects of performance. In addition, advances related to computing devices provide also a basis for improving developments concerning aircraft manufacture and making the involved operations more efficient. With respect to structural fiber technology, very significant additional efforts are required until the advantages of this technology can be applied to future aircraft. G.R.

A83-24153#
DEVELOPMENT TREND IN GENERAL AVIATION [ENTWICKLUNGSTREND IN DER GENERAL AVIATION]
J. SPINTZYK (Dornier GmbH, Friedrichshafen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 30 p. In German.
(DGLR PAPER 82-026)

The present investigation is particularly concerned with the two-engine propeller aircraft of the utility/commuter class. Market analyses have shown that there exists an increasing demand for two-engine PTL-aircraft with gas turbine engines. It is estimated that for the coming ten years there will be a demand for 4,500 aircraft with a capacity for carrying from 10 to 30 passengers. Attention is given to the reasons for the increasing demand concerning PTL aircraft, the requirements which utility/commuter aircraft have to satisfy, approaches for improving the economics of aircraft operations by reducing fuel consumption, measures for reducing engine noise, the improvement of riding qualities, the reductionof manufacturing costs on the basis of a utilization of the most modern manufacturing methods, and the employment of novel technology for aircraft of general aviation. G.R.

A83-24168#
ECONOMIC CONDITIONS AND KEY POINTS OF BMFT AIR TRANSPORT RESEARCH REQUIREMENTS IN THE EIGHTIES [WIRTSCHAFTLICHE RAHMENBEDINGUNGEN UND SCHWERPUNKTE DER BMFT-FOERDERUNG DER LUFTFAHRTFORSCHUNG IN DEN ACHTZIGER JAHREN]
H. A HERTRICH (Bundesministerium fuer Forschung und Technologie, Bonn, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 31 p. In German
(DGLR PAPER 82-044)

The economic conditions for air transport in the seventies and eighties are briefly reviewed and predicted, and the effects of those conditions on research and technology in air transport are discussed. The areas considered include large civil aircraft, aircraft in general aviation, helicopters, engine technology, air transport electronics, and test installations. Competition between German and foreign firms, changes in markets, advances in engine and electronics technology, and the features of planned test installations are emphasized C.D.

A83-24425
THE COST DEFINITION PHASE OF A NEW COMMERCIAL AIRCRAFT PROGRAMME
W. G. LOEKEN (Boeing Commercial Airplane Co., Seattle, WA) Aeronautical Journal, vol. 87, Feb 1983, p. 68-75.

The cost estimating process and cost management of the 757 aircraft are discussed. At peak production, 10,000 people will be employed directly, while 1000 suppliers of parts and materials will employ another 20,000. The configuration of the 757 was determined after analyses of traffic and airline service patterns, with the constraint that the aircraft had to sell in economic quantities Major changes from the 727 program included a new technology wing and advanced, fuel-efficient engines Computer aided design and manufacturing practices reduced the changes necessary for successful construction of the 757 with respect to the 727 as the baseline aircraft, and commonality with the 767 was added to the flight deck. Computers were also used to track release dates for various components in order to assure an economic work flow and avoid costly surprises and delays. The program was completed within 0.5% of cost estimates M S.K.

A83-25122
HOMEBUILT AIRPLANES - THE SKY'S THE LIMIT
E. DE MAN Technology Review, vol. 86, Apr. 1983, p 26-34.

Design innovations in the ultralight aircraft industry are surveyed The Rutan Aircraft Co. has made extensive use of canards, including extending them enough to become forward landing gear. Large canards have virtually eliminated stall and spin, while cruising speeds of 100 mph at 100 mi/gal of fuel have been attained. The Christen Eagle biplane can be flown with equal stability upside down, on a side, straight up, or rightside up CAD techniques have shortened the time necessary for making precise aeronautical engineering integrations necessary for optimizing the small aircraft. Since many of the models are constructed from kits, modifications are possible at the purchaser's home. The foam-core structure VariEze weighs 570 lb and, built with advanced lightweight materials, can withstand 12 g's. NASA wind tunnel tests have demonstrated that natural laminar flow occurs with the smooth-skinned ultralights. D.H.K.

N83-18652# Dowty Rotol Ltd., Gloucester (England)
HISTORICAL REVIEW OF PROPELLER DEVELOPMENTS
R. M BASS *In* Von Karman Inst. for Fluid Dyn. Propeller Performance and Noise, Vol. 1 40 p 1982 refs
Avail: NTIS HC A17/MF A01

A brief history of propellers is given. Ship propellers are considered in some detail. Aircraft propellers are discussed with an emphasis upon the variable pitch propeller. Propeller construction materials are discussed R.J.F.

N83-18656# Von Karman Inst for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
PROPELLER PERFORMANCE AND NOISE, VOLUME 2
1982 424 p refs Lecture held in Rhode-Saint-Genese, Belgium, 24-28 Mar 1982 2 Vol
(VKI-LS-1982-08-VOL-2) Avail: NTIS HC A18/MF A01

Methods for measuring, predicting, certifying, and controlling interior and exterior noise from propeller driven aircraft are described and assessed. Advances in prop-fan technology for general aviation aircraft are considered

N83-20227# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
APPLICATION OF AN ANALYTICAL METHOD TO THE ELABORATION OF A MAINTENANCE PROGRAM FOR A NEW AIRCRAFT [APPLICATION D'UNE METHODE ANALYTIQUE A L'ELABORATION DU PROGRAMME DE MAINTENANCE D'UN NOUVEL AERONEF]
R ADAM *In* ESA Reliability and Maintainability p 345-350 Sep. 1982 refs In FRENCH
Avail: NTIS HC A99/MF A01

General objectives of a program for aircraft maintenance are listed and the history of the evolution of elaboration methods is reviewed including empirical and analytical methods with successive revisions. The last of the revisions, MSG3 was disseminated in 1980 and was recently applied. This method for analyzing the complete aircraft (systems, structures, and zones) is presented. Its objectives are to analyze the definition of the aircraft to study failure modes which are capable of affecting constitutive elements, and to define appropriate maintenance tasks so as to forewarn about failure modes capable of affecting the level of operational security and intrinsic reliability. Transl. by A.R H.

N83-20831*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AMES RESEARCH CENTER OVERVIEW
C. T. SNYDER *In* American Planning Association Proc. of the Monterey Conf. on Planning for Rotorcraft and Commuter Air Transportation p 17-21 Feb. 1983
Avail. NTIS HC A09/MF A01 CSCL 05A

The aeronautical research programs of the Ames Research Center are reviewed with particular emphasis on V/STOL aircraft development. Test facilities and simulation capabilities are briefly described. The Tilt Rotor Research Aircraft, X-Wing vehicle, Rotor Systems Research Aircraft, and the Quiet Short Haul Aircraft are discussed M.G.

02

AERODYNAMICS

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

A83-24039#
MODIFYING A GENERAL AVIATION AIRFOIL FOR SUPERCRITICAL FLIGHT
G. B. COSENTINO Journal of Aircraft, vol. 20, Apr. 1983, p 377-379 refs
(Contract N00014-76-C-0182; AF-AFOSR-81-0107)

A technique for delaying onset of flow separation due to the *appearance of a supersonic bubble on the upper surface of a* transport aircraft wing when speeds in the transonic regime are reached is described. The existence of shock-free airfoil designs has been established for decades, but have not been adequately modeled. The fictitious gas design method of Sobieczky (1978) is used in computations that revert the hyperbolic governing equations for supersonic flow at the forming sonic bubble to the elliptical equations for subsonic flow. The solution provides smooth data on the sonic line, and a marching procedure is performed through the area of supersonic flow until the original airfoil has a surface extended through the supersonic flow. Application to the GA(W)-2 *airfoil is demonstrated to yield an airfoil with no shock.* M S.K.

A83-24181#
DEVELOPMENT OF FOUR PROFILES FOR AN EXPERIMENTAL PROPELLER IN THE PERFORMANCE CLASS OF 750 PS [ENTWICKLUNG VON VIER PROFILEN FUER EINEN EXPERIMENTALPROPELLER IN DER LEISTUNGSKLASSE 750 PS]
K. H. HORSTMANN, H. KOESTER, and A. QUAST (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Entwurfs-Aerodynamik, Brunswick, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 24 p. In German. refs
(DGLR PAPER 82-067)

It is pointed out that a number of new design concepts for wings were implemented during the last 20 years, while there were no comparable profile changes in the case of propellers. The present investigation shows that recent design concepts for wing profiles can also be applied to propeller profiles. Such applications lead to distinct performance improvements for the propeller Four profiles were designed for the propeller of an experimental aircraft with two engines. One of these profiles was *studied in a transonic wind tunnel. Attention is given to analogies* between propeller and wing, design considerations concerning the propeller profiles, the operational ranges of the propeller profiles for four different radial positions, design criteria for propeller profiles, computational procedures for propeller profiles, the pressure distributions on the four propeller profiles, and a comparison between experimental and computed data regarding the propeller profiles. G R.

A83-24241
THE AERODYNAMIC CHARACTERISTICS OF CARET WINGS AT SUBSONIC FLIGHT SPEEDS [AERODINAMICHESKIE KHARAKTERISTIKI LAMBDA-KRYL'EV PRI DOZVUKOVYKH SKOROSTIAKH POLETA]
V. I VORONIN Moskovskii Universitet, Vestnik, Seriia 1 - Matematika, Mekhanika, Jan -Feb 1983, p. 89-91. In Russian.

Attention is given to the problem of determining the aerodynamic characteristics of thin, platform-tranigular caret wings moving at a subsonic speed in an ideal incompressible medium with flow separation from the leading edge. The vortex lattice method is employed in the solution. The wing, the nose sheet, and the tail sheet are modeled by systems of discrete vortices; on the wing, the systems are separated into transverse and longitudinal bound vortices that are perpendicular to each other. It is found that at low speeds, a decrease in the opening angle lowers the coefficient of the normal force, the coefficient having its maximum value with a flat wing (an opening angle of 180 deg) It is also found that an *increase in the caret wing sweep angle lowers the coefficient of* the normal force and that the size of the decrease is greater for large angles of attack. C.R

A83-24326*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FINITE DIFFERENCE MODELING OF ROTOR FLOWS INCLUDING WAKE EFFECTS
F X. CARADONNA, C. TUNG (NASA, Ames Research Center, U.S Army, Aeromechanics Laboratory, Moffett Field, CA), and A. DESOPPER (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) ONERA, TP no 1982-114, 1982. 27 p. refs
(ONERA, TP NO. 1982-114)
(Previously announced in STAR as N82-33345)

A83-24330#
COMPARATIVE TRIALS OF HELICOPTER ROTORS IN A WIND TUNNEL [ESSAIS COMPARES DE ROTORS D'HELICOPTERE EN SOUFFLERIE]
J. P. DREVET (ONERA, Modane, Savoie, France) and F GUILLET (Societe Nationale Industrielle Aerospatiale, Marignane, Bouches-du-Rhone, France) ONERA, TP no. 1982-119, 1982. 48 p In French.
(ONERA, TP NO. 1982-119)

The characteristics of wind tunnel testing of helicopter rotors in the ONERA S1 wind tunnel are outlined, together with the techniques for comparing the performances of various rotors The 8 m diam tunnel has a maximum flow velocity of 120 m/sec, and rotors are tested at 800-1000 rpm, corresponding to tip speeds of 176-220 m/sec. The rotor mount is equipped with a torsiometer to measure coupling transmitted by the rotor, with 110 sensor leads for data gathering, and with a six component balance to assay the global moment development by the rotor. Pressure level and dynamic performance parameters measured during trials are *detailed, together with a discussion of the data analysis techniques,* noting that up to 1600 points can be separately monitored for later statistical treatment through a multilinear regression technique and a least squares analysis Comparative tests between two evolutive examples of a rotor are provided for the transonic regime. The necessity of taking a large number of samples in order to draw statistically valid comparisons between the performances of different rotors is demonstrated. M.S.K.

A83-24331#
CALCULATION OF THE AVERAGE SLIPSTREAM OF A PROPELLER AND ITS EFFECT ON THE PERFORMANCE OF AN AIRCRAFT [CALCUL DU SOUFFLE MOYEN D'UNE HELICE ET DE SON INFLUENCE SUR LES PERFORMANCES D'UN AVION]
C KIRRMANN (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France), A. ROUSSEAU (Societe Bertin et Cie., Plaisir, Yvelines, France), and M. YERMIA (Societe Nationale Industrielle Aerospatiale, Toulouse, France) ONERA, TP no. 1982-120, 1982 45 p. In French refs
(ONERA, TP NO. 1982-120)

An analytical model of a propeller slipstream was developed in order to determine its effects on aircraft performance, particularly in the transonic regime produced by use of the prop-fans. The model was developed based on wake-fuselage calculations previously performed for helicopter rotors. The slipstream was treated as turbulence ring singularities and cylindrical turbulence tubes Account was taken of the contraction of the slipstream and the radial repartition of the load on the propeller Converted into a computer program, the model was applied to data taken from experiments on a bimotor transport aircraft in cruise and take-off. The slipstream was expressed in terms of repartitions of pressure levels on the wings and on the aircraft engines. The overall results showed good agreement between experiment and prediction, allowing for the simplicity of the model. M.S.K.

N83-18654# Purdue Univ., Fort Wayne, Ind. Dept of Aeronautics.
ADVANCED THEORETICAL TREATMENTS OF PROPELLER AERODYNAMICS
J. P. SULLIVAN *In* Von Karman Inst. for Fluid Dyn Propeller Performance and Noise, Vol. 1 86 p 1982 refs
Avail: NTIS HC A17/MF A01

Advanced analytical techniques used to accurately predict propeller efficiency losses are discussed. Blade element theory, wake models, lifting line theory, blade geometry, induced velocities, boundary conditions, and aerodynamic coefficients are discussed R.J.F

N83-18660# National Aerospace Lab., Tokyo (Japan)
CALCULATION OF DAMPING DERIVATIVES FOR ARBITRARY 3-DIMENSIONAL BODIES USING NEWTONIAN IMPACT THEORY
M. YANAGIZAWA and K. KIKUCHI 1982 19 p refs In JAPANESE; ENGLISH summary
(NAL-TR-722; ISSN-0389-4010) Avail. NTIS HC A02/MF A01

In order to calculate the aerodynamic characteristics of arbitrary 3-D bodies at very high Mach numbers, the Newtonian impact theory can be used by automatically determining the boundaries between exposed and shielded portions of the bodies. In the impact theory, the boundaries at a finite angle of attack are expressed as the relation of geometrical functions of body and a main flow direction. The functions of the boundary are more complicated on an ordinary winged body For the sake of simplicity in the present analysis, it is assumed by Newtonian theory that the pressure coefficients in the shielded portions are zero. The boundaries are easily determined by applying the proposed criteria to each panel of body surface. The pressure coefficients of the shielded portions of the body surface are excluded for the summation of the aerodynamic force. The predicted aerodynamic characteristics of a cone, a cone-cylinder, the Gemini type vehicle and the Space Shuttle are compared with those measured results. Author

N83-18661# National Aerospace Lab., Tokyo (Japan).
FINITE ELEMENT CALCULATIONS FOR AERODYNAMIC COEFFICIENTS OF 3-DIMENSIONAL BODY IN SUBSONIC FLOW USING GREEN'S FUNCTION METHOD
M. YANAGIZAWA and K. KIKUCHI 1982 29 p refs In JAPANESE; ENGLISH summary
(NAL-TR-724; ISSN-0289-4010) Avail NTIS HC A03/MF A01

An accurate method for evaluating the derivatives along circular paths on the surface is proposed Calculations are made on various practical configurations such as wing-body combinations, tandem wings, wings with the dihedral angles at sideslip, ground effects, interference between a sphere and wind-tunnel etc. Comparisons with experiments show good agreement Author

N83-18662*# Nevada Univ., Reno Engineering Research and Development Center.
COMPUTATIONS AND TURBULENT FLOW MODELING IN SUPPORT OF HELICOPTER ROTOR TECHNOLOGY Progress Report, 1 Jun. - 30 Nov. 1982
W. C ROSE 30 Nov. 1982 17 p
(Contract NSG-2291)
(NASA-CR-169927; NAS 1.26 169927) Avail: NTIS HC A02/MF A01 CSCL 01A

Efforts continue to investigate the applicability of the Deiwert's time dependent numerical airfoil calculation code to the simulation of two dimensional airfoil flows with large amounts of separation present A modified logarithmic region mixing length term produced substantial differences in the calculated flow fields for the large separation of the M=0 4, high angle of attack cases Reasons are given for interest in applying that model to previously investigated cases of the 64A010 airfoil section at Mach number 0.8 for angles of attack of 4 deg and 6 2 deg. The effects of these turbulence models at alterations and the time dependent behavior from impulsively started conditions are discussed.
A.R.H.

N83-18653*# Mississippi State Univ , Mississippi State. Dept. of Aerospace Engineering.
THEORETICAL INVESTIGATIONS OF HIGH LIFT AERODYNAMICS Semiannual Status Report, 1 Apr. 1982 - 31 Jan. 1983
G. BENNETT and J. THOMPSON 17 Feb. 1983 9 p refs
(Contract NSG-1623)
(NASA-CR-169926, NAS 1.26·169926) Avail: NTIS HC A02/MF A01 CSCL 01A

A program which generates a coordinate system for a two element airfoil with the mesh points concentrated in areas of significant vorticity, i.e , boundary layer and wake is operational. The 'imbedded' grid method developed allows a transition from the scale of the main airfoil to the scale of the flap. This requirement is essential for the modeling of viscous flows over the flap and slat of a multielement airfoil. An airfoil mounted in a 2-D wind tunnel was formulated. The program is ready for a fine grid and a large number of planes to explore the characteristics of a Navier-Stokes solver in a quasi-3D case. The program was converted to a form suitable for the STAR computer. Runs were made to map a three dimensional flow field for a wall airfoil intersection with and without lift. S.L.

N83-18672*# Virginia Polytechnic Inst. and State Univ., Blacksburg Dept. of Aerospace and Ocean Egnineering.
PRESSURE INVESTIGATION OF NASA LEADING EDGE VORTEX FLAPS ON A 60 DEG DELTA WING Semiannual Progress Report
J F. MARCHMAN, III, D. DONATELLI, and J. TERRY 28 Feb. 1983 90 p refs
(Contract NAG1-274)
(NASA-CR-169984, NAS 1.26:169984) Avail. NTIS HC A05/MF A01 CSCL 01A

Pressure distributions on a 60 deg Delta Wing with NASA designed leading edge vortex flaps (LEVF) were found in order to provide more pressure data for LEVF and to help verify NASA computer codes used in designing these flaps. These flaps were intended to be optimized designs based on these computer codes However, the pressure distributions show that the flaps wre not optimum for the size and deflection specified. A second drag-producing vortex forming over the wing indicated that the flap was too large for the specified deflection. Also, it became apparent that flap thickness has a possible effect on the reattachment location of the vortex Research is continuing to determine proper flap size and deflection relationships that provide

well-behaved flowfields and acceptable hinge-moment characteristics. Author

N83-18673*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
FLAP EFFECTIVENESS ON SUBSONIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A MODIFIED ARROW WING
P. F. QUINTO and J W. PAULSON, JR. Mar 1983 53 p refs (NASA-TM-84582, L-15239, NAS 1.15:84582) Avail NTIS HC A04/MF A01 CSCL 01A

An investigation of the subsonic longitudinal aerodynamic characteristics of a modified arrow-wing model was conducted in the Langley 4- by 7-Meter Tunnel. This investigation addressed the effectiveness of the leading and trailing edge flap deflections of this model. The arrow wing was tested at a Mach number of 0.02 and at an angle-of-attack range from -4 deg to 24 deg. The results of the investigation showed that deflecting the leading edge and trailing edge in combination could promote an attached-flow condition at the wing leading edge. Also, the leading edge suction could be maximized over the complete lift-coefficient range by scheduling a combination of leading and trailing edge flap deflections Author

N83-18674# National Aerospace Lab , Tokyo (Japan).
WIND TUNNEL INVESTIGATION OF AN UPPER SURFACE BLOWN-FLAP HALF MODEL OF THE NALSTOL RESEARCH AIRCRAFT
1982 34 p refs In JAPANESE, ENGLISH summary
(NAL-TR-734; ISSN-0389-4010) Avail NTIS HC A03/MF A01

An investigation has been conducted to determine the aerodynamic characteristics of the aerodynamic elements of an 8% subsonic jet transport half model with an upper surface blowing flap system that would augment lift Wind tunnel tests of leading edge and trailing edge high lift devices were conducted After investigating those wind tunnel test data, some results were obtained. The set up angles of outer leading edge slats which were divided into three parts were all fixed at 40 degrees It was determined that the USB flap was a hinged 40-70 type Forward - Main flap and that the inner leading edge had no device because any inner leading edge high lift devices were less effective in augmenting lift Many data obtained in the wind tunnel tests were offered for the design of the NALSTOL Research Aircraft Author

N83-18675# National Aerospace Lab., Tokyo (Japan)
A STUDY OF AERODYNAMIC CHARACTERISTICS OF WING-BODY COMBINATIONS. PART 1: CASE OF A MID-WING AIRPLANE
M. YANAGIZAWA and K. KIKUCHI 1982 20 p refs In JAPANESE, ENGLISH summary
(NAL-TR-729-PT-1, ISSN-0389-4010) Avail NTIS HC A02/MF A01

Measurements of pressure distributions on a 5 to 1 ellipsoid and wing-body combinations at low subsonic speed are reported The experiments were carried out in the 2 x 2 m low speed wind tunnel at wind speeds from 20 m/s to 50 m/s with a corresponding chord Reynolds number range of 0.2 x 1 million to 0.5 x 1 million. These wind tunnel experiments were conducted in order to verify assumptions relating to the location of the intersection curve between the body surface and the wake surface, which are necessary for analyzing problems of lifting body by the finite elements method (FEM). Observations of the flow around these bodies by use of tufts indicate that the velocity field predicted by FEM agrees fairly well with the actual field It was found that theory and the results of experiments generally show good agreement in aerodynamic characteristics. R.J.F.

N83-18686# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France).
FLOW VISUALIZATION TECHNIQUES FOR THE STUDY OF HIGH INCIDENCE AERODYNAMICS
H. WERTE *In* AGARD High Angle-of-Attack Aerodyn. 36 p Dec 1982 refs In FRENCH and ENGLISH Original language document was announced as A82-34493
Avail NTIS HC A18/MF A01

Descriptions are given of the use of solid, liquid or gas tracers in water and wind tunnels for the visualization of aerodynamic flows, with emphasis on the methods employed by the experimental facilities of ONERA. The range of visualization techniques covered reveal flow patterns with all their parietal singularities, as well as the evolution of such patterns as a function of such aerodynamic parameters as incidence, yaw angle and Reynolds number Visualization methods also reveal the separation phenomena which characterize high incidence angle aerodynamics, and they precisely define vortical, transitional and unsteady flow regimes The aerodynamic surfaces tested by visualization methods include airfoil profiles, sweptback wings, slender bodies, inlets, and entire aircraft configurations Attention is given to the layout of ONERA and other water tunnel facilities. O.C (IAA)

N83-18687# Northrop Corp , Hawthorne, Calif Aerodynamics Research Dept
MODERN FIGHTER AIRCRAFT DESIGN FOR HIGH-ANGLE-OF-ATTACK MANEUVERING
A. M SKOW and G. E ERICKSON *In* AGARD High Angle-of-Attack Aerodyn 59 p Dec. 1982 refs
Avail NTIS HC A18/MF A01

Design methodologies for fighter aircraft that operate at high AOA are discussed. Basic wing design features and the effects of high-lift devices on high-AOA characteristics are presented. Forebody design considerations for high-AOA stability are developed, as are the effects of forebody shape on radar performance The interaction of the vortex system emanating from the forebody with other vortex systems downstream, such as from a leading edge extension (LEX) or canard or from a highly swept main wing panel, are shown to be significant Control surface placement relative to the wing flowfield and to the vortex flowfield downstream of a highly swept LEX is shown to be important for both stability and controllability A criterion for high-AOA pitch controllability including the effects of kinematic and inertial coupling is presented Inlet design considerations regarding placement relative to the body and wing and the effects of duct geometry on engine compressor face distortion at high AOA are discussed Author

N83-18694# Dornier-Werke G.m.b.H , Friedrichshafen (West Germany)
INFLUENCE OF CONFIGURATION COMPONENTS OF STATICALLY UNSTABLE COMBAT AIRCRAFT ON THE AERODYNAMIC DESIGN FOR HIGH ANGLE-OF-ATTACK
G WEDEKIND *In* AGARD High Angle-of-Attack Aerodyn. 33 p Dec 1982 refs
Avail NTIS HC A18/MF A01

The influence of some aircraft components on the design of statically unstable aircraft will be shown in order to give an insight into the basic problems of such aircraft All tendencies related to aerodynamics are derived from wind-tunnel tests. Special problems at high angles of attack that occur when the upper limit of the maneuver range is shifted to angles of attack that are far beyond the angle for maximum lift are discussed. R J F.

N83-18695# British Aerospace Dynamics Group, Bristol (England) Aerodynamics Research Dept
MISSILE BODY VORTICES AND THEIR INTERACTION WITH LIFTING SURFACES
J. R DEANE *In* AGARD High Angle-of-Attack Aerodyn. 40 p Dec. 1982 refs
Avail: NTIS HC A18/MF A01

It is shown that existing empirical prediction methods for vortex characteristics can yield reasonable estimates of overall circulation

contained in the symmetric body vortex wake and that core positions are similarly well predicted However, it is also shown that the concept of modeling the vortex wake as a single pair of contra-rotating potential line vortices will not adequately represent the true distributed nature of the vorticity. At the very least, a viscous core and feeding sheet should be added to the flow model When flow around wing-body combinations is considered, the importance of considering the vortices as diffuse rather than concentrated entities is emphasized Comparison of results for spanwise loading distributions for the predicted and experimental cases shows that, even using a viscous core and feeding sheet model, satisfactory results are not likely to be achieved at high angles of incidence with the panel rolled into the leeside It is speculated that this follows from the action of the wing panel and is dispersing the previously well-defined body vortex core at some point adjacent to the wing panels. Evidence of flow visualization tests in water and wind tunnels indicated that significant changes of trajectory and drastic changes of structure are possible in such areas. R.J.F.

N83-19709*# Joint Inst. for Advancement of Flight Sciences, Washington, D C.
LIFTING SURFACE THEORY FOR A HELICOPTER ROTOR IN FORWARD FLIGHT Final Report
H. L RUNYAN and H. TAI 1983 19 p refs
(Contract NAG1-13)
(NASA-CR-169997; NAS 1.26:169997) Avail NTIS HC A02/MF A01 CSCL 01A

A lifting surface theory has been developed for a helicopter rotor in forward flight for incompressible flow. The method utilized the concept of the linearized acceleration potential and make use of the vortex lattice procedures. Results in terms of lift coefficient slope for several forward flight conditions are given Author

N83-19714*# North Carolina State Univ., Raleigh Dept. of Mechanical and Aerospace Engineering.
SUBSONIC BALANCE AND PRESSURE INVESTIGATION OF A 60 DEG DELTA WING WITH LEADING EDGE DEVICES
S. A TINGAS and D. M. RAO (Vigyan Research Associates, Inc., Hampton, Va.) Hampton, Va NASA Langley Research Center May 1982 215 p refs
(Contract NCC1-46)
(NASA-CR-165923; NAS 1.26:165923) Avail: NTIS HC A10/MF A01 CSCL 01A

Low supersonic wave drag makes the thin highly swept delta wing the logical choice for use on aircraft designed for supersonic cruise. However, the high-lift maneuver capability of the aircraft is limited by severe induced-drag penalties attributed to loss of potential flow leading-edge suction. This drag increase may be alleviated through leading-edge flow control to recover lost aerodynamic thrust through either retention of attached leading-edge flow to higher angles of attack or exploitation of the increased suction potential of separation-induced vortex flow A low-speed wind-tunnel investigation was undertaken to examine the high-lift devices such as fences, chordwise slots, pylon vortex generators, leading-edge vortex flaps, and sharp leading-edge extensions. The devices were tested individually and in combinations in an attempt to improve high-alpha drag performance with a minimum of low-alpha drag penalty. This report presents an analysis of the force, moment, and static pressure data obtained in angles of attack up to 23 deg, at Mach and Reynolds numbers of 0.16 and 3.85 x 10 to the 6th power per meter, respectively. The results indicate that all the devices produced drag and longitudinal/lateral stability improvements at high lift with, in most cases, minor drag penalties at low angles of attack Author

N83-19715*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va
PUMPED VORTEX Patent Application
L. R. JACKSON and A. H. TAYLOR, inventors (to NASA) 10 Jan. 1983 14 p
(NASA-CASE-LAR-12615-1; US-PATENT-APPL-SN-456915)
Avail: NTIS HC A02/MF A01 CSCL 01A

A system for increasing vortex lift and delaying vortex breakdown in aircraft is described A turbofan or turbojet engine is located near and slightly above the trailing edge of an aircraft wing which produces a leading edge vortex system The engine is located such that the leading edge vortex is centered on and forms the engine input stream Suction produced by the engine inlet serves to pump (increase the velocity of) the core flow and surrounding high energy vortex flow of the vortex system. Pumping the core and surrounding flows near the trailing edge of the wing creates a more negative pressure above the wing, thereby increasing lift. Pumping the core flow also delays vortex breakdown which occurs at high angles of attack. The downstream vortex is rendered less turbulent, that is, lower in vorticity, thus less dangerous to following aircraft NASA

N83-19718# Rockwell International Corp , Thousand Oaks, Calif.
COMPUTATIONAL TREATMENT OF TRANSONIC CANARD-WING INTERACTIONS Interim Report
V. SHANKAR and N D. MALMUTH Jan. 1982 11 p refs Presented at the AIAA 20th Aerospace Sci. Meeting, Orlando, Fla., 11-14 Jan. 1982 Original document was announced as A82-17814
(Contract F49620-80-C-0081, AF PROJ. 2307)
(AD-A121662; AFOSR-82-1007TR) Avail: NTIS HC A02/MF A01 CSCL 20D

The transonic canard-wing interaction problem is simulated using modified small disturbance (MSD) transonic theory. The wing and the canard are treated in a sheared fine grid system that is embedded in a global Cartesian crude grid. An appropriate far field and asymptotic expression for the velocity potential derived using Green's theorem is implemented. Results are presented for a few canard-wing configurations and compared with available experimental data. The weakening of the wing shock due to the presence of the canard downwash is illustrated in terms of contour plots An empirical incidence correction for the wing leading edge vortex gives good agreement with experiment at low incidences. For higher angles of attack, the results indicate that a more sophisticated vortex roll-up and induction model is required.
Author (IAA)

N83-19719# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
TRANSONIC AND NONLINEAR FLOW RESEARCH Final Report, 1 Jun. 1980 - 28 Feb. 1982
N. D. MALMUTH, J D COLE, C. C WU, and F. ZEIGLER May 1982 97 p refs Prepared in cooperation with the California Univ. and Wisconsin Univ
(Contract F49620-80-C-0081; AF PROJ. 2307)
(AD-A121477, SC5267 3FR, AFOSR-82-0954TR) Avail NTIS HC A05/MF A01 CSCL 08J

The research program consists of the investigation of transonic slender body theory and optimization procedures as well as asymptotic methods for wind-tunnel interference in the supercritical regime For the slender body portion, two areas received attention. In the first, the existence of an unsteady equivalence rule has been verified in which the outer solution is governed by axisymmetric unsteady small disturbance theory subject to an unsteady line source internal boundary condition and far field. As in the steady case, the strength of the line source depends on an inner solution for the potential, which is harmonic in cross planes to the flow. This solution specifies the line source intensity in terms of a rate of change of the cross sectional area distribution in which the unsteady motion of the body surface is taken into account The second aspect of the research effort deals with optimization of slender lifting wing-body combinations. A restricted

class of these shapes has been considered in which the wing span increases monotonically from a common apex with the body. For the wall interference portion of the effort, the method of matched asymptotic expansions is utilized to study the singular perturbation problem relevant to transonic airfoils confined by large height to chord ratio solid walls. GRA

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents

A83-23373
POSSIBLE IMPROVEMENTS IN METEOROLOGY FOR AIRCRAFT NAVIGATION
M. BISIAUX, M E. COX, J T. STOREY (EUROCONTROL, Bruxelles, Belgium), and D. A FORRESTER (Meteorological Office, Bracknell, Berks , England) Journal of Navigation, vol. 36, Jan 1983, p. 54-63 refs

It is pointed out that any estimate of flight progress and fuel requirements based on the use of the most economical aircraft speeds, whether made by the pilot or by a flight management system (FMS), can only be as good as the knowledge of the wind-vector data pertinent to the flight. Even though FMS-equipped aircraft in level cruise can often 'update' or correct the forecast data relating to the next flight leg, this is not feasible when major changes of altitude are necessary, e g during the descent phase. After surveying the present meteorological scene, aircraft measurements of wind and temperature are discussed. C R

A83-24158#
NOISE-REDUCING TAKEOFF AND LANDING PROCEDURES AND THE POTENTIAL FOR THEIR OPERATIONAL USE IN THE AIRBUS A300 [LAERMMINDERNDE START- UND LANDEVERFAHREN UND IHRE OPERATIONELLEN EINSATZMOEGLICHKEITEN AM BEISPIEL DES AIRBUS A300]
R. FRIEDEL and K. HEEGE (Darmstadt, Technische Hochschule, Darmstadt, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 32 p In German. Research supported by the Deutsche Forschungsgemeinschaft. refs
(DGLR PAPER 82-032)

Research on developing noise-reducing takeoff and landing procedures, taking into account pilot load and flight safety are reported using the Airbus A300 as an example Aircraft guidance for the vertical flight path only is considered. Results of noise calculations based on flight data obtained in a simulator show that considerable improvements in noise load in the near-airport areas are possible when compared with the takeoff and landing procedures preferred today. At takeoff the improvement is accomplished by reducing thrust, while on landing it is done by increasing the glide path angle. C D.

A83-24166#
SELECTED TOPICS IN LICENSING AIRBUS A310 [AUSGEWAEHLTE ZULASSUNGSTHEMEN AIRBUS A310]
M. STRAUBER (Messerschmitt-Boelkow-Blohm GmbH, Hamburg, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 28 p. In German.
(DGLR PAPER 82-042)

Some aspects of the administrative hearing concerning the licensing of Airbus A310 are discussed in the context of the applicable structural requirements and interpretive material. The special problems arising from the introduction of computer-controlled steering, control, and monitoring systems, as well as those arising from tightened requirements in the FAR structural requirements are addressed. The significance of the damage tolerance principle and additional requirements for the analysis of fiber-bound structural parts are considered. It is shown that fulfilling these requirements entails considerable increases in the cost of administrative hearing. C.D

A83-24167#
SAFETY REQUIREMENTS AND TRENDS IN THE PASSENGER AIRCRAFT CABIN AREA [SICHERHEITSANFORDERUNGEN UND -TENDENZEN IM KABINENBEREICH VON GROSSRAUMFLUGZEUGEN]
H. TRABER (Messerschmitt-Boelkow-Blohm GmbH, Hamburg, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 27 p In German. refs
(DGLR PAPER 82-043)

The development of passenger aircraft cabin materials which are low in emission of smoke and poisonous gases during burning, as well as self-extinguishing, is discussed in the context of accident records and general and legal requirements imposed on passenger aircraft equipment The characteristics which distinguish materials that meet those requirements are constrasted with those which fail to meet them. The most recent trends and developments in the area of passenger restraint systems to prevent injuries during emergency landings are examined. Newly developed evacuation equipment, which exhibits shorter opening time and greater flame resistance than that used up to now, is described C.D

A83-24171#
THE CONSIDERATION OF OPERATIONAL ASPECTS FOR UTILITY-/COMMUTER AIRCRAFT, TAKING INTO ACCOUNT THE EXAMPLE OF THE DORNIER 228 [BERUECKSICHTIGUNG OPERATIONELLER ASPEKTE FUER UTILITY-/COMMUTER-FLUGZEUGE AM BEISPIEL DER DORNIER 228]
J. WIPPICH (Dornier GmbH, Friedrichshafen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 22 p. In German
(DGLR PAPER 82-047)

The design of the Dornier 228 takes into consideration two types of employment for the aircraft, including a use as utility aircraft and as commuter aircraft The operating costs of an aircraft are determined by fuel costs and, in addition, by reliability considerations and maintenance expenses The operator of the Dornier 228 aircraft has the possibility to select one of two maintenance concepts on the basis of suitability considerations The expenses involved in the use of the 'Continuous Maintenance Program' (CMP) are somewhat higher than the costs incurred in connection with the 'Standard' maintenance concept. However, for airlines engaged in commuter operations, the CMP may provide the only possibility to conduct operations economically in connection with a maximal availability of the aircraft G.R.

A83-24327#
WIND TUNNEL STUDY OF ICING AND DE-ICING ON OSCILLATING ROTOR BLADES
D GUFFOND (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) ONERA, TP no 1982-116, 1982 11 p.
(ONERA, TP NO. 1982-116)

The results of icing and de-icing tests performed at an ONERA facility are reported, noting the simulation of a cyclic variation in the angle of attack for a helicopter rotor Analysis of the test data included accounting for the presence of two regions, one where the icing was less than 3 mm thick, and the other being the leading edge, where icing was thickest. Centrifugal forces were determined to have a negligible effect on the shape of the ice accumulation, while the velocity of the advancing blade did have a significant impact, i.e., increased speed resulted in the formation of horn-shaped growths. Larger droplets tended to extend the horn farther behind the leading edge, while oscillations in the blade had no important effect on ice geometry Ice is removed in-flight only when a sufficiently thick layer of water forms between the ice and the blade during de-icing heating M.S.K.

A83-24901
PILOT FATIGUE - A DEADLY COVER-UP
R. P. CHAPMAN Smithtown, NY, Exposition Press, 1982. 262 p $11.00

Work overloads for pilots are investigated as a cause of pilot fatigue, and thereby fatal air accidents, with emphasis on conditions which led to the Sept. 25, 1978 air disaster of Flight 182 near San Diego, CA Rapid company expansion over three decades, coupled with the necessity of minimizing operating expenses, is pinpointed as the cause of pilot fatigue. Attention is given to the routing practices designed to make maximum use of a pilot working a shift, noting the stressful conditions which arise when excessive numbers of landings and takeoffs are written into the schedule. The increase in air safety arising from the inclusion of a third person in the cockpit is stressed as a cautionary note in the light of attempts to reduce crew numbers because of the introduction of computerized avionics. M.S.K.

A83-25693*# Tennessee Univ., Knoxville
'SCALING' ANALYSIS OF THE ICE ACCRETION PROCESS ON AIRCRAFT SURFACES
E. G. KESHOCK, A H TABRIZI (Tennessee, University, Knoxville, TN), and J R. MISSIMER (Environmental Systems Corp., Knoxville, TN) American Society of Mechanical Engineers, Winter Annual Meeting, Phoenix, AZ, Nov 14-19, 1982, 8 p. refs
(Contract NAG3-90)
(ASME PAPER 82-WA/HT-39)

A comprehensive set of scaling parameters is developed for the ice accretion process by analyzing the energy equations of the dynamic freezing zone and the already frozen ice layer, the continuity equation associated with supercooled liquid droplets entering into and impacting within the dynamic freezing zone, and energy equation of the ice layer No initial arbitrary judgments are made regarding the relative magnitudes of each of the terms The method of intrinsic reference variables in employed in order to develop the appropriate scaling parameters and their relative significance in rime icing conditions in an orderly process, rather than utilizing empiricism The significance of these parameters is examined and the parameters are combined with scaling criteria related to droplet trajectory similitude. N B.

A83-25896
DEVELOPMENT OF A VARIABLE-LOAD ENERGY ABSORBER
L. P. DOMZALSKI (U S. Naval Material Command, Air Development Center, Warminster, PA) and J. C WARRICK (Simula, Inc., Tempe, AZ) SAFE Journal, vol. 13, Spring, 1983, p. 8-15. Navy-supported research refs

An energy absorbing system with ten load settings for use in military helicopters is described The number of settings allows for a wider range of weights with equal crash protection capability for the seat occupant. The design combines wire-bender for impact energy absorption and an inversion tube to damp the rebound, compression energy. The manufacturing techniques chosen for producing the inversion tube are discussed. Drop tests were performed to simulate crash conditions, e.g , a 45 g peak impulse accompanied by a velocity change of 13.7 m/sec. A 50% increase in the seat bucket stroke was demonstrated, together with reductions in the forces imparted on the test dummy, compared to the currently used system. The crashworthy seats are presently being produced for installation on the Seahawk, Black Hawk, and Apache aircraft. M.S.K

A83-26481#
CONFLICT RECOGNITION AND COLLISION PROBABILITY IN CONNECTION WITH HORIZONTAL EVASION MANEUVERS [KONFLIKTERKENNUNG UND KOLLISIONSWAHRSCHEINLICHKEIT BEI HORIZONTALEN AUSWEICHMANOEVERN]
W. SCHROER (Braunschweig, Technische Universitaet, Brunswick, West Germany) In The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p 141-181 In German.

Hazards regarding midair collisions make it necessary to consider measures which will provide protection against an occurrence of such accidents. Form (1981) has reported about a number of technical solutions which have been proposed in this connection However, up to now none of these proposals could be implemented. Brunner (1979) has considered the reduction of the collision frequency by means of an improvement of air traffic control with the aid of computer-based systems However, in connection with uncontrolled air traffic, the employment of an additional onboard system appears to be vital Aspects of collision probability are investigated, taking into account the logical structure of a conflict solution, simulation results, and collision in connection with rectilinear motion without acceleration. The feasibility of collision avoidance by means of suitable aircraft maneuvers is explored, giving attention to vertical maneuvers, flight dynamics boundary conditions of horizontal maneuvers, and noncooperative and cooperative horizontal maneuvers. G.R.

N83-18697*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE SAFETY ADVISORY PANEL Annual Report
Jan. 1983 100 p refs
(NASA-TM-85220, NAS 1 15:85220) Avail: NTIS HC A05/MF A01 CSCL 01C

Data acquired on the actual flight experience with the various subsystems are assessed. These subsystems include flight control and performance, structural integrity, orbiter landing gear, lithium batteries, EVA and prebreathing, and main engines. Improvements for routine operations are recommended. Policy issues for operations and flight safety for aircraft operations are discussed. S.L

N83-18698# National Transportation Safety Board, Washington, D C Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT. WORLD AIRWAYS, INC., FLIGHT 30H, N112WA MCDONNELL DOUGLAS DC-10-30, BOSTON-LOGAN INTERNATIONAL AIRPORT, BOSTON, MASSACHUSETTS, JANUARY 23, 1982
15 Dec. 1982 113 p refs
(PB82-910415; NTSB-114-82-15) Avail: NTIS HC A06/MF A01 CSCL 01C

On January 23, 1982, World Airways, Inc , Flight 30H, a McDonnell Douglas DC-10-30, was a regularly scheduled passenger flight from Oakland, California, to Boston, Massachusetts, with an en route stop at Newark, New Jersey. Following a nonprecision instrument approach to runway 15R at Boston-Logan International Airport, the airplane touched down about 2,500 feet beyond the displaced threshold of the 9,191 foot usable part of the runway. About 1936 40, the airplane veered to avoid the approach light pier at the departure end of the runway and slid into the shallow water of Boston Harbor. The nose section separated from the forward fuselage in the impact after the airplane dropped from the shore embankment. Of the 212 persons on board, two are missing and presumed dead. The weather was 800 foot overcast, 2 1/2 mile visibility, with light rain and fog The temperature was 38 deg with the wind from 165 deg at 3 kns. The surface of runway 15R was covered with rain, hard-packed snow, and glaze ice. At 1736, 2 hours before the accident, runway braking was reported by a ground vehicle as fair to poor; subsequently, several pilots had reported braking as poor, and one pilot had reported braking as poor to nil in the hour before the accident The National Transportation Safety Board determines that the probable cause

of this accident was the pilot landed the airplane without sufficient information as to runway conditions on a slippery, ice-covered runway B.W.

N83-18699*# Ohio State Univ , Columbus. Dept. of Aviation
STUDY TO DETERMINE THE IFR OPERATIONAL PROFILE AND PROBLEMS OF THE GENERAL AVIATION SINGLE PILOT Final Report
G S. WEISLOGEL Washington NASA Feb. 1983 67 p refs
(Contract NAS1-15969)
(NASA-CR-3576; NAS 1.26:3576) Avail: NTIS HC A04/MF A01 CSCL 01C

General aviation single pilot operating under instrument flight rules (GA SPIFR) was studied The objectives of the study were to (1) develop a GA SPIFR operational profile, (2) identify problems experienced by the GA SPIFR pilot, and (3) identify research tasks which have the potential for eliminating or reducing the severity of the problems. To obtain the information necessary to accomplish these objectives, a mail questionnaire survey of instrument rated pilots was conducted. The general aviation IFR single pilot operational profile and selected data analysis examples are presented. Author

N83-18700# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.
AIRCRAFT ACCIDENT REPORT: REEVE ALEUTIAN AIRWAYS, NIHON YS-11A, N169RV, KING SALMON, ALASKA, FEBRUARY 16, 1982
30 Nov 1982 31 p
(PB82-910414; NTSB-AAR-82-14) Avail: NTIS HC A03/MF A01 CSCL 01C

About 0905, Alaska standard time, on February 16, 1982, Reeve Aleutian Airways, Inc , Flight 69, a Nihon YS-11A, N169RV, with 36 passengers and 3 crewmembers onboard, made an emergency gear-up landing on the frozen Naknek River adjacent to the King Salmon Airport, King Salmon, Alaska, following the loss of power in both engines The aircraft was damaged substantially, and one crewmember, two passengers, and two firefighers suffered minor injuries during the evacuation, firefighting, and rescue activities. The National Transportation Safety Board determines that the probable cause of this accident was the loss of power in the right engine due to the freezing of water in the fuel filter after the fuel heaters were turned off in accordance with the before-landing checklist, and the loss of power due to the destruction of the left-engine turbine from overtemperature due to excessive fuel flow for undetermined reasons. Author

N83-18701*# Northwestern Univ., Evanston, Ill. Transportation Center
A REAPPRAISAL OF TRANSPORT AIRCRAFT NEEDS 1985 - 2000: PERCEPTIONS OF AIRLINE MANAGEMENT IN A CHANGING ECONOMIC, REGULATORY, AND TECHNOLOGICAL ENVIRONMENT
F. A SPENCER Mar. 1982 179 p refs
(Contract NAG1-180)
(NASA-CR-165887, NAS 1.26:165887) Avail: NTIS HC A09/MF A01 CSCL 01C

Views of the executives of 24 major, national, regional, and commuter airlines concerning the effect of recent regulatory, economic, and technological changes on the roles they see for their airlines, and consequent changes in their plans for acquiring aircraft for the 1985 to 2000 period were surveyed. Differing perceptions on the economic justification for new-technology jets in the context of the carriers' present and projected financial conditions are outlined. After examining the cases for new or intermediate size jets, the study discusses turboprop powered transports, including the carriers' potential interest in an advanced technology, high-speed turboprop or prop-fan. Finally, the implications of foreign competition are examined in terms of each carrier's evaluation of the quality and financial offerings, as well as possible 'Buy American' policy predisposition. J.M.S.

N83-18702*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
COMPARATIVE EVALUATION OF TWENTY PILOT WORKLOAD ASSESSMENT MEASURE USING A PSYCHOMOTOR TASK IN A MOVING BASE AIRCRAFT SIMULATOR
S A. CONNOR and W. W WIERWILLE Jan. 1983 39 p refs
(Contract NAG2-17)
(NASA-CR-166457; NAS 1.26.166457) Avail NTIS HC A03/MF A01 CSCL 05H

A comparison of the sensitivity and intrusion of twenty pilot workload assessment techniques was conducted using a psychomotor loading task in a three degree of freedom moving base aircraft simulator The twenty techniques included opinion measures, spare mental capacity measures, physiological measures, eye behavior measures, and primary task performance measures. The primary task was an instrument landing system (ILS) approach and landing All measures were recorded between the outer marker and the middle marker on the approach Three levels (low, medium, and high) of psychomotor load were obtained by the combined manipulation of windgust disturbance level and simulated aircraft pitch stability. Six instrument rated pilots participated in four seasons lasting approximately three hours each. Author

N83-18703# Technische Univ , Berlin (West Germany) Inst fuer Luft- und Raumfahrt.
DEVELOPMENT STUDIES FOR INCORPORATION OF AIR TRANSPORTATION DOCUMENTATION IN THE BUILDING UP OF A TRANSPORT INFORMATION SYSTEM Final Report [ENTWICKLUNGSARBEITEN ZUR EINBELIEHUNG DES DOKUMENTATIONSGEBIETES LUFTVERKEHR BEIM AUFBAU DES FACHINFORMATIONSSYSTEMS VERKEHR (FIS 7)]
G STUMPF and U KNUEPFER Jul 1982 203 p In GERMAN Sponsored by Bundesministerium fuer Verkehr and Gesellschaft fure Information und Dokumentation m.b.H.
(Contract BMFT-PT-754.04)
Avail: NTIS HC A10/MF A01

An information systems on air transportation consisting of the closed documentation systems and the selective information area of single traffic carriers were analyzed. Development of the basics for a closed documentation system in transport information is only available in a centrally buildup finished uniform rules of traffic information pool The air traffic projects' state of the arts, especially the computer supported information pool on air traffic is still in a developmental stage and needs further development.
Transl. by E.A.K.

N83-19438# Naval Air Development Center, Warminster, Pa.
THE U.S. NAVY APPROACH TO CRASHWORTHY SEATING SYSTEMS
M. SCHULMAN *In* AGARD Impact Injury Caused by Linear Acceleration 12 p Oct. 1982 refs
Avail: NTIS HC A21/MF A01

The U.S. Navy has for the past 22 years been committed to the support of a number of research and development programs to improve seating systems in non-ejection aircraft This committment has resulted in a family of crashworthy seats which have gone through considerable testing and evaluation to demonstrate their capacity to manage crash loads and to limit those loads transmitted from the aircraft to the crewmembers. The development process has led to crashworthy armored and unarmored pilot/co-pilot, troop, passenger, gunner and specialty seats. However, the demonstration that these seats are effective in increasing the probability of survival during and after a crash does not necessarily mean that they will be adopted for military aircraft. New generation helicopters will require crashworthy seating in accordance with the latest military specifications, but retrofitting current operational aircraft with advanced seats is a more difficult undertaking. The acquisition manager must make the final decision and then provide the funding to support the effort. Author

N83-19443# Institute of Aviation Medicine, Farnborough (England).
RECENT IMPROVEMENTS IN CRASH RESTRAINT IN UK HELICOPTERS
A. P. STEELE-PERKINS *In* AGARD Impact Injury Caused by Linear Acceleration 9 p Oct. 1982 refs
Avail: NTIS HC A21/MF A01

The introduction into the RAF Chinook HCI of crew seats with energy attenuation resulted in a major advance in crashworthiness, and the principles of the seat are outlined. Shortcomings in the quick release facilities in passenger restraint harnesses are discussed briefly together with suggested improvements. A seat rotation mechanism with good crashworthy features which can be incorporated into any existing seat system is described, and finally the problems of providing an efficient harness for mobile aircrew are discussed and solutions offered. Author

N83-19444# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
EVALUATION OF THE EFFICIENCY OF HELICOPTER ANTICRASH SEATS USING A HORIZONTAL ACCELERATION BENCH AND A SIMULATED CRASH [EVALUATION SUR BANC D'ACCELERATION HORIZONTAL ET LORS D'UN CRASH SIMULE DE L'EFFICACITE DE SIEGES ANTICRASH D'HELICOPTERES]
B. VETTES and G BEZAMAT *In* AGARD Impact Injury Caused by Linear Acceleration 17 p Oct. 1982 refs In FRENCH
Avail: NTIS HC A21/MF A01

A horizontal acceleration bench and a simulated crash of the PUMA SA 330 helicopter were used to qualify a pilot seat, a three-man seat for flying personnel, and a joined seat for passengers, all with disposible energy absorbers. An automatic method for analyzing and interpreting accelerations on the dummy and seat was used to evaluate the intensity, the duration of acceleration, the jolt, and the elastic response of the different corporal masses of the dummy (pelvis-thorax-head). Tests on the horizontal acceleration bench were conducted in the unitary vertical, unitary horizontal, and in combined directions Despite their severity, the tests verified the good functioning of the energy absorber systems and the attenuation of accelerations transmitted to the dummies The crash test confirmed that occupants of these such apparatus would be reasonably safe; however, there does exist risk of more or less serious injuries (shock, fracture, confusion) especially in the lower cervical region (C5 to C7).
Transl. by A.R H.

N83-19721*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIME SCHEDULING OF A MIX OF 4D EQUIPPED AND UNEQUIPPED AIRCRAFT
L. TOBIAS Feb. 1983 17 p refs
(NASA-TM-84327; A-9225; NAS 1.15:84327) Avail: NTIS HC A02/MF A01 CSCL 01C

In planning for a future automated air traffic system, it is necessary to confront the transition situation in which some percentage of the traffic must be handled by conventional means. A safe, efficient transition system is needed since initially not all aircraft will be able to respond to a more automated system. The specific problem addressed was that of time scheduling a mix of 4D-equipped aircraft (aircraft that can accurately meet a controller specified time schedule at selected way points in the terminal area) when operating in conjunction with unequipped aircraft (aircraft that require air traffic handling by means of standard vectoring techniques). First, a relationship between time separation and system capacity was developed The time separations were incorporated into a set of scheduling algorithms which contain the required elements of flexibility needed for terminal-area operation, such as delaying aircraft and changing time separations. The problem of reducing the size of time separations allotted for vectored aircraft by means of computer assists to the controller was also addressed. B G.

N83-19722# General Dynamics/Fort Worth, Tex.
ADVANCED ULTRA-VIOLET (UV) AIRCRAFT FIRE DETECTION SYSTEM. VOLUME 2: SYSTEM HARDWARE DESIGN, SOFTWARE DESIGN, AND TEST Final Report, 15 Dec. 1977 - 26 Oct. 1981
Wright-Patterson AFB, Ohio AFWAL Aug. 1982 512 p refs
(Contract F33615-77-C-2029; AF PROJ 2348)
(AD-A121721; AFWAL-TR-82-2062-VOL-2) Avail: NTIS HC A22/MF A01 CSCL 01B

The objective of this program was to utilize ultra-violet (UV) radiation technology to provide advanced means of detecting fire hazards more reliably and more rapidly than current thermally activated continuous cable type system. This volume, Volume 2, of three volumes provides detail information on the development, circuit/software design and qualification testing of the systemcomponent. Author (GRA)

N83-19723# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
AIRCRAFT ACCELERATION SENSITIVE INERTIA REEL LOCK
T J ZENOBI 1982 10 p
(AD-A122208; NADC-82249-10) Avail: NTIS HC A02/MF A01 CSCL 13E

The Navy has built and tested an aircraft acceleration sensitive inertia reel lock for crewmember positioning and restraint during eyeballs out (-gx) accelerations, primarily during an aircraft flat spin. The design is simple and retrofitting to many ejection seats. Centrifuge tests at NADC indicate the locking device performs effectively and reliably. GRA

N83-19724# Air Force Academy, Colo Flight Dynamics Lab.
CATAPULT DYNAMICS IN A HIGH ACCELERATION ENVIRONMENT Final Report, 1 Oct. 1979 - 30 Sep. 1981
A. M HIGGINS 15 Oct. 1982 79 p refs
(AD-A122314; USAFA-TN-82-5) Avail: NTIS HC A05/MF A01 CSCL 01B

This paper presents the results of a test program in which ejection catapults were test fired both in an environment of zero acceleration (catapult horizontal) and in a high acceleration environment. These test results showed a marked effect of G loading on the catapult dynamics. The catapult pressures, for example, were significantly higher. This paper also describes an attempt made to construct a computer model which would predict the catapult's dynamics under any G loading. A discussion of the model results is included, as is the computer model program
Author (GRA)

N83-19725# Army Aviation Research and Development Command, St. Louis, Mo. Applied Technology Lab.
VERIFICATION TESTING OF A UH-1 WIRE STRIKE PROTECTION SYSTEM (WSPS)
L. T. BURROWS Nov. 1982 28 p refs
(AD-A122220; USAAVRADCOM-TR-82-D-35) Avail: NTIS HC A03/MF A01 CSCL 01B

In-flight wire strikes poses a serious threat to low-level helicopter operations. Under the sponsorship of Headquarters, US Army Aviation Research and Development Command (AVARADCOM) tests were conducted by ATL to determine the suitability for UH-1H helicopter application of a Wire Strike Protection System (WSPS) manufactured by Bristol Aerospace Limited (BAL). The WSPS initially tested consisted of fuselage-mounted upper and lower cutters and a windshield centerpost deflector with a sawtooth cutter. Using the NASA-Langley Research Center's Impact Dynamics Research Facility, a UH-1H helicopter fitted with the WSPS was subjected to pendulum swing tests in which the helicopter struck strung wires at approximately 40 knots airspeed. The WSPS demonstrated its capability to sever an 11,500-pound tensile strength steel, seven-strand 3/8 guy wire. Also, a significant wire-cutting limitation peculiar to the UH-1H was identified. At wire impact 30 degrees from the normal to the flight path, it was demonstrated that the wire could be snagged by the windshield wiper shaft, preventing the wire from being deflected into the upper cutter. As a result, BAL and ATL analyzed the situation and both

concluded that a simple windshield wiper shaft deflector could alleviate the problem. Windshield wiper shaft deflectors fabricated by BAL were installed on the test aircraft and additional swing tests were conducted Successful deflection and wire cutting were demonstrated Installation of the WSSPS, as modified by this effort, on the Army's UH-1H helicopter fleet is recommended. GRA

N83-19727# National Bureau of Standards, Washington, D C. National Engineering Lab.
AN ASSESSMENT OF CORRELATIONS BETWEEN LABORATORY AND FULL-SCALE EXPERIMENTS FOR THE FAA AIRCRAFT FIRE SAFETY PROGRAM. PART 1: SMOKE
J. G. QUINTIERE Atlantic City, N.J. FAA Jul. 1982 54 p refs 5 Vol
(PB83-113522, NBSIR-82-2508-PT-1, DOT/FAA/CT-82/100-PT-1)
Avail NTIS HC A04/MF A01 CSCL 01C

An extensive review is presented demonstrating the nature of comparison between full-scale fire smoke data and test method results for materials. These correlations are presented in terms of consistent parameters established through a development of the governing equations for smoke concentration and light attenuation. Visibility data pertaining to light transmission through smoke is presented, but no general results exist on the sensory irritant effect of smoke on vision. Analysis shows the complex dependence on smoke production on many parameters acting in fire growth and shows the futility and nature of simple correlation attempts. Recommendations are made for further research to establish a sounder basis for correlations, and a practical strategy is suggested. GRA

N83-19728# National Bureau of Standards, Washington, D C. National Engineering Lab.
AN ASSESSMENT OF CORRELATIONS BETWEEN LABORATORY AND FULL-SCALE EXPERIMENTS FOR THE FAA AIRCRAFT FIRE SAFETY PROGRAM. PART 2: RATE OF ENERGY RELEASE IN FIRE
J. G. QUINTIERE Atlantic City, N.J. FAA Jul. 1982 25 p refs 5 Vol.
(PB83-113530; NBSIR-82-2536-PT-2; DOE/FAA/CT-82/108-PT-2)
Avail: NTIS HC A02/MF A01 CSCL 01C

The rate of energy release in fire is discussed. The significance of calorimetric measurements of energy release for materials is related to thermal-dynamic parameters, namely heat of reaction and stoichiometric coefficients. It is shown that a common set of parameters is necessary to express ignition, flame spread and mass loss due to combustion and heat transfer in fires. The relationship of ignition and flame spread to rate of energy release in fires is presented along with a presentation on upward spread. Author (GRA)

N83-19729# National Bureau of Standards, Washington, D.C. National Engineering Lab.
AN ASSESSMENT OF CORRELATIONS BETWEEN LABORATORY AND FULL-SCALE EXPERIMENTS FOR THE FAA AIRCRAFT FIRE SAFETY PROGRAM. PART 4: FLAMMABILITY TESTS
J. G. QUINTIERE Atlantic City, N.J FAA Jul. 1982 28 p refs 5 Vol.
(PB83-113548; DOT/FAA/CT-82/101-PT-4; NBSIR-82-2525-PT-4)
Avail: NTIS HC A03/MF A01 CSCL 01C

Full-scale fire growth studies were compared with laboratory test data on materials. Both room and corridor fires are included in which primarily interior lining materials were combustible element. The studies include standard test methods and other laboratory devices. An effort was made to intercompare experimental results in a common basis. For example, maximum room temperature data are compared with ASTM E-84 flame spread classifications for several full-scale tests which involved nearly the same room geometries and same fuel arrangements. GRA

N83-19730# National Bureau of Standards, Washington, D.C National Engineering Lab.
AN ASSESSMENT OF CORRELATIONS BETWEEN LABORATORY AND FULL-SCALE EXPERIMENTS FOR THE FAA AIRCRAFT FIRE SAFETY PROGRAM. PART 5: SOME ANALYSES OF THE POST CRASH FIRE SCENARIO
J. G. QUINTIERE and T. TANAKA (Building Research Inst) Atlantic City, N.J. FAA Jul. 1982 27 p refs 5 Vol.
(PB83-113555; NBSIR-82-2537-PT-5; DOT/FAA/CT-82/107-PT-5)
Avail: NTIS HC A03/MF A01 CSCL 01C

An attempt is made to develop mathematical predictions for various aspects of the dynamics of post-crash aircraft fires The basis of the analysis is the experimental simulation scenario under study by the FAA. The effects of wind are considered as well as the effect of interior and exterior fires Suggestions are presented for estimating cabin door flow rates from measured temperatures. Author (GRA)

N83-19731# Office of Technical Services, Washington, D. C
IMPACT OF ADVANCED AIR TRANSPORT TECHNOLOGY. PART 4: FINANCING AND PROGRAM ALTERNATIVES FOR ADVANCED HIGH-SPEED AIRCRAFT
Aug 1982 52 p refs
(PB83-110585; OTA-BP-T-14) Avail: NTIS HC A04/MF A01 CSCL 01C

The potential financial and managerial barriers to carrying out a large scale program to create a new, long range commercial air transport employing new technology is discussed. The structure and financing practices of the conventional aircraft industry are described. A broad assessment of the economic, environmental, energy, societal, and safety aspects of technological advances that might occur in several types of transport aircraft are evaluated Author (GRA)

N83-20188# Societe Nationale Industrielle Aerospatiale, Toulouse (France)
DEMONSTRATION OF AN ACCEPTABLE SAFETY LEVEL FOR DIGITAL EQUIPMENT ON BOARD CIVIL TRANSPORT AIRCRAFT [DEMONSTRATION D'UN NIVEAU ACCEPTABLE DE SECURITE DES EQUIPMENTS NUMERIQUES A BORD DES NOUVEAUX AVIONS DE TRANSPORT CIVILS]
P. TOULOUSE *In* EAS Reliability and Maintainability p 65-69 Sep. 1982 refs In FRENCH
Avail: NTIS HC A99/MF A01

The demonstration of an acceptable level of safety depends on a qualitative measurement which considers a total analysis of equipment breakdown, the quality level of the software, in proportion to its criticalness and, if necessary, architectural precautions which permit exemption from the consequences of not easily predicted occurrences of latent errors in the software or modes of equipment breakdown. This effort must be reflected in documentation and should be recognized as acceptable by all principals involved in certification. Transl. by A.R.H.

N83-20834*# Helicopter Association International, Washington, D.C
ROTORCRAFT AIR TRANSPORTATION
G. A. GILBERT *In* American Planning Association Proc. of the Monterey Conf on Planning for Rotorcraft and Commuter Air Transportation p 73-83 Feb. 1983
Avail: NTIS HC A09/MF A01 CSCL 01C

Intermodal relationships and the particular ways in which they affect public transportation applications of rotorcraft are addressed. Some aspects of integrated services and general comparisons with other transportation modes are reviewed Two potential application scenarios are discussed: down-to-downtown rotorcraft service and urban public transport rotorcraft service. It is concluded that to integrate well with ground access modes community rotorcraft service should be limited stop service with published schedules, and operate on a few specific routes between a few specific destinations. For downtown-to-downtown service, time savings favorable to rotorcraft are benefits that reflect its more direct access, relatively higher line-haul travel speeds, and less

circuitous travel. For the scenario of public transport within urban areas, first, improving cruise speeds has a limited potential due to allowing for a "station spacing" effect Secondly, public acceptance of higher acceleration/deceleration rates may be just as effective as a technological innovation as achieving higher cruise speeds. M.G.

N83-20836*# Vitro Labs , Silver Spring, Md
COMMUNITY ROTORCRAFT AIR TRANSPORATION: OPPORTUNITIES AND BENEFITS
D J. FREUND *In* American Planning Association Proc. of the Monterey Conf on Planning for Rotorcraft and Commuter Air Transportation p 96-106 Feb. 1983
Avail: NTIS HC A09/MF A01 CSCL 01C

Opportunities and benefits of rotorcraft transportation are examined in light of the flight capabilities of rotorcraft. Promising helicopter scenarios include public service, public transportation, energy exploration, construction, cargo, agriculture/forestry, and other business/commercial uses. M G.

N83-20837*# Vought Corp , Dallas, Tex
LESSONS FROM THE PAST: STOL SYSTEM STUDIES AND OTTAWA-MONTREAL STOL DEMONSTRATION
R. RANSONE *In* American Planning Association Proc of the Monterey Conf. on Planning for Rotorcraft and Commuter Air Transportation p 107-113 Feb. 1983 refs
Avail. NTIS HC A09/MF A01 CSCL 01C

The study for the Floating Interim Manhattan STOLPORT is discussed and experiences with public reaction are related. M.G.

N83-20838*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPPORTUNITIES AND BENEFITS
T. L. GALLOWAY *In* American Planning Association Proc of the Monterey Conf on Planning for Rotorcraft and Commuter Air Transportation p 118-136 Feb. 1983 refs
Avail. NTIS HC A09/MF A01 CSCL 01C

The service characteristics and changes affecting commuter airline operations are summarized. Community and passenger considerations are addressed and the benefits identified in NASA-sponsored aircraft studies are discussed. M G.

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

A83-23371
AIRCRAFT SEPARATION ASSURANCE - SYSTEMS DESIGN
P. BROOKER (Civil Aviation Authority, London, England) Journal of Navigation, vol. 36, Jan. 1983, p. 28-36.

A simple model of collision risk modeling is described, and a brief description is given of its application to the lateral spacing of the North Atlantic track system. This is considered an appropriate model for that situation because the air traffic controller cannot intervene to prevent collisions through loss of lateral separation It is noted that the same basic model can be used to assess changes in the longitudinal separation criteria where there is the possibility of controller intervention to prevent a collision between a pair of aircraft on the same flight path using a knowledge of reporting times The degree of intervention likely is an extra factor, hence a decision on a change in the minimum longitudinal separation relies on both the model formulation and the operational judgement. C.R

A83-23372
THE ROLE OF ADVANCED NAVIGATION IN FUTURE AIR TRAFFIC MANAGEMENT
R. C. RAWLINGS (Royal Aircraft Establishment, Farnborough, Hants., England) Journal of Navigation, vol 36, Jan. 1983, p. 37-53.

Attention is called to the trend whereby the separate parts of an operational system are improved without properly evaluating the interactions between the parts, in particular the interaction between air traffic control and the flight deck It is stressed that unless this aspect is studied, it is likely that the full capability of the system for improving the safety and economy of operation will not be fully realized. Potential improvements in plan navigation, vertical profile management, and time control are examined, together with the developments that will be needed to achieve them and the implications that this would have on the air traffic management of the future. It is shown that at present the problem rests not in the capability of the machine in performing the task but in the communication with the machine by the pilot and air traffic controller. C.R.

A83-23414#
MULTIPATH PROPAGATION IN THE RADIO FIELD OF AIRCRAFT NAVIGATION SYSTEMS [MEHRWEGEAUSBREITUNG IM FUNKFELD VON NAVIGATIONSSYSTEMEN DER LUFTFAHRT]
P. FORM and K -G WESTPHAL (Braunschweig, Technische Universitaet, Brunswick, West Germany) (International Union of Radio Science and Nachrichtentechnische Gesellschaft, Gemeinsame Tagung, Kleinheubach, West Germany, Oct. 4-8, 1982.) Kleinheubacher Berichte, vol. 26, 1983, p 487-499. In German. refs

An overview is presented of the measurement of multipath propagation at real sites in the VHF and L-band range which is utilized at two airports in West Germany and Austria. Simulation of an ideal point-contact rectification is used to present the entire broadband received signal potential as a function of time. Spectral analysis is used to separate signal components. Three-dimensional spectra over time provide comprehensive information on the multipath propagation during approach flight, and binary spectra relate that propagation to the topography. C D.

A83-23494
AIR TRAFFIC CONTROL FOR TOMORROW - PROBLEMS AND SOLUTIONS [FLUGSICHERUNG VON MORGEN - PROBLEME UND LOESUNGEN]
T. G. ANODINA (Ministerstvo Grazhdanskoi Aviatsii SSSR, USSR) Technisch-oekonomische Information der zivilen Luftfahrt, vol. 18, no 4, 1982, p. 126-128, Discussion, p. 128, 129. In German (Translation).

Problems regarding the further development of the air traffic control (ATC) system have been discussed in the USSR on a conference concerned with the 'problems of the control of air traffic in the year 2000'. Plans regarding such a development have to take into account trends with respect to a continuously increasing density of the air traffic Aspects of flight safety have to be considered along with the favorable economic effects of an increase in punctuality concerning the performance of flight operations. The optimization of airspace structure has already led to substantial savings in fuel consumption. Improvements related to the ATC system will lead to a further reduction in fuel consumption The further automatization of ATC operations is planned, although a complete automatization does not appear to be feasible within the foreseeable future. Attention is given to the utilization of satellite systems for ATC operations, the advantages to be obtained by the employment of a microwave landing system, and the in

A83-23495
INSTRUMENT LANDING SYSTEMS /ILS/ AT GDR AIRPORTS. II [INSTRUMENTENLANDESYSTEME /ILS/ AUF DDR-FLUGHAEFEN. II]
W. TREMPLER (Interflug Gesellschaft fuer Internationalen Flugverkehr mbH, Berlin, East Germany) Technisch-oekonomische information der zivilen Luftfahrt, vol 18, no 4, 1982, p. 132-144 In German refs

The accuracy to be provided by the ILS in connection with directional control and on-path indication has been specified by the ICAO in 1978. In addition, there exist for civil aviation in the GDR recommendations and national standards issued by GDR authorities in 1980. A ground-based surveillance system is employed to ensure that the requirements are satisfied. Several times a year, measurements of all relevant parameters are also conducted with the aid of an aircraft which is especially equipped for this task Official admission of an ILS installation for use in air traffic operations depends upon the successful completion of this flight test. Guide beam tolerances near the ground are investigated by means of a vehicle equipped with an antenna. Attention is given to details regarding ILS operations in the GDR, and the introduction of the operational Category II G R.

A83-24040#
MODELING THE SPATIAL DISTRIBUTION OF AIRCRAFT ON VISUAL FLIGHT RULES
N. J. MEYERHOFF and J. GARLITZ (U.S. Department of Transportation, Office of Air and Marine Systems, Cambridge, MA) Journal of Aircraft, vol. 20, Apr. 1983, p. 380-382. refs

An FAA-supported pilot program to develop models that will estimate the average and peak instantaneous aircount (IAC) of aircraft flying on visual flight rules (VFR) is summarized. The IACs are spatially distributed, similar to a checkerboard effect, over the cross-sectional area of each state in the continental United States for a typical VFR day in 1980. The approach followed in estimating the spatial distribution of VFR aircraft is similar to that described in an earlier study (Meyerhoff, 1982). An important point in the model development is that over a 24-h day, the number of VFR aircraft leaving and entering any large geographic area is about equal The model presented here is economical in that its basic input, the annual number of general aviation itinerant aircraft, is readily available, thereby avoiding costly data collection procedures C.R.

A83-24163
INTEGRATED AVIONICS/WEAPON SYSTEM FOR AIR/GROUND MISSIONS [INTEGRIERTES AVIONIK/BEWAFFNUNGSSYSTEM FUER LUFT/BODEN MISSIONEN]
R. SCHRANNER (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 12 p. In German.
(DGLR PAPER 82-039)

The combat aircraft Tornado is already being used in German Navy aircraft units, and it will soon be introduced for service in the German Air Force Requirements regarding the design of this weapon system are related to differing mission objectives in connection with a use in the Navy and in the Air Force In both cases, the aircraft must be able to defend itself against hostile fighter aircraft. A consideration of the entire system architecture is necessary for the design and the optimization of the weapon system, taking into account also all avionics subsystems. Navigation is to ensure an accurate approach to the target under all weather conditions. Attention is given to two TV displays, the head-up display, the mapping radar display, the main computer, the fire-control system, and the missile control system. G.R.

A83-24164
GROUND TESTS FOR OBTAINING THE AIRWORTHINESS CERTIFICATE FOR AN AUTOMATIC TERRAIN-FOLLOWING SYSTEM [BODENTESTS ZUR ERREICHUNG DER FLUGZULASSUNG EINES AUTOMATISCHEN GELAENDEFOLGESYSTEMS]
U TRIEBE (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 12 p In German
(DGLR PAPER 82-040)

In 1982, the first delivery of the Tornado aircraft was made to the German Navy The essential features of this combat aircraft are related to very accurate navigation, a terrain-following system, and the main computer, which is used for navigation applications, control calculations, weapon guidance, and weapon delivery The automatic terrain-following system is vital for the successful accomplishment of the missions assigned to the Tornado. A number of ground tests are required in connection with the certification of airworthiness with respect to the terrain-following (TF) system. Attention is given to the terrain-following radar, the autopilot and flight director system, digital and hardware simulation operations conducted in connection with the development and testing of the TF system, and the simulation of an error in the radar output G R

A83-24375
A NEW DESIGN OF AN ACCURATE POSITIONING SYSTEM AT 2 MHZ [UNE NOUVELLE CONCEPTION DE SYSTEME DE POSITIONNEMENT PRECIS A 2 MHZ]
R. BARTON (Racal-Decca Survey, Ltd., England) (Instituts de Navigation, Congres International, Paris, France, Sept 21-24, 1982) Navigation (Paris), vol. 31, Jan. 1983, p 97-104. In French.

The Hyper-Fix positioning system, intended for offshore and military applications, and operating at 2 MHz, is described. A grid of stationary waves is emitted by pairs of shore-based transmitters, with the receiver comparing the phase of the two signals A zero difference between the wave phases produces a positioning line in the form of a hyperbola, and a series of hyperbolas constitutes a grid. The distance separating one hyperbola from another is a baseline between two stations, with the distance equal to half a wavelength, which is 75 m at 2 MHz A group of three to six stations operates with each station emitting a signal at its turn, with a complete cycle taking 600 msec. The end of the cycle is marked by a 40 msec signal by the prime station. The signal is coded and followed by another 40 mse signal which indicates the time for data transmission Details of the hardware of the Hyper-Fix system are provided. M.S.K.

A83-24435#
ARINC 429 DIGITAL DATA COM CATIONS FOR COMMERCIAL AIRCRAFT
R K CHUN (Boeing Aerospace Co , Seattle, WA) (Digital Avionics Systems Conference, 4th, St. Louis, MO, November 17-19, 1981, Collection of Technical Papers, p. 252-256) Journal of Guidance, Control and Dynamics, vol 6, Mar -Apr. 1983, p 120-123.

(Previously cited in issue 03, p. 318, Accession no. A82-13485)

A83-24779
AN ADAPTIVE SCHEME FOR OPTIMAL TARGET DETECTION IN VARIABLE CLUTTER ENVIRONMENT
A. MAHMOODI (Honeywell, Inc., Defense Systems Div., Hopkins, MN) and M K. SUNDARESHAN (Minnesota, University, Minneapolis, MN) In: Conference on Decision and Control, 20th, and Symposium on Adaptive Processes, San Diego, CA, December 16-18, 1981, Proceedings. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1981, p. 828, 829.

An adaptive scheme for detection of ground targets in a variable clutter environment by an airborne radar is presented. The scheme consists of three basic units - an adaptive decorrelator, a clutter pattern classifier and a constant false alarm rate detector. It is

shown that this results in a significant improvement in detection performance by optimizing the signal to interference ratio.
(Author)

A83-24851
INTEGRATED NAVIGATION: ACTUAL AND POTENTIAL - SEA-AIR-SPACE; PROCEEDINGS OF THE INTERNATIONAL CONGRESS, PARIS, FRANCE, SEPTEMBER 21-24, 1982. VOLUMES 1 & 2
Congress sponsored by the Institutes of Navigation. Paris, Institut Francais de Navigation, 1982 Vol 1, 352 p.; vol 2, 366 p

Among the topics discussed at the present conference on sea, air, and space integrated navigation systems are the development analysis of an integrated marine navigation system, the integration of navigation resources in a modern avionics system, a multifunction integrated approach to providing aircraft inertial data, a systems approach to carrier aircraft inertial navigation system, a differential Omega/VLF navigator, and the technical and operational evaluation of wide area coverage navigation systems in the continental U.S. Also considered are the characteristics of the laser gyro, the effect on air traffic control systems of flight management and performance management systems, the study of an on-board trajectography system for the in-flight checking of air navigation and radio landing aids, and a comparison of Navstar equipment accuracy with experimental results. O.C.

A83-24852#
INTEGRATION OF NAVIGATION RESOURCES IN MODERN AVIONICS SYSTEMS
J. J DEYST, JR. In: Integrated navigation: Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1 Paris, Institut Francais de Navigation, 1982, p EU-P1-1-A to EU-P1-7-A. refs

An essential element of next-generation tactical aircraft integrated navigation systems will be inertial sensors capable of serving such multiple functions as flight control, pilot display, and weapon delivery, as well as navigation. In addition, fault tolerance must be an integral part of the inertial sensor design. While mechanical gyros have never achieved sufficient scale factor stability to perform adequately as strapdown aircraft navigators, laser gyros are beginning to demonstrate adequate strapdown performance Attention is given to the role naturally played by a strapdown inertial measurement package as a fault-tolerant system, as well as to gyro geometry and tactical aircraft inertial guidance system integration with such other navigation resources as the Navstar Global Positioning System O.C.

A83-24853#
A MULTIFUNCTION INTEGRATED APPROACH TO PROVIDING AIRCRAFT INERTIAL DATA
G. J. ROBINETTE and R. E. WITTERS (USAF, Avionics Laboratory, Wright-Patterson AFB, OH) In: Integrated navigation: Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1. Paris, Institut Francais de Navigation, 1982, p. EU-P2-1-A to EU-P2-5-A. refs

Advanced fighter aircraft avionics subsystems requiring inertial data include those of navigation, reference, flight control, autopilot, cockpit displays, mission avionics, and weapon delivery, each of which obtain inertial data from a dedicated set of inertial sensors. This conventional approach, while possessing a redundancy of inertial sensors and a duplication of inertial data, allows no communication between these subsystems and accordingly forfeits the advantages of redundancy and duplication. By providing all required inertial data from a common set of inertial sensors, by contrast, duplication can be eliminated and redundancy advantages maximized. Such a cost-effective integrated system architecture, satisfying all safety-of-flight and survivability constraints, is currently being developed by the U.S. Air Force's Wright Aeronautical Laboratories in the course of the Integrated Inertial Reference Assembly program. O.C.

A83-24854#
CARRIER AIRCRAFT INERTIAL NAVIGATION SYSTEM /CAINS/ INTEGRATED SYSTEM APPROACH
D. BRIENZA and H. BELL In Integrated navigation. Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1. Paris, Institut Francais de Navigation, 1982, p. EU-P4-1-A to EU-P4-16-A.

By using a ring laser gyro to replace the spinning mass gyro employed in the conventional gimbal systems of the Carrier Aircraft Navigation System (CAINS), it has become possible to design a strapdown inertial navigation device with state-of-the-art technology application The CAINS system also includes standard alignment/navigation software, and is integrated with the following external reference sensors: the Ship Inertial Navigation System, Doppler radar, position fixes, and air data computer Future integration will add Omega, the Global Positioning System, and attack radar. The same Single Mode Alignment filter is used to process autonomous external reference data for aided navigation, in accordance with the emphasis of the new avionics architecture on distributed microprocessors with the MIL-STD-1553 multiplex data bus O.C.

A83-24855#
THE INTEGRATED INERTIAL NAVIGATION SYSTEM - AN/ASN-132
J. NIEMELA (U.S. Army, Navigation Laboratory, Fort Monmouth, NJ) In: Integrated navigation: Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1. Paris, Institut Francais de Navigation, 1982, p. EU-P5-1-A to EU-P5-14-A

The navigation system architecture and standard digital interface of the Integrated Inertial Navigation System (IINS) allows substantial portions of initial development and testing to proceed without necessary commitment to specific hardware. The suitability of the standard data bus as a means of hybrid navigation integration has been in evidence to date, and, in addition to its advantages for standardization and configuration control, significant wire weight savings have been obtained through its serial multiplex approach (as compared to point-to-point unidirectional interconnection). Significant improvements over current systems are also noted in size, weight, and power consumption, due to the use of up-to-date inertial, receiver and microelectronic technology. Upon reaching development maturity, IINS is expected to be more reliable than current systems by a factor of four. O.C.

A83-24856#
A DIFFERENTIAL OMEGA/VLF NAVIGATOR
H. RICK (Pacific Aerosystem, Inc., San Diego, CA) In. Integrated navigation Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1 Paris, Institut Francais de Navigation, 1982, p. EU-R1-1-A to EU-R1-19-A. refs

The Differential Omega/VLF Navigator concept has its basis in the observation that phase disturbances affect the signals from a particular Omega System station equally, within an extensive geographic area, in a manner that remains nearly constant for several hundred miles in a given region. If phase anomalies can be precisely measured at a given ground location, the resulting data can be employed by mobile Omega users by correcting their phase measurements to a degree equivalent to the anomaly. The Differential Omega concept can thereby improve receiver position calculation accuracies from a nominal 1-2 mi to about 0.25 mi. Compensatable propagation errors include sudden ionospheric disturbances from solar radiation, diurnal effects due to day/night changing of ionospheric height, and subsurface conductivity effects. Correction quality is degraded by increasing distance between ground receiver and user. O.C.

A83-24857#
TECHNICAL AND OPERATIONAL EVALUATION OF WIDE-AREA COVERAGE NAVIGATION SYSTEMS IN THE CONTINENTAL UNITED STATES
D. W. RICHARDSON (Systems Control Technology, Inc., West Palm Beach, FL) In: Integrated navigation: Actual and potential - Sea-air-space, Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1. Paris, Institut Francais de Navigation, 1982, p. EU-R2-1-A to EU-R2-13-A.

The expanding use of helicopters has increased the demand for low altitude all-area navigation services, such as those provided by navigation sensor and microprocessor technology developments in the form of Loran-C, Omega, and Omega/VLF. Many of these off-airway operations require the ability to make instrument landing approaches at airports or remote launch sites not normally served by standard navigation aids. The Federal Aviation Administration has undertaken a data base acquisition program relating to the certification of civilian airborne navigation systems The integration of air-derived vertical guidance capability with the lateral guidance capability of Loran-C represents a potential for increased safety and operational utility in a number of both fixed wing aircraft and helicopter applications. O.C

A83-24860#
STUDY OF AN ON-BOARD TRAJECTOGRAPHY SYSTEM FOR IN-FLIGHT CHECKING OF AIR-NAVIGATION AND LANDING RADIO AIDS
J. P. DAVADANT In. Integrated navigation Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1 Paris, Institut Francais de Navigation, 1982, p FR 2-1-A to FR 2-28-A.

An attempt is made to modernize and automate the reference trajectography system for in-flight checking of air navigation and landing radio aids, achieving independence from such ground aids as theodolites and IR. trackers. The importance of such a modernization is underscored by the fact that the ILS and MLS landing systems' required precision is of the order of 0.30-15 m While assuming existing sensor technology, the goals of the present study are approached through a more elaborate drift-estimation mathematical model and inertial sensor trajectory resetting system. O.C

A83-24861#
NAVSTAR EQUIPMENTS ACCURACY COMPARED WITH EXPERIMENTAL RESULTS
G. DAVID (Telecommunications Radioelectriques et Telephoniques, Paris, France) and L JACOBSON (Magnavox Government and Industrial Electronics Co., Fort Wayne, IN) In: Integrated navigation. Actual and potential - Sea-air-space, Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1. Paris, Institut Francais de Navigation, 1982, p. FR 4-1-A to FR 4-13-A.

Navstar user positioning errors are of two kinds: either due to errors made in the measurement of the pseudorange, which depend on receiver noise, ionosphere model, satellite ephemeris determination, etc., or due to the geometry of the system. For each pseudorange measurement, the noncorrelated part of the error observed is called the User Equivalent Range Error (UERE). The resultant navigation error is defined by the UERE multiplied by the Geometric Dilution of Precision, which is uniquely established by the geometric relationship between the user's position and the position of the four satellites used in the observations. Attention is given to experimental results obtained for a one-hour visibility period of the four satellites of the future Navstar system. O.C.

A83-24862#
EXPERIMENTS OF OMEGA FOR AVIATION
K. KOREMURA (Ministry of Transport, Electronic Navigation Research Institute, Tokyo, Japan) and S MATSUDA (Ministry of Transport, Electronic Navigation Research Institute, Tokyo, Japan Radio Co , Ltd., Japan) In: Integrated navigation: Actual and potential - Sea-air-space, Proceedings of the International Congress, Paris, France, September 21-24, 1982 Volume 1 Paris, Institut Francais de Navigation, 1982, p. JP 1-1-A to JP 1-8-A.

An assessment is presented of experimental results for sensor errors of the Omega component of the Integrated Navigation System for aircraft. A position error of about 5 nautical miles is obtained in the area of Japan, over which the SNR is approximately constant. Ground test results obtained over the course of one year show that the diurnal changes of the SNR values for H, E, C and A Omega stations are small, and that an increase in position error caused by the interruption of the C station signal is prominent by comparison with other station interruptions O.C.

A83-24863#
AIRCRAFT SEPARATION ASSURANCE - SYSTEMS DESIGN
P BROOKER (Civil Aviation Authority, Directorate of Operational Research and Analysis, London, England) In: Integrated navigation: Actual and potential - Sea-air-space, Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 2. Paris, Institut Francais de Navigation, 1982, p. BP 1-1-A to BP 1-12-A.

A mathematical model for collision risk is developed on the basis of a risk rate expressed in terms of fatal aircraft accidents per ten million flying hours The model is discussed with reference to its major applications. lateral and longitudinal separation in the North Atlantic Track System, the Threat Alert and Collision Avoidance System, and the lateral separation of parallel VOR-defined (i e., defined by ground beacons) routes. Consideration is likewise given to the degree of controller intervention S.C S.

A83-24867#
THE ROLE OF ADVANCED NAVIGATION IN FUTURE AIR TRAFFIC MANAGEMENT
R C RAWLINGS (Royal Aircraft Establishment, Bedford, England) In: Integrated navigation· Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 2. Paris, Institut Francais de Navigation, 1982, p. BR 2-1-A to BR 2-12-A.

The future of air traffic control is considered in terms of advanced navigation techniques, vertical profile management, and time control. Navigation performance is assessed noting VHF omni-directional ranging or nondirectional beacons as well as distance measuring equipment. The accuracies of these various systems are discussed with reference to a test aircraft operated over Wales. Future developments in air traffic control are identified, including improvements in the pilot-machine interface, computerized control systems, and advanced communications links. S.C.S

A83-24869#
MAIN TECHNICAL AND OPERATIONAL CHARACTERISTICS OF NAVIGATION SYSTEMS WITH A VIEW TO IDENTIFYING A MIXED RADIONAVIGATION SYSTEM
P. MOJA In: Integrated navigation: Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 2. Paris, Institut Francais de Navigation, 1982, p. IP-3-1-A to IP-3-24-A. refs

A number of air navigation systems are discussed and compared, including the C-band microwave landing system, the Navstar/GPS system, and the joint tactical information distribution system. The Kalman filter is considered with reference to the fact that it requires a linear mathematical model. Measurement errors are outlined noting both path following errors and control motion noise. A potential mixed system based on VOR, DME/N and dead-reckoning is described showing how it can reduce errors by a factor of two. Attention is also given to combining the future Navstar/GPS low-cost receiver plus INS to civil aviation. S.C.S.

A83-24870#
INTEGRATED NAVIGATION SYSTEM FOR THE AGUSTA 129 ATTACK HELICOPTER
L. FORZANI and F. REINA (Costruzioni Aeronautiche Giovanni Agusta S p.A , Gallarate, Italy) In: Integrated navigation Actual and potential - Sea-air-space, Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 2 Paris, Institut Francais de Navigation, 1982, p. IR 1-1-A to IR 1-18-A.

Consideration is given to the integrated navigation system developed for the Agusta 129 attack helicopter. The two-person helicopter has twin engines and fully articulated four-composite blades in both the main and tail rotors. Its navigational requirements are outlined for enroute navigation, battle-area navigation, and attack. The distributed data processing system is described noting overall functions, the computing system architecture, sensor structure (for the Doppler radar, vertical gyro, gyrocompass, radar altimeter and air data system), and the navigation display structure. S.C S

A83-24871#
FLIGHT TESTS OF INTEGRATED NAVIGATION BY LEAST SQUARES ADJUSTMENT
K. RAMSAYER In. Integrated navigation. Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982 Volume 2. Paris, Institut Francais de Navigation, 1982, p AP 2-1-A to AP 2-18-A.

A technique of integrated navigation by least-squares adjustment has been developed to simplify the Kalman filtering method without an essential loss of accuracy. The adjustment is based on combining the dead reckoning system (DRS) with radio navigation systems by computer and describing the errors of the DRS by observation equations. These equations correspond to a simplified error model of the DRS, as determined by least-squares adjustment. The influence of these systematic errors can be accounted for by a corresponding correction. The method has been tested on a number of flights, and the results are presented S C S.

A83-24872#
INTEGRATED NAVIGATION BY SUPPLEMENTING MLS WITH DAS
G. BLASCHKE In: Integrated navigation: Actual and potential - Sea-air-space, Proceedings of the International Congress, Paris, France, September 21-24, 1982 Volume 2. Paris, Institut Francais de Navigation, 1982, p. AP 3-1-A to AP 3-29-A.

The study examines the functional principles and modularity of the DME-based azimuth system (DAS) with particular reference to navigation in the terminal control area The importance of navigation accuracy for noise abatement procedures, landing minima and missed-approach procedures is assessed. The operational and economic benefits of combining DAS and MLS systems are identified, including the closer spacing of adjacent aircraft, curved or segmented approaches, the substitution of radar vectoring for absolute bearings, and a significant reduction in ground and airborne equipment. Applications of DAS without MLS are likewise noted. S.C.S.

A83-24873#
SIMPLE INTEGRATED NAVIGATION SYSTEMS
U. BROKOF and K. HURRASS (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Flugfuehrung, Brunswick, West Germany) In Integrated navigation: Actual and potential - Sea-air-space, Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 2. Paris, Institut Francais de Navigation, 1982, p. AP 5-1-A to AP 5-23-A refs

Investigations aimed at improving the navigation accuracy of aircraft by the more efficient use of existing VOR/DME measurements in a simple integrated system are presented. The error models of onboard simple air data systems, Doppler navigation systems and inertial navigation systems are compared, and factors influencing the use of VOR and DME ground navigation systems to compensate the random errors generated by the dead reckoning systems are considered Results of nearly 20 test flights of HFB 320 and DO 28 aircraft carrying one of the three different dead reckoning systems integrated with VOR/DME measurements by the use of a Kalman filter are then reported which demonstrate the improvements in navigation accuracy provided by an integrated system over the VOR/DME system alone. It is noted that the more sophisticated Doppler and inertial navigation systems do not lead to higher accuracies than the simple air data system, based on measurements of true air speed, magnetic compass heading and estimated wind velocity, when integrated with VOR and DME from different stations A.L W.

A83-24874#
VIEWPOINTS ON SELECTION OF COLLISION AVOIDANCE SYSTEMS
P. FORM and W. SCHROER (Braunschweig, Technische Universitaet, Brunswick, West Germany) In. Integrated navigation: Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982 Volume 2. Paris, Institut Francais de Navigation, 1982, p. AP 7-1-A to AP 7-16-A refs

The paper reviews factors in the development and statistical and dynamic characteristics of airborne collision avoidance systems (CAS) which have a bearing on individual system specification. Particular attention is given to initial proposals for cooperative systems based on small black boxes signaling alarm when in the vicinity of similar devices, the onboard Cygned autonomous primary radar system, beacon collision avoidance systems (BCAS), and the currently proposed ground-based discrete addressed beacon system for dense traffic areas and active BCAS interrogating the ATC transponders of nearby aircraft The overall collision probability is examined as a chain of factors including the probability of conflict situations, the probabilities of not detecting these situations and detecting them without successful escape, and the influence of false maneuvers in a nonconflict situation. The importance of airborne CAS in an ATC environment is then noted in relation to the dynamics of the situation. A.L.W.

A83-24875#
OBSERVATIONS OF THE OMEGA POSITION FIX ACCURACY IN SOUTHERN GERMANY
S. BLOCH (Standard Elektrik Lorenz AG, Stuttgart, West Germany) In: Integrated navigation: Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 2. Paris, Institut Francais de Navigation, 1982, p. AR 1-1-A to AR 1-20-A

Observational data relating to the positional performance of the Omega navigation system in southern Germany is presented. Position fix observations were carried out with a three-frequency state-of-the-art Omega receiver equipped with the VLF marine communications option operating at the rate of 10 measurements per hour at Stuttgart, West Germany. Results show position fix accuracies on the order of 2-3 n mi, in agreement with theoretical predictions Omega observations were more stable in summer than in winter, and during daytime than at night. Signals were received with adequate quality from four of the seven Omega stations, indicative of a redundancy adding to system reliability. Problems of skin currents, static discharges, field variations and other motion effects as well as questions of geometrical aspects and ambiguity resolution remain, however, for future investigation. A L.W.

A83-25772
THERMAL DESIGN OF STANDARD AVIONIC ENCLOSURES
J. L. FRANKLIN and T. J KRAMER (Boeing Aerospace Co., Seattle, WA) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 10 p. refs
(SAE PAPER 820878)

This paper details the development of standardized avionic enclosures for Naval aircraft, with particular emphasis on the package's thermal design The packaging system is unique in that it can accommodate modules of two different standardized sizes (ISEM-2A and 1/2 ATR), and modules having three different cooling

modes - conduction cooled, flow-through cooled, and heat pipe cooled. The three module cooling modes, together with required package dissipation rates of 125 watts/MCU and pressure drops below 2.8 mm mercury create a great deal of complexity in the optimization of the thermal system A computerized optimization program was therefore utilized to achieve specific designs, with results reported for various module mixes and heat exchanger designs. (Author)

A83-26261
ESTIMATION AND PREDICTION FOR MANEUVERING TARGET TRAJECTORIES
R. F. BERG (General Dynamics Corp, Pomona, CA) IEEE Transactions on Automatic Control, vol. AC-28, Mar. 1983, p. 294-304 refs

The Kalman filter is well suited for application to the problem of anti-aircraft gun fire control. In this paper we make use of the Kalman filter theory to develop an accurate, numerically efficient scheme for estimating and predicting the present and future position of maneuvering fixed-wing aircraft. This scheme was implemented in a radar tracker gun fire control system and tested against a variety of fixed-wing aircraft targets. Actual field test results are presented to demonstrate the high accuracy pointing which can be achieved by this approach. (Author)

A83-26262
MULTICONFIGURATION KALMAN FILTER DESIGN FOR HIGH-PERFORMANCE GPS NAVIGATION
M. H. KAO and D. H. ELLER (Magnavox Advanced Products and Systems Co., Torrance, CA) IEEE Transactions on Automatic Control, vol. AC-28, Mar. 1983, p. 304-314. USAF-supported research. refs

This paper describes the design, implementation, and performance of a real-time multiconfiguration Kalman filter for high-performance Navstar global positioning system (GPS) navigation. The design provides extreme flexibility in order to operate with a wide variety of host sensors. It configures automatically (four filter configurations) based upon the host vehicle requirements and sensor availability, in order to process GPS measurements and provide the best estimate of the navigation states. Two new techniques, namely an unaided dead-reckoning Kalman filter implementation and an automatic inertial platform tilt estimation control scheme, are developed to improve the navigation accuracy, especially for high-dynamics applications. Performance results are presented to demonstrate the advantages of these techniques. (Author)

A83-26263
NONLINEAR KALMAN FILTERING TECHNIQUES FOR TERRAIN-AIDED NAVIGATION
L. D. HOSTETLER and R D ANDREAS (Sandia National Laboratory, Albuquerque, NM) IEEE Transactions on Automatic Control, vol AC-28, Mar. 1983, p. 315-323. Research supported by the U.S. Department of Energy. refs

The application of nonlinear Kalman filtering techniques to the continuous updating of an inertial navigation system using individual radar terrain-clearance measurements has been investigated During this investigation, three different approaches for handling the highly nonlinear terrain measurement function were developed and their performance was established These were (1) a simple first-order extended Kalman filter using local derivatives of the terrain surface, (2) a modified stochastic linearization technique which adaptively fits a least squares plane to the terrain surface and treats the associated fit error as an additional noise source, (3) a parallel Kalman filter technique utilizing a bank of reduced-order filters that was especially important in applications with large initial position uncertainties. Theoretical and simulation results are presented. (Author)

A83-26264
APPLICATION OF MULTIPLE MODEL ESTIMATION TO A RECURSIVE TERRAIN HEIGHT CORRELATION SYSTEM
G L. MEALY and W. TANG (Analytic Sciences Corp, Reading, MA) IEEE Transactions on Automatic Control, vol. AC-28, Mar. 1983, p. 323-331 refs
(Contract DAAK80-79-C-0268)

This paper describes the results of an investigation of the performance capabilities of an extended Kalman filter (EKF)-based recursive terrain correlation system proposed for low-altitude helicopter navigation. The major disadvantage of this concept is its sensitivity to initial position error One method for reducing this sensitivity involves the use of multiple model estimation techniques In the multiple model approach, a bank of identical EKF's, each of which is initialized at a different point in the a priori uncertainty basket, is employed to ensure that one filter is initialized near the true aircraft position. In this manner, the probability of filter convergence is increased substantially, leading to improved navigation performance. (Author)

A83-26266
AN INTEGRATED MULTISENSOR AIRCRAFT TRACK RECOVERY SYSTEM FOR REMOTE SENSING
W. S GESING (Toronto, University, Toronto, Canada) and D. B REID (Huntec, Ltd., Scarborough, Ontario, Canada) IEEE Transactions on Automatic Control, vol. AC-28, Mar. 1983, p. 356-363. refs

This paper describes an application of the Kalman filter in a track recovery system (TRS) for postflight processing of aircraft navigation sensor data. The track recovery system has been successfully used as a key component of the Canadian aerial hydrography pilot project for mapping of shallow costal waters Recorded data from an inertial navigation system (INS) is combined with data obtained from a number of auxiliary sensors to construct a set of error measurements. The measurements are prefiltered to compress the data and are then processed using a U - D factorized Kalman filter and a modified Bryson-Frazier smoother to produce estimates of the time-correlated sensor errors. The flight profile is obtained by subtracting the computed error estimates from the recorded INS data. The residual errors observed in processing real data collected in a number of a field tests are less than 1 m in position and less than 0.03 degrees in attitude. (Author)

A83-26476
THE SPECIAL RESEARCH AREA OF FLIGHT CONTROL, COLLOQUIUM, BRUNSWICK, WEST GERMANY, SEPTEMBER 9, 10, 1981, REPORTS [SONDERFORSCHUNGSBEREICH FLUGFUEHRUNG, KOLLOQUIUM, BRUNSWICK, WEST GERMANY, SEPTEMBER 9, 10, 1981, BERICHTE]
Brunswick, West Germany, Technische Universitaet Braunschweig, 1982. 373 p In German

An integrated flight path control system is considered along with the structure and mode of operation of an interactive onboard four-dimensional flight path control system, a procedure for an evaluation of control systems on the basis of human factor considerations, adjacent channel interference in the case of the precision distance measuring system DME/P, and aspects of conflict recognition and collision probability in connection with horizontal evasion maneuvers. Other subjects explored are related to advantages of statistically interrogating onboard anticollision systems, the design of wind shear filters, the research aircraft of the Special Research Area 'Flight Control' as scientific test stand, advances related to the measurement and representation of real multipath propagation, and the improved simulation of ground reflections. Attention is also given to an estimation regarding the feasibility of using larger distances in measurements with L2F systems in flight tests, and a digital measuring system for the determination of pneumatic air data. G R.

A83-26480#
ADJACENT CHANNEL INTERFERENCE IN THE CASE OF THE PRECISION DISTANCE MEASURING SYSTEM DME/P [NACHBARKANALSTOERUNGEN BEIM PRAEZISIONSENTFERNUNGSMESSSYSTEM DME/P]
W. J KOLLER (Braunschweig, Technische Universitaet, Brunswick, West Germany) In: The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p. 118-140 In German refs

In 1959, the DME (distance measuring equipment) system has been standardized by the International Civil Aviation Organization (ICAO) for the measurement of the distance between aircraft and ground. In connection with the development of the Microwave Landing System (MLS), it was decided to employ the DME as integral component of the MLS for the determination of the distance between aircraft and touchdown point. The DME system used for doing this, which is now called 'DME/P', has to satisfy the specifications of the current standard DME. However, in addition, it has to provide a much higher accuracy. The effects of adjacent channel interference have become, in this connection, a significant factor. In the present investigation, a comparison is conducted between the accuracy requirements for the standard DME and those for the DME/P. Considerations with respect to pulse form selection are discussed along with the needed larger processing bandwidth. Particular attention is given to approaches for overcoming difficulties related to adjacent channel interference.
G.R.

A83-26482#
ADVANTAGES OF STATISTICALLY INTERROGATING ONBOARD ANTICOLLISION SYSTEMS [VORZUEGE STATISTISCH ABFRAGENDER KOLLISIONSSCHUTZSYSTEME AN BORD]
P. PLUMEYER (Braunschweig, Technische Universitaet, Brunswick, West Germany) In. The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p 182-204. In German. refs

The Air Traffic Control (ATC) system represents a vital factor in connection with the objective to reduce midair collision hazards for aircraft. However, the employment of onboard anticollision systems appears to be also desirable because devices of cooperative systems will provide protection for uncontrolled visual flight air traffic and a certain redundancy regarding a protection for the controlled airspace. It is pointed out that an effective anticollision system should have a repetition rate of at least one per second. Many of the currently proposed anticollision systems do not appear to be capable to satisfy this requirement The present investigation is, therefore, concerned with the possibility to employ for anticollision applications systems utilizing the technology of statistical interrogation. Attention is given to the American systems Secant and Avoids. It is found that the investigated systems would be able to satisfy the necessary requirements for an anticollision system. G.R.

A83-26485#
ADVANCES RELATED TO THE MEASUREMENT AND REPRESENTATION OF REAL MULTIPATH PROPAGATION [FORTSCHRITTE BEI DER MESSUNG UND DARSTELLUNG REALER MEHRWEGEAUSBREITUNG]
P. FORM and K.-G. WESTPHAL In. The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p. 296-314. In German. refs

During the last few years, civil aviation has been concerned with the possibility to obtain more accurate systems for radio navigation and instrument landing applications, taking into account systems which are also less affected by interference effects. In connection with these objectives, multipath propagation and its effects on the system have become important research subjects Improved simulation represents a suitable approach for systematic comparisons of systems and system variants. A decisive criterion regarding the selection and development of a measuring procedure is the capability to recognize at the receiver location the various interference components on an individual basis Attention is given to Doppler effects related to the motion of the aircraft, the reflection of the signal by various objects, and the design of a suitable installation for measuring multipath propagation. G.R

A83-26486#
IMPROVED SIMULATION OF GROUND REFLECTIONS [VERBESSERTE NACHBILDUNG VON BODENREFLEXIONEN]
W. SCHROER In: The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p 315-340. In German. refs

The propagation of HF signals employed in connection with flight control applications involving the use of radio navigation systems is significantly affected by reflections. Reflections produced by discrete reflectors can cause high-frequency disturbances of the navigation system. An analytical description of ground reflection is needed for the development of approaches which prevent a 'penetration' of ground reflections into the measuring system. The possibilities for a description of the propagation of electromagnetic waves over inhomogeneous ground by the relations of geometrical optics are limited. This is particularly true for the calculation of ground reflections involving small angles. Such reflections have a significant effect on signal propagation in the case of radio navigation systems. Kirchhoff's theory concerning the diffraction of light at a slit can be used in connection with these problems. An integration procedure with variable integration step size was developed for the numerical evaluation of the Fresnel-Kirchhoff integral. G R.

A83-26602
AIR TRAFFIC FLOW CONTROL SYSTEMS - MODELLING AND EVALUATION
M. BIELLI, G. CALICCHIO, S. IOZZIA, and B. NICOLETTI (CNR, Istituto di Analisi dei Sistemi ed Informatica, Rome, Italy) In: Control science and technology for the progress of society; Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981. Volume 4 Part B. Oxford, Pergamon Press, 1982, p. 2357-2362. refs

Some mathematical models for supporting the development of semi/fully automated air traffic control systems are discussed. Particularly, the flow control problem is approached as a constrained optimization problem on a multicommodity network. The proposed mathematical model, by means of a suitable time discretization, is initially changed into a 'static' one. Then a multicommodity algorithm, based on the resource directive decomposition method, is used for the actual computation of the optimal flow in the network. The method is evaluated from the point of view of its practical implementation and its capability to take into account the peculiar aspects of the problem. An application, relative to the Rome air traffic control region, is discussed (Author)

A83-26830
ANALYSIS OF MICROSTRIP WRAPAROUND ANTENNAS USING DYADIC GREEN'S FUNCTION
S. BARROSO DE ASSIS FONSECA (Brasilia, Universidade, Brasilia, Brazil) and A. J. GIAROLA (Campinas, Universidade Estadual, Campinas, Sao Paulo, Brazil) IEEE Transactions on Antennas and Propagation, vol. AP-31, Mar. 1983, p. 248-253. Research supported by the Conselho Nacional de Desenvolvimento Cientifico e Tecnologico and Telecommunicoes Brasileiras SA. refs

The radiation pattern of microstrip wraparound antennas was obtained using a theory based on dyadic Green's functions for concentric-cylindrical layered media. The dielectric layer that is usually neglected as a first-order approximation was considered. An asymptotic expression for the dyadic Green's function that takes into account only the space wave is first obtained. Radiation patterns for various radii, permittivities, and thicknesses of the dielectric layer of a microstrip wraparound antenna were obtained

using as a source of a uniform annular magnetic walls. The calculated values of the percent pattern coverage decreases as the thickness and the permittivity of the dielectric layer increase. The influence of the dielectric layer is more pronounced for radiation direction near that of the axis of the cylindrical surface. It is also shown that the radiation patterns at a frequency of 2 0 GHz are not much dependent on the diameter of the antenna for values from 3 to 120 in (Author)

A83-26835
CONSTRAINED OPTIMIZATION OF MONOPULSE CIRCULAR APERTURE DISTRIBUTION IN THE PRESENCE OF BLOCKAGE
M. SACHIDANANDA and S. RAMAKRISHNA (Indian Institute of Science, Bangalore, India) IEEE Transactions on Antennas and Propagation, vol. AP-31, Mar. 1983, p 286-293 refs

A method of synthesizing aperture antenna excitations to obtain optimum performance in the presence of aperture blockage is presented. The problem of optimizing the performance indices such as directivity and angular sensitivity is formulated as an N-dimensional minimization problem, with constraint on the sidelobe level In most cases, the objective function is nonlinear with multiple minima which does not yield readily to gradient methods. A simplex search method is used in the study for optimizing the performance index. The sidelobe level (SLL) constraint has been incorporated using the penalty function method The method is applied to circular monopulse aperture distribution with circular blockage to obtain maximum directivity factor (DF) in the sum mode and maximum angular sensitivity factor (ASF) in the difference mode, with sidelobe level constraint. The effect of blockage on the maximum directivity and maximum angular sensitivity is studied for various sidelobe level constraints. (Author)

A83-26929
POTENTIAL ACCURACY OF THE GONIOMETER SECTION OF A COMPLEX SHORT-RANGE NAVIGATION SYSTEM [POTENTSIAL'NAIA TOCHNOST' UGLOMERNOGO TRAKTA KOMPLEKSNOI RADIOTEKHNICHESKOI SISTEMY BLIZHNEI NAVIGATSII]
A. I. PAPKOV Radiotekhnika, Mar. 1983, p. 23-25. In Russian refs

A method is developed for assessing the accuracy of the goniometric section of a complex short-range navigation system with optimal processing of information from the outputs of individual subsystems. Doppler instrumentation is used to measure ground speed and angle of drift. Errors in the determination of flight path are investigated in relation to the accuracy characteristics of the subsystems of the complex. B.J.

A83-26934
ESTIMATION OF THE MUTUAL INFLUENCE OF A GROUP OF RADIO-ELECTRONIC DEVICES [OTSENKA VZAIMNOGO VLIIANIIA GRUPPY RADIOELEKTRONNYKH SREDSTV]
S. K. SAVIN and P. F. SALIENKO Radiotekhnika, Mar. 1983, p. 41-44. In Russian.

The paper proposes an index for the estimation of the mutual influence of a group of radio-electronic devices in an air-navigation system, the index taking into account the frequency instability of the devices as well as frequency-separation norms. It is shown that this approach can be used to augment the electromagnetic compatibility of

N83-18638*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
USE OF LORAN-C FOR GENERAL AVIATION AIRCRAFT NAVIGATION
K. NATARAJAN *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 p 13-18 Mar. 1981 refs Previously announced as N81-22002
(Contract NGL-22-009-640)
Avail: NTIS HC A07/MF A01 CSCL 17G

Quantitative and qualitative observations were made on the Loran-C in general aviation aircraft. The evaluation of Loran-C for both cross country flights and nonprecision approaches was conducted under simulated instrument flight rules conditions Particular emphasis was placed on the reliability and failure of Loran-C equipment as well as its susceptibility to atmospheric effects such as P static. Efforts were made to quantify the long term stability of the Loran-C time difference grid. Several E field antenna configurations were also evaluated in terms of performance Significant results are reported R.C T

N83-18642*# Ohio Univ., Athens. Avionics Engineering Center
RESULTS OF A LORAN-C FLIGHT TEST USING AN ABSOLUTE DATA REFERENCE
J. P. FISCHER *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 p 75-90 Mar. 1981 refs Previously announced as N80-16051
Avail NTIS HC A07/MF A01 CSCL 17G

A closed circuit flight test was conducted using VOR's and NDB's as reference points. The Loran-C data collected during the flight was then compared against a reference provided by the Discrete Address Beacon System (DABS) facility. A commercial receiver was used to record Loran-C time differences which were also compared with the data provided by the DABS facility The low cost receiver used for this test was used in the DC-3 flying laboratory The Loran-C time difference data was recorded with a microcomputer data collection system and stored on magnetic tape for subsequent analysis The equipment configuration in the aircraft, the flight procedure and the results obtained from the data collected with the receiver and recording system are described S.L.

N83-18644*# Princeton Univ., N. J. Dept of Mechanical and Aerospace Engineering.
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT PRINCETON UNIVERSITY, 1980
R. F. STENGEL *In* NASA. Langley Research Center Joint Univ Program for Air Transportation Res., 1980 p 107-113 Mar. 1981 Previously announced as N81-22008
Avail: NTIS HC A07/MF A01 CSCL 17G

Several aspects of air transportation technology are discussed. The following are included: evaluation of an OMEGA-dead reckoning hybrid navigation system, implementation of a microprocessor controlled flight research ground station; investigation of fuel use characteristics of general aviation aircraft; investigation of a dead reckoning concept incorporating a fluidic rate sensor; experimentation related to ultrasonic altimetry; and concept development for a laser based collision avoidance system. R.C T.

N83-18645*# Princeton Univ., N. J.
LASER BEACON COLLISION AVOIDANCE SYSTEMS
L. M. SWEET, R B. MILES, E. WONG, and M. TOMEH *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res , 1980 p 115-122 Mar. 1981 Previously announced as N81-22009
Avail: NTIS HC A07/MF A01 CSCL 17G

The development objectives for a laser beacon collision avoidance system are outlined. A system suitable to general aviation aircraft is briefly described. M G.

N83-18646*# Princeton Univ., N. J.
DEAD RECKONER NAVIGATION PROJECT
R. ELLIS and L. M SWEET *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 p 123-130 Mar. 1981 Previously announced as N81-22010
Avail: NTIS HC A07/MF A01 CSCL 17G

A low cost, reliable dead reckoning navigation system for use in general aviation aircraft, with possible application in a hybrid Loran/dr navigator was developed A previous dead reckoner involved a classical gyrocompass, a Hewlett-Packard minicomputer, and a true airspeed sensor In an effort to bring the cost of this system more in line with the realities of general aviation, the minicomputer was replaced with a microcomputer and a fluidic

rate sensor was implemented in the compass system in place of the directional gyro S.L.

N83-18704*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HELICAL AUTOMATIC APPROACHES OF HELICOPTERS WITH MICROWAVE LANDING SYSTEMS
J. D. FOSTER, L A. MCGEE, and D. C. DUGAN Dec. 1982 89 p refs
(NASA-TP-2109, A-9034; NAS 1.60 2109) Avail NTIS HC A05/MF A01 CSCL 17G

A program is under way to develop a data base for establishing navigation and guidance concepts for all-weather operation of rotorcraft. One of the objectives is to examine the feasibility of conducting simultaneous rotorcraft and conventional fixed-wing, noninterfering, landing operations in instrument meteorological conditions at airports equipped with microwave landing systems (MLSs) for fixed-wing traffic. An initial test program to investigate the feasibility of conducting automatic helical approaches was completed, using the MLS at Crows Landing near Ames. These tests were flown on board a UH-1H helicopter equipped with a digital automatic landing system. A total of 48 automatic approaches and landings were flown along a two-turn helical descent, tangent to the centerline of the MLS-equipped runway to determine helical light performance and to provide a data base for comparison with future flights for which the helical approach path will be located near the edge of the MLS coverage In addition, 13 straight-in approaches were conducted. The performance with varying levels of state-estimation system sophistication was evaluated as part of the flight tests. The results indicate that helical approaches to MLS-equipped runways are feasible for rotorcraft and that the best position accuracy was obtained using the Kalman-filter state-estimation with inertial navigation systems sensors Author

N83-18705# Federal Aviation Administration, Atlantic City, N.J
GLOBAL POSITIONING SYSTEM EN ROUTE/TERMINAL EXPLORATORY TESTS Final Report, Mar. 1981 - Feb. 1982
J T. CONNOR, R. J ESPOSITO, and P. LIZZI Dec. 1982 122 p
(Contract FAA PROJ. 049-311-110)
(FAA-RD-82-71, FAA-CT-82-64) Avail NTIS HC A06/MF A01

The Federal Aviation Administration Technical Center performed this effort under the Technical Program Document 04-109, subprogram 049-311, project Navigation Satellite Timing and Ranging (NAVSTAR)/Global Positioning System (GPS). The report covers the exploratory laboratory test in 1981 and 33 hour flight test from June through July 1981 of the single channel GPS receiver (Z-set) manufactured by Magnavox and procured by the Department of Defense (DOD) The report documents the performance of the Z-set in the laboratory and during different flight profiles including rectangles, orbits, radials, nonprecision approaches, and area en route flights to the Philadelphia, Dulles, Norfolk, Wilmington, and John F Kennedy Airports during periods when up to five satellites were visible to the antenna. Author

N83-18706# Analytic Sciences Corp., Reading, Mass.
LORAN-C GRID CALIBRATION REQUIREMENTS FOR AIRCRAFT NON-PRECISION APPROACH Final Report, Mar. 1981 - Jul. 1982
L. M. DEPALMA and P. M. CREAMER 17 Jul. 1982 70 p refs
(Contract DTFA01-81-C-10031)
(AD-A121191; TASC-TR-3030-1; DOT/FAA/RD-82/65) Avail NTIS HC A04/MF A01 CSCL 17G

The Federal Aviation Administration (FAA) Technical Center has conducted tests to measure spatial warpage and temporal instability in the Loran-C hyperbolic navigation grid Airborne Loran-C calibration requirements identified from the test data are discussed in this report. The test results have been obtained in support of the Federal Radionavigation Plan decision process Test emphasis is placed on non-precision approach, the flight phase for which FAA Advisory Circular AC-90-45A accuracy requirements are most stringent. Spatial warpage is assessed using Time Difference (TD) data collected at approximately 25 sites within 20 km of each of five airports. It is found that the Loran-C TD bias is the dominant warpage component and that the bias must be calibrated to meet AC-90-45A requirements for certain airports and station triads. An alternative but less accurate method than bias calibration makes use of propagation models based on mixed land/sea signal paths Temporal instability is assessed using TD data collected over two-to-three week periods at each airport and over an entire year at a fixed-site monitor at London, KY It is concluded that short-term instability is negligible, but seasonal instability is potentially a problem for certain regions and triads. GRA

N83-19732# Boeing Commercial Airplane Co., Seattle, Wash
TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM: DEVELOPMENTAL SIMULATION Final Report, 1981 - Apr. 1982
G. P. BOUCEK, JR., R. W. WHITE, W D. SMITH, and J. M. KRAUS Washington FAA Jul 1982 190 p refs Sponsored by FAA
(FAA-RD-82-49) Avail NTIS HC A09/MF A01

One of a series of studies being conducted to develop the Traffic Alert and Collision Avoidance System (TCAS) is described. The purpose of this study was to investigate display technology appropriate for the presentation of TCAS information on both conventional and advanced flight decks The alerting effectiveness of candidate TCAS display concepts, the variability of including a caution level alert (TA) that would precede the warning (RA), minimum information requirement for the RA and TA, and a TCAS display concept to be used in the operational simulation were studied. In the tests, experienced transport pilots were presented TCAS alerts while flying a transport simulator. Their responses to the alerts were recorded as were their opinions about the system. Author

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AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

A83-23645
ADVANCED COMPOSITES STRUCTURES AT HUGHES HELICOPTERS, INC
R. A. D LOFLAND (Hughes Helicopters Research and Development Composites Laboratory, Culver City, CA) In: Material and process advances '82; Proceedings of the Fourteenth National SAMPE Technical Conference, Atlanta, GA, October 12-14, 1982. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 521-528.

An American aerospace company has concentrated its efforts in wet filament winding over the past ten years, because of cost savings, ease of manufacturing, and flexibility of design. A description is provided of the wet filament winding process used in the fabrication of three helicopter components, taking into account a composite main rotor blade, a composite tail rotor, and a composite helicopter tail section. The fiber materials are used in the form of their lowest cost available, including roving and broadgoods such as Kevlar 29 and 49, S-2 Glass, and graphite. The main rotor blade is intended for use on the U.S. Army's AH-64 Attack Helicopter. The primary materials employed are Kevlar/epoxy and graphite/epoxy The composite flexbeam tail rotor is also to be employed for the AH-64 Attack Helicopter. The tail rotor blade assembly includes Kevlar 49 in the outer skin, Kevlar/epoxy for the inner skin, and graphite/epoxy stiffening doublers G.R.

A83-23679#
HELICOPTER-ROTOR AEROELASTIC EQUILIBRIUM UNDER NONLINEAR AERODYNAMIC FORCES
J. J COSTES (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) La Recherche Aerospatiale (English Edition), no. 5, 1982, p 47-63. refs

Techniques for coupling mechanics equations with unsteady, compressible, three-dimensional linear theory to describe airfoils in stall conditions are presented. The fact that blades respond to aerodynamic forces in a quasi-linear manner is used to simplify the aerodynamic equations, resulting in a nonlinear system of equations which can be solved for lift at a particular angle of attack Solutions are obtained through a generalized Newtonian method and matched against test results in the Modane wind tunnel Calculations were performed for two- and three-dimensional steady and unsteady aerodynamics of wings in forward motion, a stalled wing, and a helicopter in forward flight. Good agreements were found for advance ratios less than 0.4, and improvements in the equations to account for aeroelastic coupling with torsional modes are indicated. M.S.K

A83-24030#
INVESTIGATION OF LANDING GEAR ALTERNATIVES FOR HIGH PERFORMANCE AIRCRAFT
A. R DEWISPELARE (USAF, Institute of Technology, Wright-Patterson AFB, OH) and R P. STAGER (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) Journal of Aircraft, vol. 20, Apr. 1983, p. 319-326. refs

(Previously cited in issue 20, p. 3463, Accession no. A81-43139) [illegible] ited i

A83-24155#
ALTERNATIVE WING CONCEPTS FOR A LONG-DISTANCE AIRCRAFT OF THE NINETIES [ALTERNATIVE FLUEGELKONZEPTE FUER EIN LANGSTRECKRNFLUGZEUG DER 90 ER JAHRE]
W OELKERS (Messerschmitt-Boelkow-Blohm GmbH, Hamburg, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 21 p In German
(DGLR PAPER 82-029)

A concept for a long-distance passenger aircraft of the nineties with a relatively large wing and a less demanding combination of length and aspect ratio is compared to the concept of an aircraft with a long wing and reduced weight. The comparison includes wing thickness and structure, bending moment, bending stress, flaps system, lift-drag ratios at cruise and lower speeds, flight profile, weight, unit fuel, and wing area/engine thrust. It is shown how the main parameter, wing area, affects the configuration, aerodynamics, structure, weight, economicality, and flexibility in application of either concept. C.D.

A83-24157#
PERFORMANCE-INCREASING MODIFICATIONS ON TRANSONIC PASSENGER PLANE WINGS [LEISTUNGSSTEIGERNDE MODIFIKATIONEN AN TRANSSONISCHEN TRAGFLUEGELN VON VERKEHRSFLUGZEUGEN]
J. MANTEL (Messerschmitt-Boelkow-Blohm GmbH, Bremen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 14 p. In German.
(DGLR PAPER 82-031)

Wing modifications for the Airbus class aimed at improving flight economicality of existing passenger aircraft are discussed. An increase in the curvature of the wing at the trailing edge is emphasized. The modifications may make it possible to alter the transonic flow around the wings by using existing flap systems, thus reducing the cost of structural alterations on the aircraft. It is shown that the design goals of raising the buffet threshold and the lift-drag ratio can be attained by preadjusting the landing flaps at the wing base. These design proposals are discussed in the context of pressure and circulation distribution calculations and are compared with wind tunnel results for a few selected configurations The attainable performance increase is shown for an aircraft representative of modern transonic passenger flight. C D.

A83-24160
CONFIGURATION DEVELOPMENT FOR A HIGHLY MANEUVERABLE EXPERIMENTAL AIRCRAFT WITH NEGATIVE SWEEP RUDDER UNITS [KONFIGURATIONSENTWICKLUNG FUER EIN HOCHMANOEVRIERFAEHIGES VERSUCHSFLUGZEUG MIT NEGATIV GEPFEILTEN SEITENLEITWERKEN]
S RANSOM (Messerschmitt-Boelkow-Blohm GmbH, Bremen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 26 p In German. Research supported by the Bundesministerium der Verteidigung. refs
(DGLR PAPER 82-035)

Future fighter aircraft must have a very high capability for maneuvering. In this connection, an investigation has been conducted of flight maneuvers which in the past have been considered as unconventional. The maneuvers require improved stability and control properties. A description is presented of the development of special control systems which are needed for the considered maneuvers, taking into account the application of the new control concepts in the case of an experimental aircraft project involving a delta wing configuration. The considered configuration has been employed in a number of modern designs proposed for fighter aircraft G.R.

A83-24161
INVESTIGATIONS CONCERNING THE STRUCTURAL DESIGN OF A FORWARD SWEPT WING FOR A COMBAT AIRCRAFT [UNTERSUCHUNGEN ZUR STRUKTURAUSLEGUNG EINES VORWAERTSGEPFEILTEN FLUEGELS FUER EIN KAMPFFLUGZEUG]
H. SCHWEIGER and O. SENSBURG (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 31 p In German refs
(DGLR PAPER 82-036)

Up to now, the aeroelastic phenomenon of flexure-torsion divergence has made it impossible to use forward swept wings for high speeds. The cause of this restriction was related to the excessive structural weight required in connection with the employment of such wings. However, the described situation has changed as a consequence of the development of carbon-fiber reinforced plastic materials for applications related to aircraft construction The new material, which combines very high rigidity with great strength and low weight, makes it possible to build wing structures with divergence speeds which are significantly higher than those obtained with aluminum structures. The present investigation is concerned with a theoretical study regarding the possibilities and limits of the new technology. It is found that combat aircraft with forward swept wings can be built without weight penalties compared to conventional wing forms. Such aircraft appear to be very promising with respect to good maneuverability and low drag G.R.

A83-24162
DESIGN AND MANUFACTURE OF THE TORNADO CARBON-FIBER REINFORCED PLASTICS TAILERON [KONSTRUKTION UND FERTIGUNG DES TORNADO CFK-TAILERONS]
W HARTMANN and J. KLENNER (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 62 p. In German.
(DGLR PAPER 82-038)

A description is presented of the manufacture of the first two left Tornado carbon-fiber composite (CFC) elevator unit components. The manufacturing processes utilized in connection

with the construction of these prototypes are comparatively simple, and do not yet represent optimized procedures It is pointed out that cost-reducing modifications of the manufacturing system are feasible in case of a large-scale production of primary aircraft components of the considered type. Suitable approaches for reducing manufacturing costs are related to modification of individual tools, hot-working techniques, the utilization of automatic cutting techniques, and the employment of economic mechanical processing operations, including, in particular, drilling, reaming, and countersinking. The discussed project demonstrates the feasibility of a manufacture of complex primary structures of modern combat aircraft on the basis of a utilization of CFC, taking into account the assurance of satisfactory quality. G R.

A83-24172#
NEW TECHNOLOGY IN GENERAL AVIATION [NEUE TECHNOLOGIE IN DER ALLGEMEINEN LUFTFAHRT]
R BIRRENBACH and W. HABERLAND (Dornier GmbH, Friedrichshafen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 69 p. In German. refs
(DGLR PAPER 82-048)

The situation with respect to the employment of new technologies is in civil aircraft construction different from the conditions concerning military aircraft. Investments related to the utilization of new technologies can only be justified in general aviation if they will pay off within relatively short time periods An experimental program was initiated by a German aerospace company to explore the feasibility of the development of wings of new technology The motivation for this program was initially (1975) related to the rapidly increasing fuel costs, and the expectation to improve efficiency, operational economy, and environmental aspects for the considered class of general aviation, taking into account a maximum aircraft weight of 6,000 kg and aircraft speeds up to 500 km/h. Attention is given to computer programs for aerodynamics calculations, wing design studies, propeller design and test results, gust alleviation systems, aspects of wing construction, the use of CRT in the cockpit, the employment of digital control systems, and laser gyroscopes. G.R.

A83-24178*# Kohlman Aviation Corp., Lawrence, Kans
PERFORMANCE IMPROVEMENTS OF SINGLE-ENGINE BUSINESS AIRPLANES BY THE INTEGRATION OF ADVANCED TECHNOLOGIES
D. L. KOHLMAN (Kohlman Aviation Corp, Lawrence, KS) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 26 p. refs
(Contract NAS1-16363)
(DGLR PAPER 82-064)

An assessment is presented of the performance gains and economic impact of the integration in general aviation aircraft of advanced technologies, relating to such aspects of design as propulsion, natural laminar flow, lift augmentation, unconventional configurations, and advanced aluminum and composite structures. All considerations are with reference to a baseline mission of 1300 nm range and 300-knot cruise speed with a 1300-lb payload, and a baseline aircraft with a 40 lb/sq ft wing loading and an aspect ratio of 8. Extensive analytical results are presented from the NASA-sponsored General Aviation Synthesis Program. Attention is given to the relative performance gains to be expected from the single-engined baseline aircraft's use of a low cost general aviation turbine engine, a spark-ignited reciprocating engine, a diesel engine, and a Wankel rotary engine. O C.

A83-24179#
DEVELOPMENTAL TRENDS IN HELICOPTER DESIGN [ENTWICKLUNGSTENDENZEN IM HUBSCHRAUBERAU]
G REICHERT (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 23 p. In German. refs
(DGLR PAPER 82-065)

Possibilities for improved helicopter aerodynamic structures, new materials and methods of construction, and improved electronics are discussed, and their effects on the next generation of helicopters is evaluated, giving examples. The main areas for improvement are economy, distance, safety, comfort, and environmental acceptability. Trends in helicopter vibration, noise level, and accident statistics are reviewed and discussed. Improvements in rotor structures and blades are depicted and discussed; the use of new materials and improved assembly in those structures to achieve gains in the targeted areas is assessed C D.

A83-24426#
GENERIC FAULTS AND ARCHITECTURE DESIGN CONSIDERATIONS IN FLIGHT-CRITICAL SYSTEMS
S. S. OSDER (Sperry Flight Systems, Sperry Corp , Phoenix, AZ) (Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers, p. 509-518.) Journal of Guidance, Control and Dynamics, vol. 6, Mar.-Apr 1983, p. 65-71. refs

(Previously cited in issue 19, p. 2976, Accession no. A82-38980)

A83-24430*# Goodyear Aerospace Corp , Akron, Ohio.
CONTROL CHARACTERISTICS OF A BUOYANT QUAD-ROTOR RESEARCH AIRCRAFT
B L NAGABHUSHAN, D. W. LICHTY, and N. P. TOMLINSON (Goodyear Aerospace Corp , Defense System Div , Akron, OH) (Guidance and Control Conference, Albuquerque, NM, August 1-2, 1981, Collection of Technical Papers, p. 370-377) Journal of Guidance, Control and Dynamics, vol. 6, Mar.-Apr. 1983, p. 91-99.
(Contract NAS2-10777)

(Previously cited in issue 21, p 3620, Accession no. A81-44122)

A83-25115
THE ATR 42 WILL KEEP ITS PROMISES [L'ATR 42 TIENDRA SES PROMESSES]
J. MORISSET and R. NOYE Air et Cosmos, vol. 20, Mar 12, 1983, p. 16-20. In French.

The design features, contractors, development schedule, and possible modifications to the propeller-driven ATR 42 regional transport aircraft are reviewed. The ATR 42 is scheduled for flight tests in 1984, and certification is expected in 1985 A total of 86 aircraft are on order for delivery by 1987 A wider body will provide more seating than other new aircraft in the same class, and a stretched version will also become available, although with lower performance standards. Powered by two PW 120 turboprops, the 22.69 m long ATR 42 will feature a 9840 kg operational weight, including 5020 kg of cargo capacity. The airspeed will be 511 km/hr during cruise conditions at 20,000 ft, with a range of 1300 km when carrying full passenger capacity. Features of the aircraft which will include composite components are described, together with the use of fiberglass propellers wound on an aluminum core. M.S.K.

A83-25137
NOW IS THE TIME FOR NEW FIGHTERS
M. LAMBERT Interavia, vol. 38, Mar. 1983, p 207-210.

The technological advancements which may be integrated in novel tactical aircraft designs that will be ready for production in the 1990-1995 period are discussed, with emphasis on aerodynamic and flight control techniques that can enhance dogfight maneuverability. Attention is given to the specifically NATO-related performance requirements of the fighter designs under

consideration, as well as the prospects for multinational development and production programs that may be pursued in the interests of cost reduction A major requirement of the new generation fighters is a radome sufficiently large to accommodate such radars as that of the Tornado ADV. Turn performance for these designs is expected to be highly efficient at air speeds closer to Mach 2 0 than the presently more common Mach 1.0. Canard configurations are a feature shared by British/German, Swedish and French design concepts O.C.

A83-25767
AIRCRAFT VEHICLE EQUIPMENT IMPROVEMENTS VIA MICROPROCESSORS
G KURYLOWICH (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) and A. J. P. LLOYD (Boeing Military Airplane Co., Seattle, WA) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 13 p. refs
(SAE PAPER 820868)

Attention is given to applications of microprocessors to environmental control, crew escape, and landing gear technology. Microprocessors are being used in the development of an integrated closed loop environmental control system and in the development of pneumatic and electropneumatic valves. They are also being applied to thrust profiles and ejection procedures, the aircraft ground roll situation under adverse weather conditions. The results of simulation studies are presented and discussed S.C S.

A83-25768
ENVIRONMENTAL CONTROL OF AN AIRCRAFT POD MOUNTED ELECTRONICS SYSTEM
T MORRIS, W. GODECKER, L. CROWE, and M. W. METZLER (Sundstrand Corp , Rockford, IL) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 9 p.
(SAE PAPER 820869)

The all-weather navigation and attack capabilities of the F-16 fighter are being expanded by means of a new Lantirn electronics system that will be mounted under the aircraft in two removable pods, each of which will carry a self-contained environmental control unit (ECU). The ECU design requirements include an extreme mission duty cycle, small and high density package, and low ambient temperature operation vapor cycle refrigeration. The modularity of the Lantirn pods minimizes flight line maintenance time by providing minimum interface/attachment requirements for line replaceable units, including the ECUs The pod navigation and targeting electronics systems have separate ECUs. Attention is given to ECU thermal performance data. O.C

A83-25769
ECS SCHEMES FOR ALL ELECTRIC AIRLINERS
F. M. ROSENBUSH (United Technologies Corp., Hamilton Standard Div., Windsor Locks, CT) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 13 p. refs
(SAE PAPER 820870)

This paper introduces the concepts and state-of-the-art advances on which the All-Electric Airliners will be based, discusses present practice and experience in the design of ECS and derives some ground rules and guidelines for generating new ECS schemes. Based on these, two examples of system schematic layout (Vapor Cycle and Recircair) are presented. Innovative development needed for execution of the systems is highlighted. The conclusion is that the systems are feasible and advantageous, but work on translating into practice should be started as soon as possible. (Author)

A83-25770
THERMAL DESIGN OF INTEGRATED AVIONIC RACKS FOR AIRCRAFT
V. CIRRITO (Grumman Aerospace Corp , Thermodynamics Dept., Bethpage, NY) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 11 p
(Contract N62269-78-R-0294)
(SAE PAPER 820871)

Consideration is given to the thermal design of integrated avionic racks for aircraft installation, noting the types of heat sinks available for cooling the avionic equipment. Environmental considerations particular to military aircraft are identified and the ISEM-2A (SEM format B) is discussed with reference to the conduction cooling arrangement and air-over components. Alternative modules are described, such as the hollow board concept and heat pipe modules. Attention is likewise given to the thermal testing of a three-tier rack using ISEM-2A conduction modules. S.C.S.

A83-25771
EVALUATING SCROLL REFRIGERANT COMPRESSORS FOR REDUCING SIZE AND WEIGHT OF MILITARY AIRCRAFT ECS
J. E. MCCULLOUGH, J T. DIECKMANN, T P. HOSMER, and A H. POST, JR. (Arthur D. Little, Inc., Cambridge, MA) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 11 p.
(Contract F33615-81-C-3405)
(SAE PAPER 820877)

The paper discusses the investigations performed in the design study phase for a compact lightweight Scroll-type refrigerant compressor for pod-mounted environmental control systems (ECS) of military aircraft. Evaluations of the total weight, volume and power consumption of a baseline system and versions with alternative heat transfer fluids, refrigerants, compression stages, motor cooling techniques, thermodynamics cycles, and capacity control methods are presented, and the optimum flight system obtained, based on a simple vapor cycle incorporating liquid subcooling, a two-stage compressor, and R-114 refrigerant, is outlined The design of a Scroll compressor driven by a nominal 3-hp 200 VAC, three-phase, 400-Hz, 11,400 rpm electric motor with a double-ended shaft and fitted with rolling bearings throughout is then examined. It is noted that a breadboard prototype has been designed and awaits fabrication and testing A.L.W

A83-25895
THE AH-64 NITROGEN INERTING UNIT
R L. CRAMER (Litton Industries, Clifton Precision Div., Davenport, IA) SAFE Journal, vol. 13, Spring, 1983, p. 5-7

Design features and preliminary test results with an on-board inert gas generating system (OBIGGS) for protection of aircraft against fuel explosions are described. OBIGGS has aluminum beds packed with molecular sieve, a motor driven rotary control valve, an air-to-air heat exchanger with a circulating fan, a droplet and particulate filter, and a built-in test indicator. Compressor air is directed through the OBIGGS, which filter out the oxygen for delivery of nitrogen-rich gas to the fuel tank. Tests have shown satisfactory stability of operation in -25 to +115 F temperatures and a 6000 hour useful life is predicted. Solid state pressure transducers monitor the pressure profile and the thermistor to detect system defects. Oxygen concentrations have been verified in inerting, taxi, hover, climb, and dive conditions with a helicopter. M.S.K.

A83-25914#
EVALUATION OF INTERIOR NOISE CONTROL TREATMENTS FOR HIGH-SPEED PROPFAN-POWERED AIRCRAFT
R A PRYDZ, J. D. REVELL, F. J BALENA, and J. L. HAYWARD (Lockheed-California Co , Burbank, CA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 14 p refs
(AIAA PAPER 83-0693)

Experimental noise reduction data have been obtained on a 43 percent scale model of a typical narrow-body aircraft. The acoustic performance of six sidewall 'add-on' noise reduction treatment designs have been evaluated under random and harmonic acoustic excitations and compared with predictions A previously derived mathematical model for sound transmission into a stiffened cylindrical shell with multilayered treatments is used for the predictions. The theory compares favorably with experimental data at high frequencies and high surface density sidewall conditions, but understimates low frequency noise reduction. It is shown that add-on noise control treatment designs are effective in reducing the interior noise of propfan powered aircraft to acceptable levels. (Author)

A83-25933*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACOUSTIC MEASUREMENTS OF A FULL-SCALE COAXIAL HELICOPTER
M. MOSHER and R. L PETERSON (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 11 p
(AIAA PAPER 83-0722)

Acoustic data were obtained during a full-scale test of the XH-59A Advancing Blade Concept (ABC) Technology Demonstrator in the NASA Ames 40- by 80-Foot Wind Tunnel. The XH-59A is a research helicopter with two coaxial rotors and hingeless blades. Performance, vibration, noise at various forward speeds, rotor lift coefficients, and rotor shaft angles of attack were investigated. In general, the noise level is shown to increase with rotor lift coefficient except under certain operating conditions where it is increased by significant impulsive blade/vortex interactions. The impulsivity appears to depend upon how the lift is distributed between the two rotors. The noise levels measured are shown to be slightly higher than on a modern conventional rotor tested in the same facility (Author)

A83-25964#
ANALYSIS OF JET-AIRFRAME INTERACTION NOISE
G. SENGUPTA (Boeing Commercial Airplane Co., Seattle, WA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 11 p. refs
(AIAA PAPER 83-0783)

This paper presents a method for analysis and identification of the physical mechanisms of jet-airframe interaction noise, based on the results of scale model tests Jet-wing interaction noise is modeled in terms of lift fluctuation noise, trailing edge noise, and jet noise reflection. The peak frequency of jet-wing interaction noise is found to be associated with selective amplification of pressure fluctuations of eddies in the fan jet shear layer that are closest to the wing trailing edge. This peak frequency is found to be inversely proportional to the transit time of the eddies traveling from the nozzle exit plane to the wing trailing edge; the turbulence scale of these eddies approximately matches this distance. Jet-flap interaction noise is modeled in terms of lift fluctuations on the flaps diffracted by the wing trailing edge. Measured directivity patterns based on overall sound pressure levels (OASPL) are consistent with the theoretical models. The levels predicted on the basis of this analysis are consistent with 747-JT9D and 707-CFM56 flight test data. (Author)

A83-25965#
FLIGHT EFFECTS FOR JET-AIRFRAME INTERACTION NOISE
W. R. MILLER (Boeing Commercial Airplane Co., Seattle, WA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 11 p refs
(AIAA PAPER 83-0784)

The results of a model-scale wind tunnel study of jet-airframe interaction noise are presented, and a theory for description of the surface and far-field unsteady pressure fields is proposed The test was conducted in an anechoic wind tunnel under both static and simulated flight conditions at tunnel mach numbers up to 0 23. The test article was a low-speed airplane half-model equipped with deployed flaps, slats, and a dual flow jet simulator Measurements of the unsteady surface pressure at various locations on the flaps were correlated with the far-field acoustic measurements to identify the dominant source regions. Measurements of the coherence of the surface pressure field were used to identify the flight effect mechanisms for the sources of jet-airframe interaction noise. Changes in the structure of the jet shear layer due to the neighboring ambient flow are shown to be responsible for the flight effects on jet-airframe interaction noise. Sound that is radiated over the wing and then diffracted by the wing leading edge is shown to be responsible for the deviation of the measured directivity from that of a half-baffled dipole. The directivity is a function of both frequency and flight mach number as well as emission angle (Author)

A83-26484#
THE RESEARCH AIRCRAFT OF THE SPECIAL RESEARCH AREA 'FLIGHT CONTROL' AS SCIENTIFIC TEST STAND [DAS MESSFLUGZEUG DES SFB FLUGFUEHRUNG ALS WISSENSCHAFTLICHER VERSUCHSTRAEGER]
D. BRUNNER (Braunschweig, Technische Universitaet, Brunswick, West Germany) In: The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p. 277-295. In German.

After the theoretical studies and simulation investigations in the various subprojects of the Special Research Area 'Flight Control' had been completed, it was attempted to obtain a confirmation of the obtained results by means of flight tests. The flight tests were conducted with the aid of a research aircraft of the type DO 28. The present investigation is concerned with results obtained in connection with studies conducted during a total flight time of almost 200 hours Attention is given to the requirements which the research aircraft had to satisfy, supplementary equipment needed by the aircraft in connection with the performance of the tests, the boundary conditions of flight operations, aspect of flight test planning, and flight test results. G R.

N83-18647*# Princeton Univ., N. J.
GENERAL AVIATION AIRPLANE FUEL ECONOMY SYSTEM MODEL
R. PARKINSON, L. M. SWEET, and H CURTIS *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res , 1980 p 131-142 Mar. 1981 Previously announced as N81-22011
Avail: NTIS HC A07/MF A01 CSCL 01C

The aerodynamic characteristics which affect the fuel consumption of general aviation aircraft are outlined. All data are presented in the form of graphs. R.C.T.

N83-18696# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
STRAKE-WING-BODY COMBINATIONS
L VIGEVANO *In* AGARD High Angle-of-Attack Aerodyn. 19 p Dec. 1982 refs
Avail: NTIS HC A18/MF A01

The complex flow fields occurring around a typical strake-wing-body missile configuration at high angle of attack are considered at subsonic and transonic speeds. Force and surface pressure measurements, together with water tunnel visualizations up to 33 degrees incidence were carried out on flat plate trapezoidal

wings and strake-wing combinations as well as complete missile configurations to provide a detailed description of the relative flow fields. Emphasis is placed on the improvement in the normal force characteristics due to the addition of the strake, and on the body-wing and wing-body interference mechanism. Compressibility effects are considered. Author

N83-18709*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va
APPLICATION OF NONLINEAR ADAPTIVE MOTION WASHOUT TO TRANSPORT GROUND-HANDLING SIMULATION
R V. PARRISH and D. J. MARTIN, JR. (Sperry Systems Management) Feb 1983 41 p refs
(NASA-TM-84568; L-15530, NAS 1.15:84568) Avail: NTIS HC A03/MF A01 CSCL 01C

The application of a nonlinear coordinated adaptive motion washout to the transport ground-handling environment is documented Additions to both the aircraft math model and the motion washout system are discussed The additions to the simulated-aircraft math model provided improved modeling fidelity for braking and reverse-thrust application, and the additions to the motion-base washout system allowed transition from the desired flight parameters to the less restrictive ground parameters of the washout. Author

N83-18710*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards, Calif.
REAL-TIME FLUTTER ANALYSIS OF AN ACTIVE FLUTTER-SUPPRESSION SYSTEM ON A REMOTELY PILOTED RESEARCH AIRCRAFT
G. B. GILYARD and J. W. EDWARDS Jan. 1983 18 p refs Prepared in cooperation with NASA. Langley Research Center
(NASA-TM-84901; NAS 1.15:84901) Avail: NTIS HC A02/MF A01 CSCL 01C

Flight flutter-test results of the first aeroelastic research wing (ARW-1) of NASA's drones for aerodynamic and structural testing program are presented. The flight-test operation and the implementation of the active flutter-suppression system are described as well as the software techniques used to obtain real-time damping estimates and the actual flutter testing procedure. Real-time analysis of fast-frequency aileron excitation sweeps provided reliable damping estimates. The open-loop flutter boundary was well defined at two altitudes, a maximum Mach number of 0.91 was obtained. Both open-loop and closed-loop data were of exceptionally high quality. Although the flutter-suppression system provided augmented damping at speeds below the flutter boundary, an error in the implementation of the system resulted in the system being less stable than predicted. The vehicle encountered system-on flutter shortly after crossing the open-loop flutter boundary on the third flight and was lost. The aircraft was rebuilt. Changes made in real-time test techniques are included. Author

N83-18711# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany)
EVALUATION OF AERODYNAMIC DERIVATIVES FROM DO 28 TNT-FREE FLIGHT MODEL TESTS
M. MARCHAND 12 Jul. 1982 45 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-82-17) Avail: NTIS HC A03/MF A01

An evaluation of stationary and dynamic derivatives of longitudinal motion of a Do-28 TNT aircraft from model free flight tests using system identification methods is given A mathematical model used for system identification is given. The influence of the type of control inputs on the identification results is discussed, as well as accuracy. The results are compared with those obtained from stationary and dynamic wind tunnel tests R.J F

N83-18712*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
A ROTOR TECHNOLOGY ASSESSMENT OF THE ADVANCING BLADE CONCEPT
W A. PLEASANTS Jan. 1983 60 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffet Field, Calif.
(NASA-TM-84298; A-9094, NAS 1 15:84298, AVRADCOM-TR-82-A-18) Avail NTIS HC A04/MF A01 CSCL 01C

A rotor technology assessment of the Advancing Blade Concept (ABC) was conducted in support of a preliminary design study The analytical methodology modifications and inputs, the correlation, and the results of the assessment are documented The primary emphasis was on the high-speed forward flight performance of the rotor. The correlation data base included both the wind tunnel and the flight test results An advanced ABC rotor design was examined; the suitability of the ABC for a particular mission was not considered. The objective of this technology assessment was to provide estimates of the performance potential of an advanced ABC rotor designed for high speed forward flight. Author

N83-18713*# Kentron Technical Center, Hampton, Va.
APPLICATION OF VARIABLE-SWEEP WINGS TO COMMUTER AIRCRAFT
A. W ROBINS, F. L. BEISSNER, JR., W. A LOVELL, J E. PRICE, R. V. TURRIIZIANI, and F. F. WASHBURN Feb. 1983 30 p refs
(Contract NAS1-16000)
(NASA-CR-166067; NAS 1.26 166067) Avail: NTIS HC A03/MF A01 CSCL 01C

The effects of using variable-sweep wings on the riding quality and mission-performance characteristics of commuter-type aircraft were studied A fixed-wing baseline vehicle and a variable-sweep version of the baseline were designed and evaluated Both vehicles were twin-turboprop, pressurized-cabin, 30-passenger commuter aircraft with identical mission requirements. Mission performance was calculated with and without various ride-quality constraints for several combinations of cruise altitude and stage lengths. The variable-sweep aircraft had a gross weight of almost four percent greater than the fixed-wing baseline in order to meet the design-mission requirements. In smooth air, the variable sweep configuration flying with low sweep had a two to three percent fuel-use penalty However, the imposition of quality constraints in rough air can result in advantages in both fuel economy and flight time for the variable-sweep vehicle flying with high sweep Author

N83-18714*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
THE VIBRATION CHARACTERISTICS OF A COUPLED HELICOPTER ROTOR-FUSELAGE BY A FINITE ELEMENT ANALYSIS
M J. RUTKOWSKI 1983 76 p refs Prepared in cooperation with Army Research and Technology Labs
(NASA-TP-2118, A-9053; NAS 1 60:2118; AVRADCOM-TR-82-A-15) Avail NTIS HC A05/MF A01 CSCL 01C

The dynamic coupling between the rotor system and the fuselage of a simplified helicopter model in hover was analytically investigated. Mass, aerodynamic damping, and elastic and centrifugal stiffness matrices are presented for the analytical model; the model is based on a beam finite element, with polynomial mass and stiffness distributions for both the rotor and fuselage representations. For this analytical model, only symmetric fuselage and collective blade degrees of freedom are treated. Real and complex eigen-analyses are carried out to obtain coupled rotor-fuselage natural modes and frequencies as a function of rotor speed. Vibration response results are obtained for the coupled system subjected to a radially uniform, harmonic blade loading The coupled response results are compared with response results from an uncoupled analysis in which hub loads for an isolated

rotor system subjected to the same sinusoidal blade loading as the coupled system are applied to a free-free fuselage. Author

N83-18715*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARISON OF SIMULATOR FIDELITY MODEL PREDICTIONS WITH IN-SIMULATOR EVALUATION DATA
R. V. PARRISH, B. T. MCKISSICK, and B. R ASHWORTH Feb 1983 39 p refs
(NASA-TP-2106; L-15519; NAS 1.60:2106) Avail: NTIS HC A03/MF A01 CSCL 01C

A full factorial in simulator experiment of a single axis, multiloop, compensatory pitch tracking task is described. The experiment was conducted to provide data to validate extensions to an analytic, closed loop model of a real time digital simulation facility The results of the experiment encompassing various simulation fidelity factors, such as visual delay, digital integration algorithms, computer iteration rates, control loading bandwidths and proprioceptive cues, and g-seat kinesthetic cues, are compared with predictions obtained from the analytic model incorporating an optimal control model of the human pilot. The in-simulator results demonstrate more sensitivity to the g-seat and to the control loader conditions than were predicted by the model. However, the model predictions are generally upheld, although the predicted magnitudes of the states and of the error terms are sometimes off considerably. Of particular concern is the large sensitivity difference for one control loader condition, as well as the model/in-simulator mismatch in the magnitude of the plant states when the other states match S.L

N83-18716*# Washington Univ, St. Louis, Mo. Dept of Mechanical Engineering.
DESIGN OF HELICOPTER ROTOR BLADES FOR OPTIMUM DYNAMIC CHARACTERISTICS Semiannual Status Report, 16 Jul. 1982 - 16 Jan. 1983
D A. PETERS, T. KO, A. E. KORN (Southern Illinois Univ., Edwardsville), and M. P. ROSSOW (Southern Illinois Univ, Edwardsville) 7 Feb. 1983 81 p refs
(Contract NAG1-250)
(NASA-CR-169940; NAS 1.26:169940; SASR-2) Avail. NTIS HC A05/MF A01 CSCL 01C

The possibilities and limitations of tailoring blade mass and stiffness distributions to give an optimum blade design in terms of weight, inertia, and dynamic characteristics are discussed. The extent that changes in mass of stiffness distribution can be used to place rotor frequencies at desired locations is determined. Theoretical limits to the amount of frequency shift are established. Realistic constraints on blade properties based on weight, mass, moment of inertia, size, strength, and stability are formulated. The extent that the hub loads can be minimized by proper choice of E1 distribution, and the minimum hub loads which can be approximated by a design for a given set of natural frequencies are determined. Aerodynamic couplings that might affect the optimum blade design, and the relative effectiveness of mass and stiffness distribution on the optimization procedure are investigated. S.L

N83-18717*# Lockheed Corp., Burbank, Calif.
X-WING NOISE DATA ACQUISITION PROGRAM
G. J. HEALY Feb. 1983 90 p refs
(Contract MDA903-81-C-0395)
(NASA-CR-166454; NAS 1.26:166454, LR30254) Avail. NTIS HC A05/MF A01 CSCL 01C

The X-wing circulation controlled rotor system model was tested for hover performance. During these performance tests, noise data from 12 microphones was recorded on magnetic tape for subsequent data reduction. The rotor system was operated at 4 tip speeds ranging from 529 to 650 ft./sec. (404 to 497 rpm), collective angles of attack fro 0 deg to 8 5 deg (maximum), and blade pressure ratios from 1.0 (no blowing) to a maximum of 2.1. The 12 microphones included 11 in the far field, and one in the transmission area. Following completion of the rotor and subsystem noise measurements, sound field calibration measurements were made of both the rotor 'bowl' and the loudspeaker system used in the 'bowl' calibration measurements. The location of 10 far field microphones was measured by a surveyor. Additionally, detailed tape logs were prepared for the six reels of tape used for the program S L.

N83-18718*# Connecticut Univ., Storrs
EVALUATION OF THE EFFECT OF VIBRATION NONLINEARITY ON CONVERGENCE BEHAVIOR OF ADAPTIVE HIGHER HARMONIC CONTROLLERS
J. A. MOLUSIS, P. MOOKERJEE, and Y. BAR-SHALOM Jan. 1983 51 p refs
(Contract NAG2-72)
(NASA-CR-166424; NAS 1.26.166424) Avail NTIS HC A04/MF A01 CSCL 01C

Effect of nonlinearity on convergence of the local linear and global linear adaptive controllers is evaluated A nonlinear helicopter vibration model is selected for the evaluation which has sufficient nonlinearity, including multiple minimum, to assess the vibration reduction capability of the adaptive controllers. The adaptive control algorithms are based upon a linear transfer matrix assumption and the presence of nonlinearity has a significant effect on algorithm behavior. Simulation results are presented which demonstrate the importance of the caution property in the global linear controller. Caution is represented by a time varying rate weighting term in the local linear controller and this improves the algorithm convergence Nonlinearity in some cases causes Kalman filter divergence Two forms of the Kalman filter covariance equation are investigated. S.L.

N83-19737* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AIRCRAFT CANOPY LOCK Patent
G. H. NICHOLS, inventor (to NASA) 30 Mar. 1981 6 p Filed 30 Mar. 1981 Supersedes N81-24047 (19 - 15, p 2007)
(NASA-CASE-FRC-11065-1, US-PATENT-4,375,281, US-PATENT-APPL-SN-248744; US-PATENT-CASE-244-121; US-PATENT-CASE-244-129.4; US-PATENT-CASE-292/254)
Avail: US Patent and Trademark Office CSCL 01C

A manually-operable lock for releasably securing a canopy in closed condition is described.
Official Gazette of the U.S. Patent and Trademark Office

N83-19739*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MATHEMATICAL MODEL OF THE SH-3G HELICOPTER
J D. PHILLIPS Dec. 1982 56 p refs
(NASA-TM-84316; A-9187, NAS 1.15 84316) Avail: NTIS HC A04/MF A01 CSCL 01C

A mathematical model of the Sikorsky SH-3G helicopter based on classical nonlinear, quasi-steady rotor theory was developed. The model was validated statically and dynamically by comparison with Navy flight-test data The model incorporates ad hoc revisions which address the ideal assumptions of classical rotor theory and improve the static trim characteristics to provide a more realistic simulation, while retaining the simplicity of the classical model.
Author

N83-19740*# Boeing Vertol Co., Philadelphia, Pa.
VARIABLE CAMBER ROTOR STUDY
L. DADONE, J. COWAN, and F. J. MCHUGH Aug. 1982 227 p refs
(Contract NAS2-10768)
(NASA-CR-166382; NAS 1.26:166382; D210-11938-1) Avail: NTIS HC A11/MF A01 CSCL 01C

Deployment of variable camber concepts on helicopter rotors was analytically assessed. It was determined that variable camber extended the operating range of helicopters provided that the correct compromise can be obtained between performance/loads gains and mechanical complexity A number of variable camber concepts were reviewed on a two dimensional basis to determine the usefulness of leading edge, trailing edge and overall camber variation schemes. The most powerful method to vary camber was through the trailing edge flaps undergoing relatively small

motions (-5 deg to +15 deg). The aerodynamic characteristics of the NASA/Ames A-1 airfoil with 35% and 50% plain trailing edge flaps were determined by means of current subcritical and transonic airfoil design methods and used by rotor performance and loads analysis codes. The most promising variable camber schedule reviewed was a configuration with a 35% plain flap deployment in an on/off mode near the tip of a blade. Preliminary results show approximately 11% reduction in power is possible at 192 knots and a rotor thrust coefficient of 0.09 The potential demonstrated indicates a significant potential for expanding the operating envelope of the helicopter. Further investigation into improving the power saving and defining the improvement in the operational envelope of the helicopter is recommended B G

N83-19742# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate.

A STUDY OF ALTERNATIVE AIRCRAFT FOR INSTALLATION OF THE NAVY STANDARD TOW TARGET SYSTEM Final Report

A. BERG 30 Jun 1982 49 p refs
(AD-A120882; NADC-82195-60) Avail: NTIS HC A03/MF A01 CSCL 01C

This report analyzes the suitability of various alternative tractor aircraft for both shore and carrier based tow target operations. The investigation considered performance, mechanical/electrical compatibility, and advantages/disadvantages of each type aircraft studied. GRA

N83-19743# Aeronautical Systems Div, Wright-Patterson AFB, Ohio.

HANDBOOK OF MILITARY AIRCRAFT DESIGN NORMAL LOAD FACTOR EXCEEDANCE DATA Interim Report, Sep. 1965 - Mar. 1982

R J. VELDMAN and C. G. PECKHAM Oct. 1982 120 p refs
(AD-A120870, ASD-TR-82-5012) Avail: NTIS HC A06/MF A01 CSCL 20K

The information presented in this handbook is derived from airborne data recorded using oscillograph and magnetic tape systems collecting Loads Environment Spectra Survey Data on a multitude of USAF aircraft. The data is broken down into three main categories: Cargo Class, Fighter/Attack Class, and Trainer class. Special information included in the handbook are Ground Data from the C-141 and Aerial Refueling from the C-5. The data is broken down by aircraft, mission, and mission phase Plots are provided and show comparisons of different aircraft models. The tables presented express NZ (normal load factor) in exceedances per 1000 flight hours and ground data in exceedances per 1000 flights GRA

N83-19744# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate.

STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT Semiannual Summary Report, 1 Jan. 1962 - 31 Dec. 1981

W. J. WILLIAMS 1 May 1982 157 p
(AD-A121989; NADC-13920-2) Avail: NTIS HC A08/MF A01 CSCL 01A

This is a semi-annual progress report, and it presents a specialized summary of the data in the counting accelerometer program. Statistics describing Navy and Marine aircraft cumulative g-count exceedances are calculated and tabulated. These tabulations are separated by calendar time and into four major categories of fleet experience: Navy Training, Navy Combat, Marine Training, and Marine Combat. These data show that the load rate distributions (counts at 1000 hours) for most models and most g-levels have a non-normal distribution. Within a model (A-7E, F-4N, etc.) differences in the average load rates exist when data are separated by calendar time or mission category. GRA

N83-19745# Notre Dame Univ., Ind Dept. of Aerospace and Mechanical Engineering

A STUDY OF ANALYTIC MODELING TECHNIQUES FOR LANDING GEAR DYNAMICS Final Report, Nov. 1980 - Dec. 1981

S. M BATILL Wright-Patterson AFB, Ohio AFWAL May 1982 82 p refs
(Contract F33615-80-K-3242; AF PROJ. 2307)
(AD-A122312; AFWAL-TR-82-3027) Avail: NTIS HC A05/MF A01 CSCL 01C

The ability to accurately predict the dynamic response of an aircraft while it is operating in the taxi mode depends, in part on the correct modeling of the dynamic characteristics of the landing gear system Traditionally, landing gear have been designed to absorb landing impact ('shock absorber') and their characteristics during periodic, oscillatory response ('spring') have been considered as secondary. With the increased emphasis on the rough or damaged field taxi operation, there is a requirement to determine the best methods for modeling the gear system. This report documents a brief review of the state of the art of gear modeling A study was then conducted to evaluate important model parameters, using a simple cantilevered gear computer simulation Also included is the development of a technique for the experimental determination of important gear system parameters. Author (GRA)

N83-19746# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Productivity, Reliability, Availability and Maintainability Program Office.

ANALYSIS OF UNITED STATES AIR FORCE AIRCRAFT ACCUMULATORS Final Report, Mar. - Apr. 1982

F. E. POAST and C. FORZONO Nov 1982 89 p refs
(AD-A122092; ASD-TR-82-5030) Avail: NTIS HC A05/MF A01 CSCL 01C

This report summarizes USAF aircraft hydraulic system accumulator installations and failure history. The purpose of this effort was to identify and select an appropriate installation for flight test of an improved accumulator of the metal bellows design. A test aircraft installation was identified GRA

N83-19747# Vereinigte Flugtechnische Werke G.m b.H., Bremen (West Germany).

AIRCRAFT DYNAMIC RESPONSE TO DAMAGED AND REPAIRED RUNWAYS

K. KOENIG Nov. 1982 17 p refs AGARD/SMP Sub-Committee Meeting Held in Cologne, 1979, Cesme, Turkey, 1981, and Brussels, 1982 Sponsored by AGARD
(AGARD-AR-198, ISBN-92-835-1441-6) Avail: NTIS HC A02/MF A01

The capability of aircraft to operate on uneven runways was investigated. It was, however, found difficult to establish realistic unevenness data Nevertheless, it is important and urgent to elaborate and agree on international ground-worthiness requirements GRA

N83-20184# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Div. Avions.

IMPACT OF ERGONOMIC STUDIES ON THE DESIGN OF CIVIL AIRCRAFT COCKPITS [IMPACT DES ETUDES ERGONOMIQUES SUR LA CONCEPTION D'UN POSTE DE PILOTAGE D'AVION CIVIL]

J. P LABORIE *In* ESA Reliability and Maintainability p 37-42 Sep. 1982 refs In FRENCH
Avail: NTIS HC A99/MF A01

The role played by human factors engineering in the design of the pilot station for the A310 airbus is described as well as the work conducted for the design of cockpits in future generation aircraft. Classical anthropometrics used in the design of the work station and seat as well as in the arrangement of the display panel are reviewed. The use of static measurements of pilot tasks dynamic measurements of a subjective type, and physiological measurements are described. Technologies developed for the man

machine interface examined include warning lights, numerialization, and cathode tubes. Transl. by A.R.H.

N83-20832*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
THE QUIET SHORT-HAUL RESEARCH AIRCRAFT
J. A. COCHRANE *In* American Planning Association Proc of the Monterey Conf. on Planning for Rotorcraft and Commuter Air Transportation p 22-23 Feb 1983
Avail: NTIS HC A09/MF A01 CSCL 01C

The design concepts, performance capabilities, and projected applications of the Quiet Short-Haul Research Aircraft (QSRA) are discussed. The propulsive lift system of the QSRA provides the lift required for short field operations at low community noise levels. This system consists of four high bipass ratio, geared turbofan engines mounted so that the engine exhaust flows across the upper surface of the wing (upper surface blowing). Large specially shaped flaps behind each engine control the direction of the flow for each phase of flight. A 95 passenger short haul transport based on this technology could operate out of a 2500 foot runway with a combined takeoff and landing 90 EPNdB footprint area of 2.7 sq mi M.G.

N83-20833*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE TILT ROTOR RESEARCH AIRCRAFT (XV-15) PROGRAM
J P. MAGEE *In* American Planning Association Proc. of the Monterey Conf. on Planning for Rotorcraft and Commuter Air Transportation p 24-33 Feb. 1983
Avail. NTIS HC A09/MF A01 CSCL 01C

The tilt rotor concept is introduced and the performance capabilities and noise characteristics of the XV-15 aircraft are discussed. In hover, the aircraft is lifted by the two wing tip mounted rotors with the nacelles in the vertical position. In this flight mode, the vehicle is a twin rotor helicopter and is controlled by rotor cyclic and collective controls. The aircraft can fly as a helicopter or tilt the nacelle to the propeller mode and operate as a fixed-wing twin turboprop airplane. It is also possible to stop the conversion at any intermediate angle and fly continuously or reconvert. The rotors are powered by two modified T-53 engines and the power train includes a cross shaft located in the wing, to allow for the engine failure case and still retain power to both rotors. M.G

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AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

A83-23374
SELF-ADAPTIVE FILTERS FOR THE INTEGRATION OF NAVIGATION DATA
J. P. ABBOTT and C. R. GENT (System Designers, Ltd., Camberley, Surrey, England) Journal of Navigation, vol. 36, Jan. 1983, p. 64-73. Research supported by the Ministry of Defence (Procurement Executive).

A study of the best ways of integrating diverse navigation information to provide accurate position estimates is outlined. The results demonstrate that a simple Kalman filter can usually combine such data in a robust way. It is pointed out, however, that occasions will arise when the environment changes in a way to which the filter cannot adapt and that for this period the filter performance may be severely degraded. The study shows that it is possible to develop a self-adaptive filter which is simple and yet can detect imperfections in its internal models of the environment. The filter is then able to adapt its models and significantly increase its position-fixing accuracy. C.R.

A83-23527
INFRARED TARGET ARRAY DEVELOPMENT
T O MCINTIRE and E A. SCOTT (U.S. Army, Methodology and Instrumentation Div., Yuma, AZ) In: Infrared technology for target detection and classification; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981 Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p 2-7.

The development of a life size thermal target array designed to facilitate in-flight testing of airborne weapon systems containing night vision subsystems is reviewed, including the thermal array test objectives, target array fabrication, methodology of target utilization, and representative test results. The thermal target array consists of a six bar recognition target, a two bar detection target, and a laser designator scoring board (cross-hair). The image dimensions of 2.3 m x 2 3 m were derived from an optimized threat envelope. The thermal signatures of the targets are controllable to within 0.3 C about a differential setpoint which is measured between the active element and the target background. Several differential temperature settings (1.25, 3, 5, 7.5, and 10 C) are available. N.B.

A83-23531
TARGET ACQUISITION AND EXTRACTION FROM CLUTTERED BACKGROUNDS
S A DUDANI, B. SMITHGALL, and P. ROBINS (Hughes Aircraft Co., Image Processing Laboratory, Culver City, CA) In: Infrared technology for target detection and classification; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 43-50.

The acquisition and extraction of a target from a field of view is presently undertaken by a two-step process in which a filter is used to approximately locate a target in a field of view, and a gate or window is placed around the estimated position. The image within the gate is then thresholded using an intensity gradient approach, in order to extract the object of interest. Attention is given to the acquisition filter and the algorithm used to select the intensity threshold within the target gate. These techniques have been evaluated using both real and simulated Forward Looking IR imagery, which only require the approximate target image size. The approach presented seems to tolerate well the various kinds of noise and clutter appearing in actual imagery. O.C.

A83-23535
ELIMINATING NEAREST NEIGHBOR SEARCHES IN ESTIMATING TARGET ORIENTATION
B. SMITHGALL (Hughes Aircraft Co , Image Processing Laboratory, Culver City, CA) In: Infrared technology for target detection and classification, Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 71-80.

The identification of an unknown image by matching its features to those of a known image may be accomplished by computing a distance measure between image features that indicates their dissimilarity. The process of exhaustively locating the known image with the minimum distance, and therefore the best match, is known as 'nearest neighbor matching'. Attention is given to a method which takes advantage of the continuous nature of the data base involved, and greatly simplifies the problem posed by the estimation of image orientation as a function of aspect angle. O.C.

A83-23536
DESIGNING FOR STRAY RADIATION REJECTION
J. S. FENDER (USAF, Weapons Laboratory, Kirtland AFB, NM) In: Infrared technology for target detection and classification; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 81-89.

Detecting weak targets in the presence of a strong background or an out of field source requires an optical system that can reject unwanted signals. Properly designed baffles can prevent unwanted energy from reaching a focal plane or detector. To illustrate basic baffle design techniques and resulting benefits, the

stray radiation analysis of a typical heat seeking missile is presented. (Author)

A83-24165#
OPTIMAL DESIGN OF A BARO/RADIO SUPPORTED INERTIAL ALTITUDE SYSTEM [OPTIMALENTWURF EINES BARO/RADIOGESTUETZTEN INERTIALHOEHENSYSTEMS]
R. WANG Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 41 p In German. Research supported by the Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt refs
(DGLR PAPER 82-041)

A hybrid baro/radio inertial altitude system (BRIS) was developed for the test transport Do 28 A Box-Jenkins time series analysis is applied in order to identify and evaluate two ARIMA failure models for vertical acceleration and barometric altitude based on measurement data BRIS is optimized using stochastic disturbances and typical approach flight conditions. The appropriate sensitivity analysis and off-line simulation are presented C.D.

A83-24374
NEW DISPLAYS FOR THE NEXT GENERATION OF CIVIL AIRCRAFT - AIRBUS A 310 AND A 300/600 COLOR CATHODE TUBES [NOUVELLES VISUALISATIONS POUR LA PROCHAINE GENERATION D'AVIONS CIVILS - TUBES CATHODIQUES COULEUR AIRBUS A 310 ET A 300/600]
M. BERNARD (Thomson - CSF, Paris, France) (Instituts de Navigation, Congres International, Paris, France, Sept. 21-24, 1982.) Navigation (Paris), vol 31, Jan. 1983, p. 78-90 In French

The types of CRT computer-generated avionics displays installed in new aircraft in the 1983-1984 time frame are described The systems will be used in airline fleets, on aircraft such as the 767, the A 310, the 757, and the 300-600. The displays permit greater clarity of presentation of data, with a higher density, and are associated with digitized control of the aircraft hardware. Navigational displays are generated automatically in the form of a map Six CRTs are present on the A 310, four for pilot functions and navigation and two dedicated to alarms and systems safety. The screens are arrayed one on top of the other before the pilot and copilot, with the superior-positioned unit for primary flight displays and the lower display for navigation The flight safety displays are located on a console between the two pilots.
M.S.K.

A83-24428#
APPLICATIONS OF HEAD-UP DISPLAYS IN COMMERCIAL TRANSPORT AIRCRAFT
J. R. LOWE and J. R. ORNELAS (Douglas Aircraft Co., Long Beach, CA) (Digital Avionics Systems Conference, 4th, St. Louis, MO, November 17-19, 1981, Collection of Technical Papers, p. 409-414.) Journal of Guidance, Control and Dynamics, vol. 6, Mar.-Apr. 1983, p. 77-83. refs

(Previously cited in issue 03, p. 327, Accession no. A81-13506)

A83-24859#
NEW ON BOARD EQUIPMENTS /PMS, FMS/ AND THE ATC SYSTEM - EVOLUTION OR REVOLUTION
J. L GARNIER (Direction de la Navigation Aerienne, Centre d'Etudes de la Navigation Aerienne, Orly Aerogare, France) In: Integrated navigation: Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 1. Paris, Institut Francais de Navigation, 1982, p. FP 5-1-A to FP 5-8-A.

An examination is presented of the prospective effects of on-board flight management and performance management systems (FMSs and PMSs) on air traffic control systems A PMS facilitates navigation in the vertical plane by supplying precise data on the optimum conditions of speed, flight profile and cruise level, while an FMS adds to these data others pertaining to navigation. It is estimated that, by 1985, International Air Transport Association member fleets will include 34 percent FMS-equipped and 10 percent PMS-equipped aircraft O.C.

A83-24868#
MULTIPROCESSORS AND THEIR IMPACT ON INTEGRATED NAVIGATION AND AVIONICS - A STATUS-OF-THE-ART PAPER
A STRUMIA (Prima Progetti S.p.A , Moncalieri, Italy) In Integrated navigation· Actual and potential - Sea-air-space; Proceedings of the International Congress, Paris, France, September 21-24, 1982. Volume 2. Paris, Institut Francais de Navigation, 1982, p IP-1-1-A to IP-1-18-A. refs

Attention is given to the structure of multiprocessors noting their use in navigation and avionics. Multiprocessors based on microprocessors are considered in terms of software modularity, hardware expandibility, architecture reliability, memory expansion, and global higher throughput. The use of micro- and multiprocessors in navigation systems is assessed for inertial, non-inertial, and such radio-assisted systems as Omega/VLF, Navstar, and the joint tactical information distribution system. Integrated navigation systems are discussed with reference to improvements in navigation performance. S C.S.

A83-26309
COMPUTER GENERATED COCKPIT ENGINE DISPLAYS
G. L. CALHOUN and S. HERRON (Bunker Ramo Corp , Dayton, OH) In Human Factors Society, Annual Meeting, 25th, Rochester, NY, October 12-16, 1981, Proceedings. Santa Monica, CA, Human Factors Society, 1981, p. 127-131. refs
(Contract F33615-78-C-3614)

Three methods of presenting aircraft engine information were evaluated in a flight simulation. (1) conventional electro-mechanical instruments, (2) monochrome cathode-ray-tube (CRT) format and (3) color CRT format. Results indicated that pilots identified failed engine parameters faster and more accurately when engine information is integrated onto a single cockput display compared to when it is presented on an array of dedicated instruments However, there was no significant performance differences between the monochrome and color CRT formats. These results, besides showing the advantages of presenting engine parameters on a single computer-driven display, indicated a means of potential cost savings since monochrome formats are less expensive to implement (Author)

A83-26312
HUMAN FACTORS IN THE APPLICATION OF LARGE SCREEN ELECTRONIC DISPLAYS TO TRANSPORT FLIGHT STATION DESIGN
M A. COMPANION and R. L. WASSON (Lockheed-Georgia Co., Marietta, GA) In: Human Factors Society, Annual Meeting, 25th, Rochester, NY, October 12-16, 1981, Proceedings Santa Monica, CA, Human Factors Society, 1981, p. 228-232.

To reduce pilot workload and increase safety, transport aircraft flight station designers have begun to introduce cathode ray tube (CRT) displays into their designs. This paper examines the concept and questions pertaining to the possible application of large electronic display devices, specifically 33.0- and 48.3-cm CRTs, to future flight station design to improve pilot performance. Large CRTs offer many intriguing possibilities such as multisegment displays and variable format size (zoom), as well as the larger display area necessary to make innovative 3-dimensional formats and touch panel overlays more feasible and usable. (Author)

A83-26313
A COMPARISON OF COLOR VERSUS BLACK AND WHITE VISUAL DISPLAY AS INDICATED BY BOMBING PERFORMANCE IN THE 2B35 TA-4J FLIGHT SIMULATOR
R. S. KELLOGG (Dayton, University, Dayton, OH; USAF, Human Resources Laboratory, Williams AFB, AZ), R. S. KENNEDY (Canyon Research Group, Inc., Orlando, FL), and R. R WOODRUFF (USAF, Human Resources Laboratory, Williams AFB, AZ) In. Human Factors Society, Annual Meeting, 25th, Rochester, NY, October 12-16, 1981, Proceedings. Santa Monica, CA, Human Factors Society, 1981, p 233, 234.

Ten highly qualified and experienced instructor pilots were tested with respect to bombing performance in the General Electric

2B35 full color wide screen flight simulator. Half the pilots flew with color first and then black and white and the other half with the reverse order. Repeated bombing runs were made and circular bombing errors obtained Under the conditions of the study, no statistically significant differences were shown between performance in color versus black and white. (Author)

A83-26314
POTENTIAL USES OF TWO TYPES OF STEREOGRAPHIC DISPLAY SYSTEMS IN THE AIRBORNE FIRE CONTROL ENVIRONMENT
S. J. MOUNTFORD and B SOMBERG (Honeywell Systems and Research Center, Minneapolis, MN) In: Human Factors Society, Annual Meeting, 25th, Rochester, NY, October 12-16, 1981, Proceedings Santa Monica, CA, Human Factors Society, 1981, p. 235-239. refs

The potential utility of three-dimensional displays in an air combat environment was investigated using two types of stereo hardware systems Helmet-mounted heads-up display symbology formats were designed for a head-coupled helmet display system. These stereographic displays were also presented on a forward projection screen and viewed using shutter goggles Pilot opinion was solicited after flying exposure to an air-to-air guns scenario. The limited data and opinion base indicated a slight disadvantage for the head-coupled system compared with the goggle system. However, pilots were very responsive to the idea of using stereographic displays and suggested air-to-ground and 4-D NAV uses. It appears that one potential use for stereo displays may be in a training context Stereographic displays offer pilots an opportunity to learn the impact that control inputs can have on the future physics of a mission environment. Many unresolved areas of research and interest concerning stereographic display technology are generated by this research study (Author)

N83-18641*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE P/POD PROJECT: PROGRAMMABLE/PILOT ORIENTED DISPLAY
J. A. LITTLEFIELD *In* NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 p 43-50 Mar 1981 refs Previously announced as N81-22004
Avail: NTIS HC A07/MF A01 CSCL 01D

A pilot orientated display system was developed for general aviation aircraft in order to reduce cockpit workloads. Emphasis was placed on the optimization of flight procedural aspects (i.e., interpretation of Loran data). Low cost hardware/software were utilized in the system to reduce developmental costs. Parallel development and testing were conducted on the ground (simulator) and in the air using the same hardware R.C T.

N83-18720*# Meteorology Research, Inc., Altadena, Calif
COMPARISON OF MODERN ICING CLOUD INSTRUMENTS Final Report
D. M. TAKEUCHI, L. J. JAHNSEN, S. M. CALLANDER, and M. C. HUMBERT Jan. 1983 133 p refs
(Contract NAS3-22760; F04611-81-C-0033)
(NASA-CR-168008; NAS 1.26:168008; MRI-82-FR-1862) Avail: NTIS HC A07/MF A01 CSCL 01D

Intercomparison tests with Particle Measuring Systems (PMS) were conducted Cloud liquid water content (LWC) measurements were also taken with a Johnson and Williams (JW) hot-wire device and an icing rate device (Leigh IDS). Tests include varying cloud LWC (0.5 to 5 au gm), cloud median volume diameter (MVD) (15 to 26 microns), temperature (-29 to 20 C), and air speeds (50 to 285 mph). Comparisons were based upon evaluating probe estimates of cloud LWC and median volume diameter for given tunnel settings. Variations of plus or minus 10% and plus or minus 5% in LWC and MVD, respectively, were determined of spray clouds between test made at given tunnel settings (fixed LWC, MVD, and air speed) indicating cloud conditions were highly reproducible. Although LWC measurements from JW and Leigh devices were consistent with tunnel values, individual probe measurements either consistently over or underestimated tunnel values by factors ranging from about 0.2 to 2. Range amounted to a factor of 6 differences between LWC estimates of probes for given cloud conditions. For given cloud conditions, estimates of cloud MVD between probes were within plus or minus 3 microns and 93% of the test cases. Measurements overestimated tunnel values in the range between 10 to 20 microns The need for improving currently used calibration procedures was indicated. Establishment of test facility (or facilities) such as an icing tunnel where instruments can be calibrated against known cloud standards would be a logical choice. B.G.

N83-18721*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN, DEVELOPMENT, AND FLIGHT TEST OF A DEMONSTRATION ADVANCED AVIONICS SYSTEM
D. G. DENERGY, G. P. CALLAS, G. H. HARDY, and W. NEDELL Jan 1983 12 p refs
(NASA-TM-84323, A-9176; NAS 1.15:84323) Avail: NTIS HC A02/MF A01 CSCL 01D

Ames Research Center initiated a program in 1975 to provide the critical information required for the design of integrated avionics suitable for general aviation. The program emphasized the use of data busing, distributed microprocessors, shared electronic displays and data entry devices, and improved functional capability. Design considerations included cost, reliability, maintainability, and modularity. As a final step, a demonstration advanced avionics system (DAAS) was designed, built, and flight tested in a Cessna 402, twin engine, general aviation aircraft A functional description of the DAAS, including a description of the system architecture, is presented and the program and flight test results are briefly reviewed Author

N83-18722# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
PROJECT COCKPIT INSTRUMENTS AND HUMAN ENGINEERING AS PART OF A JOINT PROGRAMME OF RESEARCH ON AIRCRAFT GUIDANCE AND CONTROL Final Report
R. BEYER 4 Jun. 1982 92 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-82-13) Avail NTIS HC A05/MF A01

Research on cockpit instruments and related human factors engineering problems is discussed. The main areas of interest were methods and procedures, the central data entry system, and various types of displays. R.J.F.

N83-18723*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATION STUDY OF TRAFFIC-SENSOR NOISE EFFECTS ON UTILIZATION OF TRAFFIC SITUATION DISPLAY FOR SELF-SPACING TASK
D. H. WILLIAMS and G. C. MOEN (Army Research and Technology Labs., Hampton, Va.) Feb. 1983 36 p refs
(Contract DA PROJ. 1L2-62209-AH-76)
(NASA-TP-2082; L-15403; NAS 1.60:2082, AVRADCOM-TR-82-B-8) Avail NTIS HC A03/MF A01 CSCL 05H

The effect of traffic sensor noise on the ability of a pilot to perform an intrail spacing task was determined. The tests were conducted in a fixed base cockpit simulator configured as a current generation transport aircraft, with an electronic traffic display provided in the weather radarscope location The true positions of the traffic were perturbed in both relative range and azimuth by random errors to simulate traffic sensor noise associated with an onboard sensor. The evaluation task involved simulated instrument approaches into a terminal area while maintaining self separation on a lead aircraft. Separation performance data and pilot subjective ratings and comments were obtained. The results of the separation data indicate that displayed traffic position errors, having standard deviation values up to 0.3-n mi. range and 8 deg azimuth, had negligible effect on the spacing performance achieved by the pilots. Speed profiles of the lead aircraft, display of the lead aircraft

groundspeed, and individual pilot techniques were found to significantly affect the mean spacing performance. S.L

N83-18724# Arinc Research Corp , Annapolis, Md.
DIGITAL SYSTEMS TECHNICAL ANALYSIS Final Report
L. H HOGLE and P. D. BLYTHE Atlantic City FAA Oct. 1982 55 p
(Contract DTFA03-81-C-00079)
(ARINC-1469-01-1-2804; FAA-CT-82-129) Avail. NTIS HC A04/MF A01

Available data specifically related to the reliability of digital avionics systems were analyzed. The relationships between reliability and airworthiness standards, maintenance programs, integrity, and safety were examined. The data are presented which support the contention that digital systems are capable of performing more reliably than comparable analog systems. Concerns are expressed, however, relative to such considerations as fault propagation, software configuration control, and electrical static discharge. It is suggested that a standardized reliability data base that includes reference to cause of failure could be useful in directing attention to means of improving unit reliability. A.R.H.

N83-19748*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATOR STUDY OF A FLIGHT DIRECTOR DISPLAY
J. J. ADAMS Mar. 1983 27 p refs
(NASA-TM-84581; L-15546, NAS 1.15 84581) Avail: NTIS HC A03/MF A01 CSCL 01D

A six degree of freedom, fixed base simulation study of the use of a flight director by general aviation pilots in an instrument landing system approach was conducted. An autopilot command law was used to drive the flight director needles. Time histories of the pilot aircraft display system responses and standard deviations and means of the glide slope and localizer errors were obtained. The pilot aircraft display system responses with the flight director were very similar to the autopilot aircraft responses Without the flight director, the pilot aircraft display system exhibited less damping than with the flight director. The sensitivity of the flight director command laws was judged to be about as high as it could be by the test subjects. Thus, further improvement in the pilot aircraft display system performance by increasing the gains in the command laws was precluded. S.L.

N83-19749# Boeing Military Airplane Development, Seattle, Wash.
ADVANCED AVIONIC SYSTEMS FOR MULTIMISSION APPLICATIONS, VOLUME 1 Final Report, Jan. 1978 - Jun. 1980
L. A. SMITH, W. A. CROSSGROVE, D. E. DEWEY, R F. BOUSLEY, and T. R. CREMEEN Wright-Patterson AFB, Ohio AFWAL Oct. 1982 54 p Presented at the NOACON Conf , 1980 3 Vol.
(Contract F33615-77-C-1252; AF PROJ. 2003)
(AD-A121793; AFWAL-TR-82-1076-VOL-1) Avail NTIS HC A04/MF A01 CSCL 09B

This study specifically addressed the role of microprocessors and LSI technology (five year forecast) in future avionic systems data bus, information transfer systems designs which allow future avionic systems additions, and the impact of Air Force standards on microprocessors. Cost models for hardware and software and information transfer system simulation models were also reviewed for possible use in the analysis of these systems. The study has resulted in the definition and analysis of three data bus information transfer systems which allow multimission applications. These information transfer systems are called stationary master, nonstationary master and contention multiple access.
Author (GRA)

N83-19750# Boeing Military Airplane Development, Seattle, Wash.
ADVANCED AVIONIC SYSTEMS FOR MULTIMISSION APPLICATIONS, VOLUME 2 Final Report, May 1979 - Jun. 1980
L. A. SMITH, S. W. BEHNEN, K. D PRATT, M. B MCCALL, and R. F. BOUSLEY Wright-Patterson AFB, Ohio AFWAL Oct 1982 88 p 3 Vol
(Contract F33615-77-C-1252, AF PROJ. 2003)
(AD-A121794, AFWAL-TR-82-1076-VOL-2) Avail: NTIS HC A05/MF A01 CSCL 09B

This study produced system control procedures and executive software design specifications for three different information transfer systems (ITS), each designed to implement multimission aspects of an avionic system The stationary master is the best understood ITS and has multimission advantages if the applications software is designed for change. The non-stationary master is an excellent candidate for a pod-oriented multimission application. The contention access ITS is designed to be most flexible in terms of change, at the potential cost of higher initial integration checkout due to the asynchronous nature of the communication. A second task was to design, develop and build a compact version of the DAIS executive that would function in a one processor system and support only synchronous bus communications. This executive, called the Single Processor Synchronous Executive (SPSE), was tested and delivered to AFWAL The primary goals of this task were to build a functional executive that: Maintains the DAIS executive-to-applications interface, Communicates on a MIL-STD-1553A bus; Is coded in J73/I, Supports the avionic system load for an AMST or modern tactical fighter aircraft, Uses DAIS support software (LINKS, ALAP, PALEFAC, PALEFAC processor); and Requires substantially less memory than the baseline DAIS executive All goals were achieved Author (GRA)

N83-19751# Boeing Military Airplane Development, Seattle, Wash.
ADVANCED AVIONIC SYSTEMS FOR MULTIMISSION APPLICATIONS, VOLUME 3 Final Report, Jul. 1980 - Jun. 1981
S. W. BEHNEN and K. D. PRATT Wright-Patterson AFB, Ohio AFWAL Oct. 1982 24 p 3 Vol.
(Contract F33615-77-C-1252; AF PROJ 2003)
(AD-A121795, AFWAL-TR-82-1076-VOL-3) Avail NTIS HC A02/MF A01 CSCL 09B

This technical report summarizes the update of the Single Processor Synchronous Executive (SPSE) to MIL-STD-1553B, MIL-STD-1750, and MIL-STD-1589B. This update was conducted as a follow-on to the original SPSE task performed for the AASMMA program. Author (GRA)

N83-19752# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
APPLICATION OF VIDEO MULTIPLEXING TO DESIGN OF COCKPIT DISPLAY SYSTEMS Final Report
F. UPHOFF 24 Mar. 1982 13 p
(AD-A122127; NADC-82089-60) Avail: NTIS HC A02/MF A01 CSCL 01C

Video multiplexing plays an important role in the success of the Advanced Integrated Display Program because it facilitates the use of cathode-ray tube displays in the cockpit with extreme simplicity, high reliability, economy of space and weight, unusual flexibility of operation, and easy adaptability to different arrays of aircraft sensors. This report describes and explains the NADC laboratory demonstration of the wide-band frequency-division video multiplex system. Author (GRA)

N83-20196# Societe Crouzet, Valence (France). Div Aerospatiale.
A FUNCTIONALLY RELIABLE AVIONICS SYSTEMS [SYSTEME AVIONIQUE SUR DE FONCTIONNEMENT]
A. DEMOMENT, J. P. STEFANINI, and N. TRAVAILLARD *In* ESA Reliability and Maintainability p 127-134 Sep 1982 refs In FRENCH Sponsored in part by STTE
Avail: NTIS HC A99/MF A01

The need to elaborate an anemometer system while considering high levels of operating safety (1 to 1 x 10 to the 7th power/hour of flight for reliability) resulted in the definition of a method for designing safe operating digital systems as well as methods for numerical processing. The principle used involved designing a nominal operating structure and them elaborating from it the fail safe structure. The construction of multimicroprocessor models permitted validation of the method. Transl. by A.R H.

N83-20697# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
CRITICAL RESEARCH ISSUES ON COCKPIT APPLICATIONS OF 3-D DISPLAYS
K R. BOFF *In* NAS-NRC Three-Dimensional Displays p 129-138 1982 refs
Avail: NTIS HC A09/MF A01 CSCL 01D

The Human Engineering Division of the Air Force Aerospace Medical Research Laboratory is engaged in exploratory research to support development of a pilot-centered cockpit design technology. This involves the development of sound theoretical and empirical bases for matching the perceptual and psychomotor characteristics of the aircrew with the design of controls, displays and approaches for portrayal of information within the cockpit. Applications of the three dimensional (3-D) presentation of information which exploit the human's highly refined and well practiced sense of depth are discussed for their potential in facilitating the transfer of information in future aircrew cockpits. L F.M

N83-20702# Federal Aviation Administration, Washington, D.C. Airborne Systems Branch
APPLICABILITY OF 3D DISPLAY RESEARCH TO OPERATIONAL NEEDS
R. P. NEELAND *In* NAS-NRC Three-Dimensional Displays p 171-176 1982
Avail: NTIS HC A09/MF A01 CSCL 01D

Potential future aircraft applications of 3-D displays are discussed Among those emphasized were· approach guidance, vertical guidance, collision avoidance, weather display, and simulation technology. L.F.M.

07

AIRCRAFT PROPULSION AND POWER

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

A83-23430
EVALUATION OF THE TECHNICAL STATE OF AIRCRAFT GAS-TURBINE ENGINES FROM THERMOGASDYNAMIC PARAMETERS WITH ALLOWANCE FOR THE NATURAL SCATTER OF STATE PARAMETERS [OTSENKA TEKHNICHESKOGO SOSTOIANIIA AVIATSIONNYKH GTD PO TERMOGAZODINAMICHESKIM PARAMETRAM S UCHETOM ESTESTVENNOGO RASSEIVANIIA PARAMETROV SOSTOIANIIA]
M. A KABESHOV, V. T. SHEPEL, I. M SOBOL, and A M. AKHMEDZIANOV Aviatsionnaia Tekhnika, no 3, 1982, p 33-37. In Russian.

An approach involving statistical testing is proposed for evaluating the technical state of the components of aircraft gas-turbine engines on the basis of limited thermogasdynamic data under conditions of natural scatter of state parameters. In accordance with the proposed approach, a finite set of solutions representing the principal solution types is selected from an infinite number of possible solutions to a linear mathematical model of an engine The most probable (based on the incidence) estimate is then selected from the finite set. The reliability of the results obtained is determined, in each specific case, by the specified range of natural scatter and possible changes in the state parameters due to the development of malfunctions. V.L.

A83-23433
STATISTICAL ESTIMATION OF THE MEAN TIME-TO-FAILURE OF AN AIRCRAFT ENGINE AS A FUNCTION OF THE CAUSE OF FAILURE [STATISTICHESKAIA OTSENKA SREDNEI NARABOTKI AVIADVIGATELIA DO OTKAZA V ZAVISIMOSTI OT EGO PRICHINY]
A IA. KUZNETSOV Aviatsionnaia Tekhnika, no 3, 1982, p 48-52. In Russian.

An algorithm is presented for calculating the mean time-to-failure of an aircraft engine for each specific failure type on the basis of operational data. The algorithm assumes a Weibull distribution of trouble-free operation, and parameter estimates are obtained using the maximum likelihood algorithm. The equations obtained allow for the nature of the initial statistical data. The proposed approach is illustrated by a specific example V.L

A83-23434
A METHOD FOR CALCULATING THE PARAMETERS OF A TURBOJET ENGINE IN THE AUTOROTATION REGIME [METOD RASCHETA PARAMETROV TRD NA REZHIME AVTOROTATSII]
V. I. KUZNETSOV Aviatsionnaia Tekhnika, no. 3, 1982, p. 52-55 In Russian.

In an effort to simplify the analysis of the parameters of a turbojet engine in the autorotation regime, an approach is developed on the basis of the assumption that the energy of the oncoming air flow is consumed to overcome the resistance forces in the air-gas channel and to perform useful work. Equations are derived which describe the specific work of the compressor as a function of the energy of the oncoming flow. With reference to a specific example, it is shown that with the proposed method, the computer time required for obtaining results for a single point is 2.5-3 min, compared with 30-40 min with existing methods. V.L.

A83-23436
A MATHEMATICAL MODEL FOR A TURBOSHAFT GAS-TURBINE ENGINE WITH AN OPTIMUM CONTROL PROGRAM FOR HIGH-LEVEL COMPUTER-AIDED DESIGN [MATEMATICHESKAIA MODEL' TURBOVAL'NOGO GTD S NAIVYGODNEISHEI PROGRAMMOI REGULIROVANIIA DLIA SAPR VERKHNEGO UROVNIA]
A V. NAUMOV Aviatsionnaia Tekhnika, no. 3, 1982, p. 62-67. In Russian refs

A mathematical model of a turboshaft gas-turbine engine is examined together with an algorithm for optimizing a control program for the power plant and the supporting structure of a helicopter A block-diagram of the subsystem for optimizing the control of the helicopter power plant is presented which is a constituent part of a high-level computer-aided helicopter and engine design system implemented with third-generation computers. V.L.

A83-23437
A SYSTEM OF CRITERIA FOR EVALUATING THE ENERGY EFFICIENCY OF AN ENGINE AT THE STATE OF TECHNICAL PROPOSALS [SISTEMA KRITERIEV ZAVIAZKI I OTSENKI ENERGETICHESKOI EFFEKTIVNOSTI DVIGATELIA NA STADII TEKHNICHESKIKH PREDLOZHENII]
V. A. SGILEVSKII Aviatsionnaia Tekhnika, no. 3, 1982, p. 67-74 In Russian.

Based on the concept of the energy efficiency of an engine in an aircraft system, complex dimensionless parameters are proposed for use at early stages of aircraft design for evaluating the power requirements of an aircraft and power consumption during the execution of various missions The system of criteria proposed here is used in a high-level computer-aided engine design system at the stage of preliminary design V.L.

A83-23440
DETERMINATION OF THE REGION OF EFFICIENT USE FOR MICROTURBINES WITH WORKING MEDIUM RECIRCULATION [OPREDELENIE OBLASTI RATSIONAL'NOGO PRIMENENIIA MIKROTURBIN S POVTORNYM PODVODOM RABOCHEGO TELA]
N T TIKHONOV and V. N. MATVEEV Aviatsionnaia Tekhnika, no. 3, 1982, p. 83-88. In Russian. refs

A single-stage microturbine where the exhaust flow is ducted back into the turbine cascade for a second impulse in order to minimize exit losses is described The gas-dynamic characteristics of this type of microturbine are examined and compared with those of a conventional single-stage microturbine. Operating conditions are defined for which a microturbine with working medium recirculation is more efficient than a conventional single-stage turbine. V.L.

A83-23442
SELECTION OF THE OPTIMAL OUTPUT PARAMETERS FOR THE STARTING DEVICE OF A DOUBLE-SHAFT TURBOFAN ENGINE [VYBOR OPTIMAL'NYKH VYKHODNYKH PARAMETROV PUSKOVOGO USTROISTVA DVUKHVAL'NOGO TRDD]
V. G. AVGUSTINOVICH, V. V. ALEKSEEV, and IU A. TRUBNIKOV Aviatsionnaia Tekhnika, no. 3, 1982, p. 91-93. In Russian

The starting process of a double-shaft turbofan engine is modeled mathematically using a computer to integrate the equation of motion for the high-pressure rotor The optimal gear ratio is shown to increase with the starter power. The gear ratio can be efficiently increased until the speed of the high-pressure rotor at which the starting device is turned off becomes equal to the speed of steady idling. V.L.

A83-23443
AN EXPERIMENTAL STUDY OF AN ANNULAR FILM-EVAPORATION COMBUSTION CHAMBER IN A LOW-POWER GAS TURBINE ENGINE [EKSPERIMENTAL'NOE ISSLEDOVANIE KOL'TSEVOI PLENOCHNO-ISPARITEL'NOI KAMERY SGORANIIA GTD MALOI MOSHCHNOSTI]
V. N. AFROSIMOVA, S A. VOLOSHIN, V. I. KAVIAROV, and E I. KOZELSKII Aviatsionnaia Tekhnika, no 3, 1982, p. 93-95 In Russian.

In the chamber examined here, the fuel-air mixture is prepared in an annular channel formed by the walls of the exhaust pipe and a special evaporation shell that encompasses the pipes and is heated on the outside by gases. To feed the fuel into the evaporation channel, use is made of a fuel collector having six dose-dispensing apertures, each with a diameter of 0 5 mm, evenly spaced along the circumference of the channel. At the inlet to the zone where the fuel is prepared, the flow of primary air is twisted with the aid of a tangential vortex generator. Centrifugal forces cause the liquid fuel to settle into a film on the inner surface of the evaporation shell, thereby favoring evaporation and the formation of the fuel mixture. The annular precombustion chamber works to ensure a uniform distribution of the fuel mixture along the circumference of the chamber; it also provides acceptable temperature fields, a satisfactory combustion, efficiency and low hydraulic losses C R.

A83-23445
CALCULATION OF PRESSURE LOSSES IN THE DIFFUSERS OF MIXING AFTERBURNERS [K RASCHETU POTER' POLNOGO DAVLENIIA V DIFFUZORAKH SMESITEL'NO-FORSAZHNYKH KAMER]
A IA. DANTSYG and N M PETROV Aviatsionnaia Tekhnika, no. 3, 1982, p 98-101. In Russian. refs

Pressure losses are determined experimentally for two diffusers, one with annular mixing elements and the other with lobe-shaped mixing elements, in order to verify a previously proposed model for computing losses in the diffusers of bypass engines. It is found that the model, which includes flow mixing in a channel of constant cross section and deceleration of uniform flow in the diffuser, gives predictions that are found to be too low. The degree to which pressure losses are underestimated is determined by the normalized flow velocity in the mixing region, the ratio of normalized flow velocities at the nozzle exit section, the mixer type, and, to a lesser extent, by the diffuser geometry. V L.

A83-23446
THE RELATIONSHIP BETWEEN THE AERODYNAMICS OF A COMBUSTION CHAMBER AND THE DYNAMICS OF HEAT RELEASE [O SVIAZI AERODINAMIKI KAMERY SGORANIIA S DINAMIKOI TEPLOVYDELENIIA]
V. T DUDKIN, L. A. DUDIN, and V. A KOSTERIN Aviatsionnaia Tekhnika, no. 3, 1982, p. 101-104. In Russian. refs

The circulation zones, the hydraulic resistance, and the dynamics of heat release are investigated experimentally for a cylindrical combustion chamber of 150-mm diameter having blunt bodies of different sizes (d = 40, 60, 80, 96, and 112 mm) and shapes (a disk, a 60-deg cone, and a cylinder with a streamlined nose) mounted inside it along the axis. Expressions are obtained which can be used for optimizing the flame stabilizer of a combustion chamber and developing a control algorithm for variable operating conditions. V.L.

A83-23515
A FINITE-ELEMENT STUDY OF THE STRESS-STRAIN STATE OF THE TURBOFAN ROTOR OF AN AIRCRAFT GAS-TURBINE ENGINE [ISSLEDOVANIE NAPRIAZHENNO-DEFORMIROVANNOGO SOSTOIANIIA ROTORA TURBOVENTILIATORA AGTD METODOM KONECHNYKH ELEMENTOV]
V. G. BAZHENOV, IU. I. TROSTENIUK, N. I. GLUSHCHENKO, N. B KRISHEVSKII, and V. IA. KRIVOSHEI Problemy Prochnosti, Feb. 1983, p. 94-97. In Russian.

The stress-strain state of a four-stage turbofan rotor is investigated numerically with allowance for the interaction forces between the rotor components. It is found that these forces may reach significant levels in the spacer ring fillets. The results are shown to be in good agreement with experimental data and can be useful in evaluating the load-bearing capacity and stiffness of the disk structure as a whole. V.L.

A83-24026*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
TURBOFAN ENGINE BLADE PRESSURE AND ACOUSTIC RADIATION AT SIMULATED FORWARD SPEED
J. S. PREISSER, J. A. SCHOENSTER, R. A. GOLUB (NASA, Langley Research Center, Noise Control Branch, Hampton, VA), and C. HORNE (NASA, Ames Research Center, Low Speed Aircraft Research Branch, Moffett Field, CA) Journal of Aircraft, vol. 20, Apr. 1983, p. 289-297. refs

(Previously cited in issue 07, p. 1010, Accession no. A81-20598)

A83-24028*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
EFFECT OF VARIABLE GUIDE VANES ON THE PERFORMANCE OF A HIGH-BYPASS TURBOFAN ENGINE
G. A. BOBULA (NASA, Lewis Research Center; U S. Army, Propulsion Laboratory, Cleveland, OH), R. H. SOEDER, and L. A. BURKARDT (NASA, Lewis Research Center, Cleveland, OH) Journal of Aircraft, vol. 20, Apr. 1983, p. 306-311 refs

(Previously cited in issue 19, p. 3265, Accession no. A81-40842)

A83-24029*# Garrett Turbine Engine Co., Phoenix, Ariz.
DESIGN AND DEVELOPMENT OF A MIXER COMPOUND EXHAUST SYSTEM
W. L. BLACKMORE and C. E. THOMPSON (Garrett Turbine Engine Co., Phoenix, AZ) Journal of Aircraft, vol. 20, Apr. 1983, p. 312-318. NASA-sponsored research. refs

(Previously cited in issue 22, p. 3815, Accession no. A81-45893)

A83-24033#
TACTICAL AIRCRAFT ENGINE USAGE - A STATISTICAL STUDY
R. J. MAY, JR., D. R. CHAFFEE, P. B. STUMBO, and M. D. REITZ (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Journal of Aircraft, vol. 20, Apr. 1983, p 338-344. refs

(Previously cited in issue 20, p. 3470, Accession no. A81-43938)

A83-24038*# Carnegie-Mellon Univ , Pittsburgh, Pa.
FRICTION DAMPING OF FLUTTER IN GAS TURBINE ENGINE AIRFOILS
A. SINHA and J. H. GRIFFIN (Carnegie-Mellon University, Pittsburgh, PA) Journal of Aircraft, vol 20, Apr. 1983, p. 372-376 refs
(Contract NAG3-231)

This paper investigates the feasibility of using blade-to-ground friction dampers to stabilize flutter in blades. The response of an equivalent one mode model in which the aerodynamic force is represented as negative viscous damping is examined to investigate the following issues: the range of amplitudes over which friction damping can stabilize the response, the maximum negative aerodynamic damping that can be stabilized in such a manner, the effect of simultaneous resonant excitation on these stability limits, and the determination of those damper parameters which will be the best for flutter control. (Author)

A83-24180#
DESIGN, CONSTRUCTION, AND TESTING OF AN EXPERIMENTAL PROPELLER IN THE 750 PS PERFORMANCE CLASS [ENTWURF, BAU UND ERPROBUNG EINES EXPERIMENTALPROPELLERS IN DER LEISTUNGSKLASSE 750 PS]
H. ZIMMER, I. U. BORCHERS, and H. FRIEDEL (Dornier GmbH, Friedrichshafen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 52 p In German. Bundesministerium fuer Forschung und Technologie refs
(Contract BMFT-LEK-7831)
(DGLR PAPER 82-066)

Aerodynamic experiments aimed at increasing thrust values toward the theoretical maximum are described The present state of propeller technology is reviewed, including research in the middle and low speed range and tests on model propellers. The development of an improved propeller profile is addressed, including the influence of blade number, rotary bending, profile, and plan form. The definition and construction of the improved propeller is addressed, and the evaluation of wind tunnel and flight tests is discussed. The wind tunnel results are compared with calculative predictions Acoustic experiments aimed at lowering the noise level during flight are briefly described C.D.

A83-24182#
EXPERIMENTAL INVESTIGATIONS CONCERNING THE NOISE PRODUCED BY MODEL PROPELLERS AND PROPELLER-DRIVEN SMALL AIRCRAFT [EXPERIMENTELLE UNTERSUCHUNGEN ZUM LAERM VON MODELLPROPELLERN UND PROPELLERGETRIEBENEN KLEINFLUGZEUGEN]
M. KALLERGIS and R. F. NEUBAUER (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Abteilung technische Akustik, Brunswick, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 16 p. In German. refs
(DGLR PAPER 82-068)

A83-24183#
JET ENGINES FOR AIRLINERS OF THE NEXT GENERATION [STRAHLTRIEBWERKE FUER VERKENHRSFLUGZEUGE DER NAECHSTEN GENERATION]
D. ECKARDT and K TRAPPMANN (Motoren- und Turbinen-Union Muenchen GmbH, Munich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 25 p. In German. refs
(DGLR PAPER 82-069)

The main development trends with respect to the coming generation of turbofan engines of new technology are related to a reduction of the fuel cost component of the direct operating costs of airliners. The new engine generation provides no basically changed concept in comparison to the turbofan engines introduced in the mid-1970s. It is rather characterized by a variety of individual improvements related to component aerodynamics, cycle processes, and mechanical service life. The reductions in fuel consumption are partly related to improvements made in connection with the energy efficient engine (EEE) program initiated by NASA in 1976 On the basis of the latest results, it can be expected that the original objectives of the EEE program can be significantly exceeded. G.R.

A83-24184#
THE MAINTENANCE OF MODERN ENGINES IN CIVIL AVIATION [ZUR INSTANDHALTUNG MODERNER TRIEBWERKE IN DER ZIVILEN LUFTFAHRT]
B BIALOJAN (Deutsche Lufthansa AG, Hamburg, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 14 p. In German.
(DGLR PAPER 82-070)

The present investigation is concerned with continuous and periodic technical operations related to the maintenance of engines in commercial aviation, taking into account conditions and developments at the German Lufthansa. Engine maintenance processes have the objective to ensure the safe, punctual, and economic performance of flight operations. In connection with efforts to achieve optimized conditions for the establishment of a suitable maintenance system, it is necessary to consider a number of different factors. It is not recommendable to design a maintenance system which will result in a minimum of maintenance costs compatible with safety and operational performance requirements. Fuel costs increase during the time between maintenance operations. For achieving a true cost minimum, it is, therefore, more economical to consider a suitable tradeoff between fuel cost and maintenance cost savings. G.R.

A83-24185
SOME ASPECTS OF THE ENGINE DESIGN OF FUTURE FIGHTER PLANES [EINIGE ASPEKTE ZUR AUSLEGUNG DER TRIEBWERKSANLAGE VON KUENFTIGEN KAMPFFLUGZEUGEN]
W BIEHL and O. HERRMANN (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 23 p. In German.
(DGLR PAPER 82-071)

The engine requirements for three types of fighter plane missions of the future are discussed: the air superiority mission, the point intercept mission, and the long loiter mission Performance parameters, engine structures, and technological considerations are addressed. The possible role and advantages of a dry engine for these missions are considered. It is concluded that a two-cycle engine of the 7.5 ton class with highest possible inlet temperature afterburners will be required. Dry engine technology is so far from being optimized that it cannot be considered for the discussed fighter plane missions. C D.

A83-24186#
DEVELOPMENT TRENDS REGARDING JET ENGINES FOR FUTURE COMBAT AIRCRAFT [ENTWICKLUNGSTENDENZEN BEI STRAHLTRIEBWERKEN FUER ZUKUENFTIGE KAMPFFLUGZEUGE]
H. GRIEB and P. TRACKSDORF (Motoren- und Turbinen-Union Muenchen GmbH, Munich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 23 p In German.
(DGLR PAPER 82-072)

Tactical requirements with respect to combat aircraft are examined. It is expected that such requirements will be directed toward longer supersonic flight phases and improved maneuverability capabilities. These requirements are related to a significant extension of combat ranges in the direction of higher supersonic Mach numbers at higher flight altitudes. In this connection, extensive development projects exist regarding the performance improvement of current engines. However, all engine manufacturers are also greatly concerned with the engines of the next generation. An evaluation is conducted regarding the potential provided by new materials and manufacturing technologies for the design of better engines. Cycle parameters are considered along with components technology, aspects of construction and weight, performance data, and an efficiency comparison. Relative advantages of engines with afterburners and engines without afterburners are found to depend on details of combat conditions. G.R.

A83-24187#
ON THE DESIGN PHILOSOPHY OF FIGHTER AIRCRAFT ENGINES [ZUR AUSLEGUNGSPHILOSOPHIE VON KAMPFFLUGZEUG-TRIEBWERKEN]
H. KUENKLER (Industrieanlagen-Betriebsgesellschaft mbH, Ottobrunn, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 19 p. In German
(DGLR PAPER 82-073)

Measures whose implementation would permit adjustment of the overall engine design in fighter aircraft to the requirements of individual missions are discussed. These measures include decoupling of the induction current throttle and regulation of the turbine cool air flow The effectiveness of these design adjustments is analyzed in terms of examples of typical missions, with emphasis on savings in system costs. Aspects of the design of a dry engine are also addressed C.D

A83-24197#
DIGITAL ENGINE CONTROL UNIT - FUTURE EMPLOYMENT POSSIBILITIES [DIGITALER TRIEBWERKSREGLER - ZUKUENFTIGE NUTZUNGSMOEGLICHKEITEN]
G. DAHL (Bodenseewerk Geraetetechnik GmbH, Ueberlingen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 21 p In German refs
(DGLR PAPER 82-085)

Digital engine control units are increasingly employed to replace hydromechanical units in engines of very different characteristics. This development occurs in the civil as well as in the military sector. A survey is presented regarding the status of the technology of digital engine control units, taking into account a comparison of the digital and the hydromechanical units On the basis of this comparison, approaches are shown for improving the maintenance of control units and engines. Attention is given to control laws and software implementation, an error indentification module, data for the surveillance of the state of the engine, aspects of analytical data redundancy, adaptation problems concerning engine and control unit, and the integration of flight and engine control tasks. G.R.

A83-24198#
PROPULSION SYSTEMS OF FLIGHT VEHICLES AND DRONES - CONDITIONS, REQUIREMENTS, AND CURRENT AND FUTURE PROPULSION SYSTEMS [ANTRIEBE VON FLUGKOERPERN UND DROHNEN - VORRAUSSETZUNGEN, ANFORDERUNGEN SOWIE JETZIGE UND ZUKUENFTIGE TRIEBWERKE]
H. FRICKE (KHD Luftfahrttechnik GmbH, Oberursel, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 16 p. In German refs
(DGLR PAPER 82-086)

Pilotless flight vehicles and drones are employed as airborne targets, or are used for reconnaissance missions, the disturbance of enemy radar detection operations, and the transportation of weapons and ammunition. There are a number of fundamental differences between the considered vehicles and aircraft. In connection with these differences, special types of propulsion systems have to be employed for the flight vehicles. Solid-propellant rockets are used for applications involving short flight distances. For larger flight ranges, ramjet engines and turbojet engines are utilized. Jet power units are predominantly used for very large distances and flight velocities at Mach numbers which can greatly exceed the value of one. Types and characteristics of such jet power units are discussed. Attention is given to approaches for lowering production costs of the propulsion units, design details for achieving low fuel consumptions, and aspects of engine control. G.R.

A83-24199#
REGENERATIVE SHAFT ENGINES FOR HELICOPTERS, MULTIPURPOSE AND FEEDER SERVICE AIRCRAFT [REKUPERATIVE WELLENTRIEBWERKE FUER HUBSCHRAUBER, MEHRZWECK- UND ZUBRINGERFLUGZEUGE]
W. KLUSSMANN (Motoren- und Turbinen-Union Muenchen GmbH, Munich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 24 p. In German. Research supported by the Bundesministerium der Verteidigung.
(DGLR PAPER 82-087)

Conventional and regenerative shaft engines in the 900 kW capacity class intended for helicopters of 4.5-6 tons takeoff weight in the 600 kW performance class, and for multipurpose and feeder service aircraft of about 6 tons takeoff weight are compared with regard to lifetime costs and direct operational costs Modern engine concepts using the latest developments in heat exchange technology are the basis of the discussion It is concluded that regenerative shaft engines for combat and transport helicopters show promise in a future of rising fuel prices. Multipurpose and feeder service aircraft with regenerative shaft engines offer attractive savings in direct operational costs at existing fuel prices. C.D.

A83-24200#
PROSPECTS FOR THE USE OF HEAT EXCHANGERS IN AIRCRAFT GAS TURBINES [MOEGLICHKEITEN DES EINSATZES VON WAERMETAUSCHERN IN FLUGTRIEBWERKEN]
K. H. COLLIN (KHD Luftfahrttechnik GmbH, Oberursel, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct 5-7, 1982, 28 p. In German
(DGLR PAPER 82-088)

Newly developed regenerative plate heat exchange structures show advantageous weight and volume characteristics when compared with existing heat exchangers The thermodynamic relations of gas turbines with and without heat exchangers, the operational role of heat exchangers, the dimensions of various types of heat exchangers and their installation into aircraft gas turbines are examined. New trends in heat exchange structures for aircraft gas turbines are discussed. C D.

A83-24332#
ONERA TEST FACILITIES FOR PROPELLERS AND ROTORS [MOYENS D'ESSAIS D'HELICES ET DE ROTORS DE L'ONERA]
G. LECLERE and J N. RAMANDET (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) ONERA, TP no. 1982-121, 1982 50 p In French.
(ONERA, TP NO. 1982-121)

Test equipment at ONERA installations for verifying analytical models for the performance of helicopter rotors and propeller designs is described. The Modane S1 wind tunnel is the only facility available for trials involving large models, transonic Mach numbers, and high Re flows. The S1 dimensions, model mounts, power systems, and operational envelopes are outlined. Attention is given to the dynamometry capability and instrumentation for measuring drag, axial speed, vibrations, and deformations. Helicopter rotors are also tested at the Chalais-Meudon Center, where data on drag, lift, pitch, roll, and yaw performance are run. Safety measures are described, together with several blade and rotor tests completed and the features of planned installations. M.S.K.

A83-24669*# Princeton Univ , N. J.
COMPUTED AND MEASURED TURBULENCE IN AXISYMMETRIC RECIPROCATING ENGINES
F GRASSO and F. V BRACCO (Princeton University, Princeton, NJ) AIAA Journal, vol. 21, Apr. 1983, p. 601-607. Research supported by the General Motors Corp., Volkswagenwerk, Fiat S.p.A and Komatsu, Ltd. refs
(Contract DE-AC04-81AL-16338; NAG3-8)

The turbulent flowfield of a spark-ignition engine affects strongly the combustion characteristics of the engine. The flowfield depends on the design of the combustion chamber and the intake system The present investigation is concerned with the effect of chamber design, and engine operating conditions on top dead center turbulence prior to ignition. It is shown that many of the trends which were identified in earlier studies can be obtained from a single model. The employed model takes into account a two-dimensional axisymmetric flowfield. Attention is given to governing equations, boundary and initial conditions, a comparison of the computed results with measurements, and the effect of swirl and squish. G.R

A83-24677#
SENSITIVITY OF CHAMBER TURBULENCE TO INTAKE FLOWS IN AXISYMMETRIC RECIPROCATING ENGINES
F. GRASSO and F. V BRACCO (Princeton University, Princeton, NJ) AIAA Journal, vol. 21, Apr 1983, p. 637-640. Research supported by the General Motors Corp , Volkswagenwerk, Fiat S.p.A, and Komatsu, Ltd refs
(Contract DE-AC04-81AL-16338; NSF CPE-80-03483)

Results are presented for a theoretical sensitivity study of a pancake-type combustion chamber and a cup-in-piston flat heat chambers, with and without intake flow swirl. In the absence of strong initial bulk flows, top dead center (TDC) turbulence is insensitive to the details of the intake process. Squish does not influence the entire chamber uniformly. Toward the center and bottom of the cup, TDC turbulence behaves in a way similar to the case of no squish. The initial strength and distribution of the swirl is remembered at TDC both in the mean flow and in the turbulence, but initial nonuniformities in turbulence still decrease rapidly during compression. O C.

A83-24826
PRE-PLANNED PRODUCT IMPROVEMENT /P3I/ THE T64-GE-418 DERIVATIVE ENGINE
R T. COFFIN and L. VARADI (General Electric Co., Aircraft Engine Business Group, Lynn, MA) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 10 p.

The widespread use, both present and foreseen, of the T64 engine is seen as making it an ideal candidate for the program known as Pre-Planned Product Improvement It is pointed out that an improved T64 could provide better performance to other aircraft, among them the P-3, the CH-47 and the C-2. Tables are included illustrating the percentage of the total improvement each component change has on the shaft horsepower and the specific fuel consumption levels to obtain a 13.5% shaft horsepower increase and a 6.9% specific fuel consumption reduction at maximum power on a 90 deg F sea level static day. Improvements in the following components are discussed: the compressor, combustor, gas generator turbine, power turbine, and engine control system (hydromechanical unit and electrical control unit). C.R.

A83-24827
PROPULSION SYSTEMS FOR ROTARY WING AIRCRAFT WITH AUXILIARY PROPULSORS
H. N. SHOHET (United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 15 p. refs

It is pointed out that in order to achieve higher speeds efficiently, it is necessary to supplement or replace the forward propulsion capability of the lifting rotor with auxiliary propulsion. Two promising concepts that have been developed, the advancing blade concept

(ABC) and the tilt rotor concept, are described, noting that for different reasons both require reduced rotor rpm at high cruise speeds A number of auxiliary propulsion variants are described, and two approaches to rpm reduction are treated in detail. In addition, results are presented from a study that clearly shows the superiority of convertible rotary wing aircraft over nonconvertible aircraft. C.R

A83-24828
AN APPROACH TO HELICOPTER POWER SELECTION
A NEUBURGER (*Pratt and Whitney Aircraft of Canada*, Ltd., Advanced Design Dept., Longneuil, Quebec, Canada) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint 15 p.

A preliminary design method is developed to determine engine ratings for take-off and emergency power which satisfy two arbitrary flight design requirements for multi-engined helicopters. The method utilizes the engine's potential for higher emergency rating which is greatly affected by the required test time at that rating. It is shown that the ratio of emergency to take-off power can be increased from 1.20 to 1 33 if the emergency rating's test time is reduced from 2 hours to 1/4 hour for one 150 hour endurance test, which can result in improved emission fuel efficiency (4%) and reduced engine operating cost (2 5%). In addition, it is found that the engine operating cost for a three-engine installation is higher than for a two-engine installation, despite superior fuel efficiency It is concluded that that this method can be used to study the impact of flight design requirements on engine economics and fuel efficiency. N B

A83-24829
RECENT DEVELOPMENTS IN DIGITAL CONTROL FOR HELICOPTER POWERPLANTS
A. CAINE (*Lucas Aerospace*, Fairfield, NJ) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 13 p. refs
(Contract DAAK51-80-C-0037)

A control system configuration now undergoing FAA certification for the Lycoming LTS101-750 engine, including the provisions for redundancy and back-up operation, is described. Descriptions are also given of the LUCOL control programming language and software management system. It is noted that this modular, high-level language was expressly developed for the implementation of digital control programs, simplifying the control engineer's programming task and providing excellent visibility of the control function. The associated software system, implemented on a host computer, furnishes numerous aids to the programmer together with the validation, verification and high-quality documentation procedures required for prime reliable software. Attention is also given to the design of an advanced control using an increased powerplant/flying-control interface and adaptive features in order to improve the performance and handling qualities of future military helicopters. C.R

A83-24830
FAA APPROVED S-76A IN-FLIGHT POWER ASSURANCE AND TRENDING PROCEDURE
J. M KOWALONEK and R. S. BARNARD (United Technologies Corp., Sikorsky Aircraft Div , Stratford, CT) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov 16-18, 1982, Preprint 11 p.

The Federal Aviation Agency (FAA) Special Condition No. 29-80-NE-09 of 1978, covering the S-76A helicopter, specifies the requirements for daily determination of whether engine power at the levels stipulated by aircraft certification is available from the engines presently installed in a given aircraft. Until recently, this requirement was met by conducting a daily power check before takeoff. An alternative procedure has been developed which combines in-flight power assurance with a trending technique to minimize schedule impact, passenger discomfort, and data variability. This technique, which was certified by the FAA in June of 1981, undertakes daily power trend checks at 135 + or - 10 knots during the 50-hour interval between 30-min power rating checks O.C.

A83-24831
FLIGHT TESTING WITH HOT JP-4 FUEL
C. E GREENBERG (United Technologies Corp , Sikorsky Aircraft Div., West Palm Beach, FL) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 8 p. Army-supported research. refs

One development undertaken in connection with the desire to provide an increased margin of safety to modern helicopters is related to the design of suction fuel systems The present investigation is concerned with flight tests conducted to ensure the satisfactory performance of hot JP-4 fuel in the suction fuel system of the Black Hawk helicopter. Attention is given to conclusions and recommendations which can be drawn from experience gained during these flight tests, taking into account conclusions which are applicable to any hot fuel flight tests. It is found that a heating device is required which heats the fuel to the desired temperature quickly and safely, without unduly 'weathering' the fuel. Flight testing of the system must be done for a variety of maneuvers to cover all aspects of operational use. G.R

A83-24834* Textron Bell Helicopter, Fort Worth, Tex
DESIGN OF AN ADVANCED 500-HP HELICOPTER TRANSMISSION
C E. BRADDOCK (Bell Helicopter Textron, Fort Worth, TX) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov 16-18, 1982, Preprint. 16 p. refs
(Contract NAS3-21595)

A 500-hp Advanced Technology Demonstrator helicopter transmission was designed by an American aerospace company under a NASA contract. The project was mainly concerned with designing a 500-hp version of the OH-58C 317-hp transmission which would have the capabilities for a long, quiet life at a minimum increase in cost, weight, and space, which usually increase along with power increases. This objective was accomplished by implementing advanced technology which has been developed during the last decade and by making improvements dictated by field experience. The improvements are related to bearings made of cleaner gear steels, spiral bevel gears made of cleaner gear steels, high contact ratio spur gear teeth in the planetary which will reduce noise level and increase gear life, and modifications concerning the sun gear. G.R

A83-24836
U.S. ARMY/DETROIT DIESEL ALLISON ADVANCED TECHNOLOGY DEMONSTRATOR ENGINE
D. S. MONSON (General Motors Corp., Detroit Diesel Allison Div., Indianapolis, IN) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 7 p.

The Diesel Advanced Technology Demonstrator Engine (ATDE) program was initiated in February 1977. An objective of this program was to determine the achievable level of performance of an advanced technology 800-shaft horsepower class turboshaft engine by test and evaluation. The results of the GMA500 engine test program showed that the Army cruise fuel consumption goals and altitude hot day performance goals are achievable It is pointed out that the experience gained with the full authority digital fuel control system was very encouraging. The ability to rapidly execute software changes and to change and combine control modes was demonstrated. Excellent stability and response characteristics could be shown. Advanced material technologies in castings, coatings, process refinements, and joining techniques were developed which are applicable to future engines. G.R.

A83-24837
HELICOPTER ENGINE DEVELOPMENT - NEW STANDARDS FOR THE '80S
R. G. RUEGG (General Electric Co., Aircraft Engine Business Group, Lynn, MA) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 10 p

The T700 Development and Maturity Program included a number of specially designed engine tests to assure early maturity of the engine prior to production and to demonstrate parts-life integrity well in advance of significant field experience. The present investigation is concerned with the methods used to develop the T700 accelerated mission test cycles and compares test cycle severity with both intended and actual field usage, through use of the T700 Engine History Recorder and the Engine Life Usage Monitor Flight recorder data provide additional information on the relationship between the test cycles and field mission usage. Finally, the experience gained during the T700 Development Program is discussed as it relates to future turboshaft engine development programs. G.R

A83-24838
FULL-FLOW DEBRIS MONITORING AND FINE FILTRATION FOR HELICOPTER PROPULSION SYSTEMS
T TAUBER (Technical Development Co , Glenolden, PA), W. A. HUDGINS (U S. Army, Applied Technology Laboratory, Fort Eustis, VA), and R. S. LEE (Technical Support Center, Pensacola, FL) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov 16-18, 1982, Preprint. 13 p. refs

The advanced oil debris discrimination and filtration system developed for the U S. Army UH-1/AH-1 helicopters was designed to detect failures reliably, reduce nuisance chip indications, and lengthen both oil change intervals and component life. Results are presented for a recent test program in which 38 UH-1 helicopters were equipped with 3-micron oil filters and full flow burn off chip detectors for both engine and transmission systems The full flow chip detection system was found to be completely effective in the detection of all oil-wetted component failures. The oil change interval of the main transmission and engine can be safely extended to 1000 hours, and nuisance chip indications have been reduced to 0.371/1000 hours for the transmission and 0.062/1000 hours for the tail rotor drive system O.C.

A83-24839
TECHNICAL QUALITIES FOR COMBAT HELICOPTER POWERPLANTS
D. LEWIS (Rolls-Royce, Ltd., Leavesden, England) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 5 p.

Design considerations in the case of an engine for a combat helicopter are different from those for a commercial or utility machine. However, in connection with the cost factors related to the use of different engines, there is reluctuance to face these facts. The present investigation is concerned with the special considerations for combat helicopter powerplants. Overall requirements are discussed along with the ideal requirements regarding weapon systems, dilemmas concerning the weapons platform, genuine dilemmas with respect to the platform powerplant, and the survivability criteria for combat helicopters. It is found that a high integrity in terms of ability to operate with degraded engines results from the survivability analysis. This integrity directly benefits the risk levels incurred in rotary wing transportation. G.R.

A83-24840
WARM CYCLE PROPULSION FOR THE 1990'S HEAVY LIFT HELICOPTERS
R. E. HEAD (Hughes Helicopters, Inc., Research and Development Div., Culver City, CA) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint 8 p.

An investigation has shown that there is an anticipated need in the 1990s for heavier lift helicopters than are currently operating. It is believed that this helicopter will surely have a jet powered rotor Several Warm Cycle Heavy Lift Helicopters were studied by an American aerospace company to compare them with equivalent tandem-rotor shaft drive helicopters. In the case of machines sized to carry 45-ton and 60-ton payloads the Warm Cycle Rotor is found to be clearly superior. It appears that the best size to consider for the Army's requirements would be a helicopter sized to carry 45 tons on two 100-nautical-mile sorties before refueling It is pointed out that the necessary basis for the construction of the heavy lift helicopters for the 1990s is available. G.R.

A83-24841
COMPOSITE ENGINE INLET PARTICLE SEPARATOR SWIRL FRAME
S. C MITCHELL and S. C. HARRIER (General Electric Co., Fairfield, CT) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 12 p.
(Contract DAAK79-C-0018)

The design, materials, and construction processes which produced the composite inlet particle separator (IPS) swirl frame for removing sand and dust at the intake of an Army gas turbine engine are detailed Incoming air is swirled and thereby centrifuged to the bypass portion of the intake duct and directed to a blower for overboard exhausting. Structural strength, weight, thermal, and interface requirements led to a choice of aluminized glass, glass, and graphite fibers in a PMR-15 polyimide matrix Iterative CAD techniques served to refine the part parameters until its ply orientation, geometry, weight, and costs were optimized for each environment it would encounter. A finite element analysis verified the critical loading resistances and a heat transfer analysis determined that changes in the skin surface temperature were small and would not jeopardize anti-icing operations. M.S.K.

A83-24842
THE T700-GE-700 ENGINE EXPERIENCE IN SAND ENVIRONMENT
Z. J. PRZEDPELSKI (General Electric Co., Aircraft Engine Business Group, Lynn, MA) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint 11 p.

The Integral Particle Separator (IPS) of the T700-GE-700 engine's helicopter turboshaft derivatives significantly enhances sand and dust environment operation capabilities. Attention is given to the results of U.S. Army deployments of T700-GE-700 engine-equipped Blackhawk helicopters into desert regions, with emphasis on the Bright Star I and II operations conducted in Egypt. No engine removals were prompted by low performance and/or stalls during the desert deployments. While some of the engines involved were subsequently removed for various causes and found to exhibit evidence of sand erosion, especially on Stage I compressor blades, the extent of this erosion is judged to be less than that measured during sand ingestion qualification tests conducted by the manufacturer. O.C.

A83-25267#
A COMPUTER MODEL FOR GAS TURBINE BLADE COOLING ANALYSIS
J C HAN (Texas A & M University, College Station, TX), D. W. ORTMAN, and C P. LEE American Society of Mechanical Engineers, Joint Power Generation Conference, Denver, CO, Oct. 17-21, 1982, 7 p refs
(ASME PAPER 82-JPGC-GT-6)

A computer model for gas turbine blade cooling analysis has been developed The finite difference technique over the chord and span of the blade is employed. A flow balance and an energy balance program are included in the model The model is capable of predicting cooling flow characteristics (mass flow rate and internal pressure distribution) and metal temperature profiles of multipass coolant passages in rotating blades with local film cooling. The paper first presents the analytical model of coolant flow and heat transfer, then the computer program is discussed Finally, the computed results of a sample blade at engine conditions is presented and discussed (Author)

A83-25909#
IN-FLIGHT ACOUSTIC MEASUREMENTS IN THE ENGINE INTAKE OF A FOKKER F28 AIRCRAFT
T. ZANDBERGEN, J. N. LAAN, H. J. ZEEMANS (National Lucht- en Ruimtevaartlaboratorium, Emmeloord, Netherlands), and S L SARIN (Fokker, Schiphol, Netherlands) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, April 11-13, 1983, 14 p. Research supported by the Nederlands Instituut voor Vliegtuigontwikkeling en Ruimtevaart. refs
(AIAA PAPER 83-0677)

One of the two tail-mounted, hard walled engine intake ducts of a Fokker F-28 aircraft was instrumented in order to determine the amplitudes of the circumferential modes constituting the sound field In the other engine, the impedance of the inlet acoustic liner was measured by means of the two-microphone technique. For the fundamental frequency of the low pressure compressor first stage rotor, considerable amounts of energy are found in modes other than the expected m = 1. The possible origin of these modes is discussed. The feasibility of obtaining the circumferential mode distribution of the intake acoustic field during flight has been demonstrated, obviating the difficulties associated with ground simulations. O.C.

A83-25910*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT EFFECTS ON FAN NOISE WITH STATIC AND WIND TUNNEL COMPARISONS
J. S. PREISSER and D. CHESTNUTT (NASA, Langley Research Center, Noise Control Branch, Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 14 p. refs
(AIAA PAPER 83-0678)

A flight test program utilizing a JT15D-1 turbofan engine has been conducted with the objectives of studying flight effects on fan noise and evaluating the simulation effectiveness of both a wind tunnel and a static test configuration that incorporated an inlet control device (ICD). In conjunction with synchronized laser-radar tracking and meteorological profile information, data obtained from a linear array of ground microphones was narrowband-analyzed and ensemble-averaged to yield highly accurate far-field flight acoustic results. Utilizing appropriate corrections, flight, wind tunnel, and static acoustic data were normalized to a static-equivalent, 100-foot radius, lossless reference condition. Data comparisons showed that both the static test with ICD and wind tunnel were generally very effective in simulating flight blade-passage-frequency (BPF) noise levels. However, differences were observed in broadband noise levels and in the details of the multiple-pure-tone harmonics. (Author)

A83-25911*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLUCTUATING PRESSURE MEASUREMENTS ON THE FAN BLADES OF A TURBOFAN ENGINE DURING GROUND AND FLIGHT TESTS
J. A. SCHOENSTER (NASA, Langley Research Center, Noise Control Branch, Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr 11-13, 1983, 11 p. refs
(AIAA PAPER 83-0679)

As part of a program to investigate fan noise generated by a turbofan engine, miniature pressure transducers were used to measure the fluctuating pressures on the surface of a fan blade on the JT15D engine. Tests were conducted on the ground, with tunnel and in flight. Using narrowband spectra analysis and signal enhancement techniques, comparisons for these various test conditions are presented. Results on the blade pressures are also presented from a flight test in which 41 rods were placed in front of the fan face to excite a known spinning mode in the duct Results showed that with care, ground tests can be conducted in which the pressure loading on the blades are similar to those in flight. Comparison of pressure transducers on the blade surface also showed that a single transducer would provide much of the information available from this type of measurement. (Author)

A83-25912*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
INTERACTION OF FAN ROTOR FLOW WITH DOWNSTREAM STRUTS
W. F. OBRIEN, JR., S. L REIMERS, and S. W RICHARDSON (Virginia Polytechnic Institute and State University, Blacksburg, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 10 p. refs
(Contract NAG1-156)
(AIAA PAPER 83-0682)

The detailed unsteady pressure field produced on the rotor blades of an axial-flow fan by interaction with downstream struts was investigated. The experimental arrangement was similar to that found in the fan casings of turbofan aircraft engines. Acoustically significant pressure fluctuations were measured on both thy suction and pressure sides of the rotor blades for several positions of the downstream struts. The level of the observed interaction decreased with increased spacing of the struts behind the rotor. An inviscid flow analysis for the disturbance level is compared with trends of the measured results. (Author)

A83-25932#
SPECIFICATION, DESIGN, AND TEST OF AIRCRAFT ENGINE ISOLATORS FOR REDUCED INTERIOR NOISE
J. F UNRUH (Southwest Research Institute, San Antonio, TX) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 10 p. refs
(AIAA PAPER 83-0718)

The paper discusses the application of a previously developed model of structure-borne noise transmission in a single-engine light aircraft in the design of an engine noise isolator. The use of the model for the specification of the mechanical properties of the isolator required to achieve a desired noise reduction is considered, and parametric design curves expressing maximum unweighted overall sound pressure levels as a function of isolator stiffness properties, engine speed and isolator material loss are presented for a range of input parameters. The selection and evaluation of the mechanical properties of candidate isolators chosen to meet a design objective of a 15-dB reduction in structure-borne noise transmission are then examined, and results of noise transmission tests, which showed an overall maximum interior noise level reduction on the order of 10 dB for the isolators tested, are presented It is concluded that the model used was adequate in assessing the trends in noise isolation for a given change in isolator properties. A.L.W.

A83-25945*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
THE PREDICTION OF THE NOISE OF SUPERSONIC PROPELLERS IN TIME DOMAIN - NEW THEORETICAL RESULTS
F. FARASSAT (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 13 p refs
(AIAA PAPER 83-0743)

In this paper, a new formula for the prediction of the noise of supersonic propellers is derived in the time domain which is superior to the previous formulations in several respects. The governing equation is based on the Ffowcs Williams-Hawkings (FW-H) equation with the thickness source term replaced by an equivalent loading source term derived by Isom (1975). Using some results of generalized function theory and simple four-dimensional space-time geometry, the formal solution of the governing equation is manipulated to a form requiring only the knowledge of blade surface pressure data and geometry. The final form of the main result of this paper consists of some surface and line integrals. The surface integrals depend on the surface pressure, time rate of change of surface pressure, and surface pressure gradient. These integrals also involve blade surface curvatures. The line integrals which depend on local surface pressure are along the trailing edge, the shock traces on the blade, and the perimeter of the airfoil section at the inner radius of the blade. The new formulation is for the full blade surface and does not involve any numerical observer time differentiation. The method of implementation on a computer for numerical work is also discussed. (Author)

A83-25946#
SOURCES OF INSTALLED TURBOPROP NOISE
R. H. BURRIN and M SALIKUDDIN (Lockheed-Georgia Co., Marietta, GA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 9 p refs
(AIAA PAPER 83-0744)

Comparisons were made between theoretically predicted and actual C130 Hercules flyover noise levels as a prelude to tests of deflected-jet/flap interaction tests. The flyover tests verified the propeller size scaling laws, and also revealed the significance of broadband noise The noise predictions were made with three models for the core, jet, and airframe. Discrepancies between the predicted and measured high-frequency broadband components lead to flap-mounted engine/wing interaction tests in a wind tunnel with scale models. The sources of detected noise were pinpointed using a polar correlation method involving placement of 28 microphones in an arc around a model turboprop. The propeller was found to be the dominant source, with a strength that increased with changes in inflow angle generated by changes in the angle of attack. M.S.K

A83-25947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
FARFIELD INFLIGHT MEASUREMENTS OF HIGH-SPEED TURBOPROP NOISE
J. R. BALOMBIN and I J. LOEFFLER (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 18 p. refs
(AIAA PAPER 83-0745)

A flight program was carried out to determine the variation of noise level with distance from a model high-speed propeller. Noise measurements were obtained at different distances from a SR-3 propeller mounted on a JetStar aircraft, with the test instrumentation mounted on a Learjet flown in formation The propeller was operated at 0.8 m flight Mach number, 1.12 helical tip Mach number and at 0 7 flight Mach number, 1 0 helical tip Mach number. The instantaneous pressure from individual blades was observed to rise faster at the 0.8 flight speed, than at the 0.7 M flight speed. The measured levels appeared to decrease in good agreement with a 6 dB/doubling of distance decay, over the measurement range of approximately 16 m to 100 m distance. Further extrapolation, to the distances represented by a community, would suggest that the propagated levels during cruise would not cause a serious community annoyance (Author)

A83-25948#
FLYOVER NOISE MEASUREMENTS FOR TURBO-PROP AIRCRAFT
D. F WILFORD and H. BONNEAU (Pratt and Whitney Aircraft of Canada, Ltd , Longueuil, Quebec, Canada) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 11 p. refs
(AIAA PAPER 83-0746)

This paper reports propeller flyover noise measurements on two different turbo-prop aircraft (single engine and twin engine), made in partial accordance with FAR 36 certification procedures. OASPL was recorded continuously at 2 microphones placed 1.2 metres and 0 metres above ground. Flyovers were conducted at a variety of propeller RPM, SHP and aircraft speeds Results are analyzed in terms of LA(max) and the time integrated noise metric LAX; and an assessment is made of published propeller noise prediction methods. Narrow-band and 1/3 octave spectra are presented and ground interference effects are discussed. Some in-flight interior noise measurements are also presented. (Author)

A83-25956#
VANE CAMBER AND ANGLE OF INCIDENCE EFFECTS IN FAN NOISE GENERATION
J. B. H M. SCHULTEN (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 11 p. Research sponsored by the Netherlands Agency for Aerospace Programs. refs
(AIAA PAPER 83-0766)

A three-dimensional lifting surface theory is developed for calculating the sound field produced by a stator with nonplanar vanes exposed to unsteady velocity disturbances. It is found that at the high frequencies prevailing in current turbofan engines the effects of vane camber and angle of incidence are essential. Even a small axial component in the vane force distribution is shown to make a significant contribution to the kernels of the pressure and velocity integrals of the problem. The integral equation for the pressure jump distribution is solved using a Galerkin projection method under certain restrictions on the vane angle of incidence and camber distribution for computational efficiency. It is shown that the lower the circumferential periodicity of the cut-on sound field, the more pronounced are the acoustic effects of vane angle of incidence and camber. In addition to the acoustic power, the modal distribution of the sound field is determined to be very sensitive to vane camber and angle of incidence. N.B.

A83-25957*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
TONE GENERATION BY ROTOR-DOWNSTREAM STRUT INTERACTION
R. P. WOODWARD and J R. BALOMBIN (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 9 p. refs
(AIAA PAPER 83-0767)

A JT15D fan stage was acoustically tested in the NASA Lewis anechoic chamber as part of the joint Lewis-Langley Research Center investigation of flight simulation techniques and flight effects using the JT15D engine as a common test vehicle. Suspected rotor-downstream support strut interaction was confirmed through the use of simulated support struts which were tested at three axial rotor-strut spacings. Tests were also performed with the struts removed. Inlet boundary layer suction in conjunction with an inflow control device was also explored. The removal of the boundary layer reduced the fan fundamental tone levels suggesting that the mounting and mating of such a device to the nacelle requires

careful attention. With the same inflow control device installed good acoustic agreement was shown between the engine on an outdoor test stand and the fan in the anechoic chamber.
(Author)

A83-25958#
PREDICTION OF HIGH BYPASS RATIO ENGINE STATIC AND FLYOVER JET NOISE
W. B MCDONALD and H. Y. LU (Boeing Commercial Airplane Co., Seattle, WA) American Institute of Aeronautics and Astronautics, *Aeroacoustics Conference, 8th, Atlanta, GA, Apr.* 11-13, 1983, 9 p
(AIAA PAPER 83-0773)

An empirical procedure that calculates the static and flight jet noise of high bypass ratio engines is described. This empirical model incorporates the following jet noise features (1) the noise of a clean jet with minimized upstream noise, (2) the broadband amplification of jet noise by upstream internal acoustic excitation, (3) distributed source extrapolation, and (4) frequency-dependent static-to-flight effects. The procedure is based primarily on model nozzle data. Comparisons of the prediction with full-scale static and flyover data show good agreement for the jet noise component. (Author)

A83-25959*# *McDonnell-Douglas Corp., St Louis, Mo.*
POROUS-PLUG FLOWFIELD MECHANISMS FOR REDUCING SUPERSONIC JET NOISE
V. KIBENS and R. W WLEZIEN (McDonnell Douglas Research Laboratories, St. Louis, MO) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 9 p. refs
(Contract NAS1-16284)
(AIAA PAPER 83-0774)

An experimental investigation was performed to characterize the changes in jet flowfield properties associated with noise reduction obtained by using porous-plug nozzles at supersonic pressure ratios. A series of constant-exit-area nozzles with various plug sizes was investigated over the Mach number range 0.8-1.4. Periodic shock cells were observed in the flow for a solid plug. For a porous surface, the shock cells are replaced by a gradual compression composed of multiple weak shocks originating at the surface holes. Reduction of far-field jet noise correlates with a decrease of the pressure cell strength. (Author)

A83-25963*# *National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.*
THE DESIGN AND FLIGHT TEST OF AN ENGINE INLET BULK ACOUSTIC LINER
H. C. LESTER, J. S. PREISSER, and T L. PARROTT (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 12 p. refs
(AIAA PAPER 83-0781)

This paper summarizes the design, fabrication and flight evaluation of a Kevlar acoustic liner configuration for a JT15D turbofan engine. The liner was designed to suppress, by a measurable amount, a dominant (13,0) BPF tone This tone or spinning mode was produced for research purposes by installing 41 circumferentially distributed small diameter rods upstream of the 28 fan blades Duct liner attenuations calculated by a finite element procedure were compared to far field power (insertion) losses deduced from flight data. The finite element program modeled the variable geometry of the JT15D inlet and used a uniform flow with a boundary layer roll-off to model the inlet flow field. Calculated liner losses were generally conservative. That is, measured far field power losses were generally greater than attenuations calculated by the finite element computer program.
(Author)

A83-26072
PW4000 USES JT9D, NEW TECHNOLOGY
K. F. MORDOFF Aviation Week and Space Technology, vol. 118, Mar. 28, 1983, p. 43-45

Design features incorporated in the PW4000 series of jet engines are reviewed The PW4000 series produces 40,000-60,000 lb of thrust and is intended for use on wide-body airline aircraft. Engine rotational speed has been increased 27%, stiffness doubled, and compressor aerodynamics improved compared to the JT9D-7R4 engines Electronic engine control has been introduced, as has a larger engine casing, while the number of parts has decreased. The PW4000 has 38 blades with controlled diffusion, and 12% of the dirt entering the intake is diverted by an air splitter bypass. Fuel consumption is 3.9% less than in the JT9D-7R4. CAD/CAM techniques, composites technology, ring rolling to produce the combustion liners, laser welding, hard facing, and drilled blade cooling holes have been used in the development of the engine design. D.H K.

A83-26923
THE RESPONSE OF A MULTISTAGE COMPRESSOR TO AN AZIMUTHAL DISTORTION [REPONSE D'UN COMPRESSEUR MULTIETAGE A UNE DISTORSION AZIMUTALE]
P. FERRAND Revue Francaise de Mecanique, no 1, 1983, p. 3-17. In French refs

Theoretical and experimental results from an investigation of the response of a multistage compressor to flow distortions at the inlet are reported A numerical model is developed for the characterization of different types of flow instabilities. Consideration is given to flow cross-sections upstream, downstream, and between two blade rows. Linearized equations are defined for a series of bladed and bladeless spaces, with solutions obtained using Fourier series for the circumferential variables and Laplace transforms for the time-dependent variables A Nyquist diagram is presented to describe the turbine response in terms of a servomechanism. Experimental results with two single stage compressors and a multistage compressor are analyzed with the numerical model The results indicate that use of blades with profiles that successively augment the boundary layer is preferable in order to maintain flow stability, even if some efficiency is lost M.S K.

N83-18653# Dowty Rotol Ltd., Gloucester (England).
PROPELLER PERFORMANCE PREDICTION AND DESIGN TECHNIQUES
R. M. BASS *In* Von Karman Inst. for Fluid Dyn. Propeller Performance and Noise, Vol. 1 75 p 1982 refs
Avail NTIS HC A17/MF A01

A review of propeller theory and mechanical design is given. Emphasis is placed upon performance prediction techniques and questions concerning propeller efficiency. Propeller control, the selection of an aerodynamic design, and heavily loaded propellers are among the topics discussed. R.J F

N83-18659# Hamilton Standard, Windsor Locks, Conn. Aircraft Systems Dept.
ADVANCED TURBOPROP PROPULSION TECHNOLOGY
B. S. GATZEN *In* Von Karman Inst. for Fluid Dyn. Propeller Performance and Noise, Vol. 2 154 p 1982 refs
(SP-03A82) Avail: NTIS HC A18/MF A01

The key technical areas associated with advanced tyrboprop propulsors are assessed with emphasis on commuter turboprops and the prop-fan. The results of several studies within the aerospace industry are included. Aspects examined include. (1) aerodynamics; (2) acoustics; (3) system characteristics; (4) blades, (5) variable pitch systems and controls; (6) core engine technology; (7) geartrains; and (8) reliability and maintainability. A.R.H.

N83-18725*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SMALL GAS TURBINE COMBUSTOR STUDY: COMBUSTOR LINER EVALUATION
C. T. NORGREN and S. M RIDDLEBAUGH 1983 20 p refs Presented at 21st Aerospace Sci. Conf., Reno, Nevada, 10-13 Jan 1983; sponsored by AIAA
(NASA-TM-83028; E-1463; NAS 1.15.83028, AIAA-83-0337)
Avail: NTIS HC A02/MF A01 CSCL 21E
For abstract see A83-16663.

N83-18728# Aeronautical Research Labs., Melbourne (Australia).
AN EVALUATION OF ENGINE PERFORMANCE ASSESSMENT PROCEDURES FOR THE LYCOMING T53 ENGINE AS INSTALLED IN THE IROQUOIS HELICOPTER
D. E. GLENNY Apr. 1981 41 p refs
(ARL-MECH-ENG-NOTE-387; AR-002-281) Avail: NTIS HC A03/MF A01
Engine performance assessment procedures, including TEAC, SFI21, HIT and IFM, were carried out for the Lycoming T53 engine installed in the Iroquois helicopter. Following an analysis of the results a number of recommendations regarding engine performance monitoring procedures in the Iroquois helicopter were made. S.L.

N83-18729*# Kansas Univ., Lawrence.
LITERATURE SEARCH OF PUBLICATIONS CONCERNING THE PREDICTION OF DYNAMIC INLET FLOW DISTORTION AND RELATED TOPICS Final Report
W. G. SCHWEIKHHARD and Y. S. CHEN Washington NASA Feb. 1983 141 p refs
(Contract NAG3-11)
(NASA-CR-3673; NAS 1.26.3673) Avail: NTIS HC A07/MF A01 CSCL 21E
Publications prior to March 1981 were surveyed to determine inlet flow dynamic distortion prediction methods and to catalog experimental and analytical information concerning inlet flow dynamic distortion prediction methods and to catalog experimental and analytical information concerning inlet flow dynamics at the engine-inlet interface of conventional aircraft (excluding V/STOL). The sixty-five publications found are briefly summarized and tabulated according to topic and are cross-referenced according to content and nature of the investigation (e.g., predictive, experimental, analytical and types of tests) Three appendices include lists of references, authors, organizations and agencies conducting the studies. Also, selected materials summaries, introductions and conclusions - from the reports are included. Few reports were found covering methods for predicting the probable maximum distortion The three predictive methods found are those of Melick, Jacox and Motycka. The latter two require extensive high response pressure measurements at the compressor face, while the Melick Technique can function with as few as one or two measurements. Author

N83-18730# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FILM COOLING AND TURBINE BLADE HEAT TRANSFER, VOLUME 2
1981 241 p refs Lecture held in Rhode-Saint-Genese, Belgium, 22-26 Feb. 1982 2 Vol.
Avail: NTIS HC A11/MF A01
Heat sink models, two dimensional film cooling, and the adiabatic effectiveness of three dimensonal film cooling from single and double rows of injection holes are discussed. The influence of free stream turbulence and laminar flow, film cooling of flat and curved surface, heat transfer rate measurements on stator and rotor profiles, and blade design are also covered.

N83-18735# Brown, Boverie und Cie, A G Baden (Switzerland). Gas Turbine Dept.
COOLING OF GAS TURBINE BLADES
D K. MUKHERJEE *In* Von Karman Inst. for Fluid Dyn. Film Cooling and Turbine Blade Heat Transfer, Vol. 1 18 p 1982 refs
Avail. NTIS HC A11/MF A01
The high inlet temperature of gas turbines requires that the first few rows of blades be cooled. Blade cooling by convection, impingment, film, and transpiration are described and design calculations are discussed. The use of sophisticated computer programs for blade design and service life prediction is covered as well as the effect of blade cooling on the turbine aerodynamic. A R.H.

N83-18736# Brown, Boverie und Cie, A.G. Baden (Switzerland). Gas Turbine Dept.
EXPERIMENTAL VERIFICATION OF BLADE COOLING SYSTEMS AND COMPARISON WITH DESIGN CALCULATION
D. K MUKHERJEE *In* Von Karman Inst. for Fluid Dyn Film Cooling and Turbine Blade Heat Transfer, Vol 1 35 p 1982 refs
Avail: NTIS HC A11/MF A01
The aerodynamic and cooling aspects of turbine blades can be only partially investigated with the computer. Systematic development necessitates verification on models and hardwares. Flow measurements on cast vane, tests on cooled rotor blades, determining the pressure loss of impingement cooled leading edge system of a turbine blade, tests on single and multistage model turbines, tests in the cascade tunnel, and tests in high temperature turbines are described and results evaluated. A R H.

N83-18738# Von Karman Inst for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FILM COOLING AND TURBINE BLADE HEAT TRANSFER, VOLUME 2
1982 314 p refs Lecture held in Rhode-Saint-Genese, Belgium, 22-26 Feb. 1982 2 Vol.
(VKI-LS-1982-02-VOL-2) Avail· NTIS HC A14/MF A01
Cooling of gas turbine engines is discussed. Emphasis is placed on the cooling of vanes and blades. Control of inlet temperature to increase performance is discussed, as is the superposition model of film cooling. Fluid dynamic scaling is discussed. R.J F.

N83-18739# Motoren- und Turbinen-Union Muenchen G.m.b H. (West Germany).
TURBINE BLADE COOLING IN AEROENGINES
D. K. HENNECKE *In* Von Karman Inst. for Fluid Dyn. Film Cooling and Turbine Blade Heat Transfer, Vol. 2 72 p 1982 refs
Avail. NTIS HC A14/MF A01
The principle cooling schemes used in the turbines of today's aeroengines are described. The emphasis lies on the cooling of the vanes and blades. Various cooling configurations are shown and the design approaches explained. Then the required computational and experimental methods are discussed These were applied to design and test a number of different blade cooling configurations The results are presented. The tests included both cascade and engine testing. An attempt is made to apply the cascade test results to actual engine conditions and compare them to the engine results. The problems associated with such an undertaking are indicated. Finally, future trends in turbine blade cooling of aeroengines are shown and areas where we lack sufficient knowledge identified. From this, recommendations for research are made. Author

N83-18740# Oxford Univ. (England). Dept. of Engineering Science.
HEAT TRANSFER RATE TO BLADE PROFILES: THEORY AND MEASUREMENT IN TRANSIENT FACILITIES
L. C. DANIELS and D. L. SCHULTZ *In* Von Karman Inst. for Fluid Dyn. Film Cooling and Turbine Blade Heat Transfer, Vol. 2 212 p 1982 refs
Avail: NTIS HC A14/MF A01

Efforts to maximize turbine entry temperature and thus increase performance in gas turbine engines are discussed. Heat transfer performance of uncooled and cooled blades is discussed in detail. The design of a gas turbine stage and scaling factors for experiments are discussed. Boundary layer development on a turbine blade, cooling systems, laminar boundary layers and their transition, turbulent boundary layers, and low Reynolds number effects are among the topics discussed. R.J F.

N83-18956# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AN EXPERIMENT TO IMPROVE THE SURGE MARGIN BY USE OF CASCADE WITH SPLITTER BLADES
T. CHIH-YA, Z. SHENG, L. REN-FU, and Z. LIAN-CHI *In its* J. of Eng. Thermophys (Selected Articles) (FTD-ID(RS)T-1011-82) p 29-35 4 Nov 1982 refs Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 1, no. 2, May 1980 p 128-131
Avail: NTIS HC A06/MF A01 CSCL 21E

Through experimental comparison on a basis of equal profile sectional area per unit frontal length, which implies a basis of equal weight, a cascade with splitter blades is found to give a maximum deflection 3.5 degrees greater than an ordinary cascade tested. The corresponding incidence angle is 6.5 degrees greater, thus markedly improving the surge margin. The nominal deflection and thus work addition ability also increase Prediction is also made on a basis of equal solidity that the use of splitter blades would give about the same nominal work addition ability as an ordinary cascade, but weight is substantially reduced to 70% approximately. Author

N83-18957# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PERFORMANCE CALCULATION OF AN AXIAL FLOW COMPRESSOR STAGE
Z. YU-JING *In its* J. of Eng. Thermophys (Selected Articles) (FTD-ID(RS)T-1011-82) p 36-50 4 Nov 1982 refs Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 1, no 2, May 1980 p 132-138
Avail: NTIS HC A06/MF A01 CSCL 21E

Based on the simplified two dimensional flow equations, the computer program for the direct program is developed. By means of this program several subsonic axial flow compressor stages are calculated. The calculated results are compared with experimental data This calculation method is evaluated and problems to be solved in the performance calculation are presented. Author

N83-18960# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF SIMULATING IMPINGEMENT COOLING OF CONCAVE SURFACES OF TURBINE AIRFOILS
C. JI-RUI and W. BAO-GUAN *In its* J. of Eng. Thermophys (Selected Articles) (FTD-ID(RS)T-1011-82) p 165-175 4 Nov. 1982 refs Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 1, no 2, May 1980 p 165-175
Avail: NTIS HC A06/MF A01 CSCL 21E

Presented in this paper are the experimental results of impingement cooling of two aluminium targets of different sizer with six impingement tubes. The target simulating edge of a turbine airfoil is preheated and cooled by jets of different impingement tubes at varius flow rates and distances The lumped-capacity method is used to determine the cooling rate of the aluminium target and the mean heat transfer coefficients which are in turn correlated in dimensionless parameters. Satisfactory results are obtained when Nu numbers calculted from the recommended expression are compared with those by experiments The recommended expression is further compared with the correlated formula of Arizona State University by Metzgor and those of University of Cincinnati by Ravuri and Tabakoff together with the experimental data, and it is found that the expression correlated by this paper is more or less reasonable. Author

N83-19040# Florence Univ. (Italy). Ist. di Energetica.
BLADE DESIGN WITH A FINITE ELEMENT METHOD
F. MARTELLI *In* Von Karman Inst for Fluid Dyn. Numerical Methods for Flows in Turbomachinery Bladings, Vol. 2 41 p 1982 refs
Avail: NTIS HC A14/MF A01

The blade design problem in compressible aerodynamics can be approached by the iterative use of direct calculations (blade to blade solution) or by the invese method based on the solution of transformed equations like the hodograph equations. The paper presents an original solution of the hodograph equations by the Finite Element method, forwarded to the blade design. The basic equations are transformed in formulation suitable for the weighted residual technique. The numerical problems involved are widely discussed, and various results of calculation are shown and analyzed. Author

N83-19753*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div
ENERGY EFFICIENT ENGINE SECTOR COMBUSTOR RIG TEST PROGRAM
D. J. DUBIEL, W. GREENE, C. V SUNDT, S. TANRIKUT, and M. H. ZEISSER Oct. 1981 160 p refs
(Contract NAS3-20646)
(NASA-CR-167913; NAS 1.26.167913; PWA-5594-180) Avail: NTIS HC A08/MF A01 CSCL 21E

Under the NASA-sponsored Energy Efficient Engine program, Pratt & Whitney Aircraft has successfully completed a comprehensive combustor rig test using a 90-degree sector of an advanced two-stage combustor with a segmented liner. Initial testing utilized a combustor with a conventional louvered liner and demonstrated that the Energy Efficient Engine two-stage combustor configuration is a viable system for controlling exhaust emissions, with the capability to meet all aerothermal performance goals. Goals for both carbon monoxide and unburned hydrocarbons were surpassed and the goal for oxides of nitrogen was closely approached. In another series of tests, an advanced segmented liner configuration with a unique counter-parallel FINWALL cooling system was evaluated at engine sea level takeoff pressure and temperature levels. These tests verified the structural integrity of this liner design. Overall, the results from the program have provided a high level of confidence to proceed with the scheduled Combustor Component Rig Test Program. Author

N83-19754*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TONE GENERATION BY ROTOR-DOWNSTREAM STRUT INTERACTION
R. P. WOODWARD and J. R. BALOMBIN 1983 17 p refs Proposed for presentation at the 8th Aeroacoustics Conf., Atlanta, 11-13 Apr. 1983; sponsored by the American Inst. of Aeronautics and Astronautics
(NASA-TM-83330; E-1577; NAS 1.15:83330) Avail: NTIS HC A02/MF A01 CSCL 21E

A JT15D fan stage was acoustically tested in the NASA Lewis anechoic chamber as part of the joint Lewis-Langley Research Center investigation of flight simulation techniques and flight effects using the JT15D engine as a common test vehicle. Suspected rotor-downstream support strut interaction was confirmed through the use of simulated support struts which were tested at three axial rotor-strut spacings. Tests were also performed with the struts removed. Inlet boundary layer suction in conjuction with an inflow control device was also explored. The removal of the boundary layer reduced the fan fundamental tone levels suggesting that the

mounting and mating of such a device to the nacelle requires careful attention. With the same inflow control device installed good acoustic agreement was shown between the engine on an outdoor test stand and the fan in the anechoic chamber. Author

08

AIRCRAFT STABILITY AND CONTROL

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

A83-24031#
STABILITY OF STEADY SIDESLIP EQUILIBRIA FOR HIGH ALPHA
R. A CALICO, JR (USAF, Institute of Technology, Wright-Patterson AFB, OH) and S. G. FULLER (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Journal of Aircraft, vol. 20, Apr. 1983, p. 327-330 refs
(Previously cited in issue 21, p 3626, Accession no. A81-44576)

A83-24156#
TRIM TANK SYSTEM FOR OPTIMIZING DRAG AT THE CENTER OF GRAVITY [TRIMM TANK SYSTEM ZUM ERREICHEN WIDERSTANDSOPTIMALER SCHWERPUNKTSLAGEN]
H. HEIDMANN (Messerschmitt-Boelkow-Blohm GmbH, Hamburg, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 21 p In German
(DGLR PAPER 82-030)
A new concept for increasing performance capacity and economicality in existing and new versions of Airbus is discussed The system is characterized by an additional fuel tank in the horizontal stabilizers and elevators The tank increases the amount of available fuel and permits control of the center of gravity via fuel reserve pumping between the wings and the horizontal stabilizers and elevators, so that drag at the center of gravity is optimized. The concept was tested on an A310, and the main parameters, performance results, and economicality results are shown. Drag was decreased by 2-3 percent, lift was improved by 3-4 percent, and operational costs were reduced by 0.8-1.4 percent. C.D.

A83-24159#
INCREASING FLIGHT SAFETY UNDER SHEAR WIND CONDITIONS BY MODIFYING THRUST REGULATION SYSTEMS AND EXISTING COCKPIT INSTRUMENTATION [ERHOEHUNG DER FLUGSICHERHEIT BEI SCHERWINDANFLUEGEN DURCH MODIFIKATION VON SCHUBREGELUNGSSYSTEMEN UND BESTEHENDER COCKPIT-INSTRUMENTIERUNG]
R. KOENIG (Braunschweig, Technische Universitaet, Brunswick, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 25 p. In German. refs
(DGLR PAPER 82-033)
The results of a multiyear study on energy loss in aircraft due to shear winds with decreasing headwind and simultaneous tailwind are discussed. A warning function derived from the temporal variation in energy loss, which in turn can be attributed to the capacity loss, alerts the pilot to adjust the thrust. Indicators for capacity and energy loss in the instrument panel were favorably evaluated in simulation tests, and they improved flight control Automated flight with autopilot and autothrottle was evaluated as sufficiently safe, with the additional superimposition of energy and capacity loss indicators reducing the peril still further. C.D.

A83-24169
MANEUVER LOAD CONTROL FOR REDUCING THE DESIGN LOADS OF MODERN COMBAT AIRCRAFT [MANOEVERLASTREGELUNG ZUR REDUZIERUNG DER BEMESSUNGSLASTEN MODERNER KAMPFFLUGZEUGE]
H BALKE (Messerschmitt-Boelkow-Blohm GmbH, Bremen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 18 p. In German. refs
(DGLR PAPER 82-046)
Aspects of advanced control technology are becoming increasingly important in connection with the development of new aircraft. The German Federal Ministry of Defense has, therefore, sponsored a study which is concerned with the application of control techniques for the reduction of loads to which combat aircraft are subjected. The results of the study are to provide a basis for an interdisciplinary discussion. A cooperation of control specialists, structural experts, aerodynamicists, and propulsion experts is a vital requirement for an effective utilization of control techniques in connection with suitable aircraft design changes. Maneuver load control is concerned with the possibility to utilize the control surfaces for affecting the distribution of aerodynamic forces in such a way that the design loads become as small as possible. G R

A83-24170#
DESIGN AND IMPLEMENTATION OF AN ACTIVE LOAD ALLEVIATION SYSTEM, TAKING INTO ACCOUNT THE EXAMPLE OF A MODERN TRANSPORT AIRCRAFT [ENTWURF UND AUSLEGUNG EINES AKTIVEN LASTMINDERUNGSSYSTEMS AM BEISPIEL EINES MODERNEN TRANSPORTFLUGZEUGES]
G. BEUCK (Messerschmitt-Boelkow-Blohm GmbH, Hamburg, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 40 p. In German. Research supported by the Bundesministerium fuer Forschung und Technologie. refs
(DGLR PAPER 82-045)
In connection with the Advanced Control Transonic Transport Aircraft program sponsored by the Federal Ministry of Research and Technology of West Germany, a West German aerospace company has developed the technological basis for an aircraft with a load alleviation system. Possibilities regarding an application within the Airbus family are being considered. It is the objective of the new developments to reduce in the wing interior the structural stresses which are produced in connection with longitudinal maneuvers and vertical gusts. Such a reduction in the stress level would make it possible to obtain savings with respect to the required structural material, and the direct operating costs would be lowered. Attention is given to design criteria, a theoretical system model, control cycle structure and control laws, design objectives, parameter identifications, aircraft models and loads, the alleviation of gust loads, and the reduction of maneuver-related loads. G.R.

A83-24329#
THE CONSTRUCTION OF AUGMENTED TRACKING REGULATORS FOR PILOTING HIGHLY MANEUVERABLE AIRCRAFT [REALISATION DE REGULATEURS DE POURSUITE AMELIORES POUR LE PILOTAGE DES AVIONS A GRANDE MANOEUVRABILITE]
O. L. MERCIER (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (NATO, AGARD, Symposium on Advances in Guidance and Control Systems, Lisbon, Portugal, Oct. 12-15, 1982.) ONERA, TP no. 1982-118, 1982. 14 p. In French. refs
(ONERA, TP NO 1982-118)
A set of nonlinear laws are developed for multivariable control of highly maneuverable next-generation aircraft. The control laws are designed from the point of view of a servomechanism with a vector output variables regulated to continuously track preset commands. It is noted that in the conditions considered the processes are highly nonlinear, will vary throughout the flight envelope, and the control models will be subject multiple errors and variations. Additionally, external circumstances will be

continuously changing while low-frequency turbulence must be eliminated from the control considerations. Nonclassical, improved control laws are presented for incorporation into new fighter control logic The results of numerical simulations are provided to demonstrate the efficiency of the new control laws in comparison with classical control laws applied to highly maneuverable aircraft M.S.K

A83-24424
FLIGHT MANAGEMENT SYSTEMS AND DATA LINKS
T. W. HENDRICKSON (Boeing Commercial Airplane Co., Seattle, WA) Aeronautical Journal, vol. 87, Feb. 1983, p 52-67 refs

Digital avionics system in modern commercial jet aircraft are examined, using as examples systems on the 757 and 767 aircraft. Eight CRTs are provided in the cockpits of the two aircraft, six on the main instrument panel and two on the central console The central units are color coded and high-resolution, and provide graphic and alphanumeric data. The number of flight deck indicators is reduced by use of the CRTs that include engine condition displays which, in addition to all previous information, are color-coded to define the levels of attention demanded by particular situations. A flight management computer integrates navigation, flight planning, performance management, and three-dimensional guidance on the flight path. Data links with ground stations and elements of the flight management system (FMS) are accomplished through a series of ARINC data buses. Most software is written in HOL, while some of the FMS software is in PASCAL The benefits of future uses of floating point microprocessors are considered (Author)

A83-24427#
FAULT ISOLATION METHODOLOGY FOR THE L-1011 DIGITAL AVIONIC FLIGHT CONTROL SYSTEM
W. B. NOBLE (Hughes Aircraft Co., Fullerton, CA) (Digital Avionics Systems Conference, 4th, St Louis, MO, November 17-19, 1981, Collection of Technical Papers, p. 56-61.) Journal of Guidance, Control and Dynamics, vol. 6, Mar -Apr. 1983, p. 72-76. refs

(Previously cited in issue 03, p. 331, Accession no. A82-13458)

A83-24429#
A UNIFYING FRAMEWORK FOR LONGITUDINAL FLYING QUALITIES CRITERIA
R. F. STENGEL (Princeton University, Princeton, NJ) Journal of Guidance, Control and Dynamics, vol. 6, Mar.-Apr 1983, p. 84-90. refs
(Contract N62269-80-C-0720)

(Previously cited in issue 21, p. 3627, Accession no A81-44580)

A83-24434#
OBSERVERS AS NOISE FILTERS IN AN AUTOMATIC AIRCRAFT LANDING SYSTEM
C. L. PHILLIPS, E R. GRAF (Auburn University, Auburn, AL), S A. STARKS (Texas, University, Arlington, TX), and R. F. WILSON Journal of Guidance, Control and Dynamics, vol. 6, Mar.-Apr. 1983, p. 119, 120. refs
(Contract N00039-80-C-0032)

A Lueunberger observer is introduced to estimate the aircraft velocity as part of a proportional-integral-derivative controller for automatic aircraft landing systems. The velocity estimate is necessary in order to avoid unacceptable phase lag in the radar return signals received by a phased array antenna used in guiding the aircraft in. A third-order model approximated the ninth-order aircraft model normally used in the lateral control system in order to replace the second-order alpha-beta filter with a third-order observer. The model reduces the response of the system to radar noise while retaining a satisfactory response to wind and maintaining system stability. M.S.K.

A83-24436#
NONLINEAR FILTER FOR PILOT'S REMNANT ATTENUATION
G R. SARMA (National Aeronautical Laboratory, Bangalore, India) Journal of Guidance, Control and Dynamics, vol. 6, Mar.-Apr 1983, p 123, 124.

The configuration of a particular nonlinear filter which does not introduce any phase shift and has good attenuation characteristics is studied for possible applications in fly-by-wire pilot/aircraft systems. The filter generates a variable coefficient with which the pilot's output signal is multiplied before it is used for the control surface actuation Under no circumstances can there be any phase shift in the signal. In principle, the bandwidth can be made adaptive to suit a particular flight phase. A rolloff rate of 40 dB/dec can be easily obtained. The proposed filter was tested using a five degree-of-freedom, nonlinear aircraft model on an analog computer to simulate a typical high-wing single-engine aircraft. Test resuts with and without the filter are shown for a situation where the pilot is applying a step displacement localizer correction in a path-following task using an instrument landing system. C.D.

A83-24650
DELTA CANARD CONFIGURATION AT HIGH ANGLE OF ATTACK
W. KRAUS (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol 7, Jan.-Feb 1983, p. 41-46 refs

The use of delta canard configurations to extend the flight regime of fighter aircraft at low speeds up to high angles of attack beyond maximum lift is discussed. It is shown that configurational difficulties in the high angle of attack regime with respect to longitudinal characteristics, trimming, and control can be avoided if the stability margin is carefully chosen. The lateral stability can be satisfactorily improved with a special trim schedule, but directional stability is somewhat poor for angles of attack from 35 to 40 degrees. Spin susceptibility due to roll control input can be avoided at stall conditions by using yaw control. C.D.

A83-24815
MULTIVARIABLE STABILITY MARGINS FOR VEHICLE FLIGHT CONTROL SYSTEMS
N. R. SANDELL, JR., S. W. GULLY, W. H LEE, and N. A. LEHTOMAKI (Alphatech, Inc , Burlington, MA) In: Conference on Decision and Control, 20th, and Symposium on Adaptive Processes, San Diego, CA, December 16-18, 1981, Proceedings. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1981, p. 1479-1483. refs
(Contract N00014-80-C-0509)

The application of recently developed notions of multivariable stability margins to the analysis of vehicle flight control systems is illustrated. In particular, three designs are developed for the lateral axis dynamics of the CH47B helicopter, all of which satisfy classical design specifications. Two of the designs, however, exhibit extreme sensitivity to modeling errors that cannot be detected by measuring classical single-loop stability margins. These sensitivities are readily detected and studied by computing the new multivariable stability margins. C.R.

A83-24876#
SUBSONIC ROLLING MOMENTS FOR WING ROLL CONTROL OF A CRUCIFORM MISSILE MODEL
V. G. SEKARAN Journal of Spacecraft and Rockets, vol. 20, Mar -Apr. 1983, p 97, 98.

Experimental results from a determination of the contribution of the wing-tail interaction to roll controllability for a cruciform missile are reported. Wind tunnel tests on a model were performed at a freestream flow of 45.6 m/sec, at an Re of 328,000, over a wide range of angle of attack and wing deflection angles. A five-component internal strain gage balance was used for measurements of the model normal force, pitch, yaw, and roll moments, and side force. The rolling moment was found to increase with angle of attack for increasing vertical tail deflection, and decrease for increasing horizontal wing-pair deflection. The moment

also decreased in the presence of a tail, while motions of body- and wing-shed vortices increased the rolling moment. D H.K

A83-24879#
FLAT SPIN OF SLENDER BODIES AT HIGH ANGLES OF ATTACK
H. KUBOTA, I. ARAI, and M. MATSUZAKA (Tokyo, University, Tokyo, Japan) Journal of Spacecraft and Rockets, vol 20, Mar -Apr 1983, p. 108-114. refs
(Previously cited in issue 06, p. 813, Accession no. A82-17755)

A83-26477#
INTEGRATED FLIGHT PATH CONTROL SYSTEM [INTEGRIERTES FLUGBAHNFUEHRUNGSSYSTEM]
R. BROCKHAUS (Braunschweig, Technische Universitaet, Brunswick, West Germany) In: The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p 22-57. In German refs

The concept of an integrated flight path control system was developed in the Institute for Flight Control at Brunswick in West Germany. During the years from 1976 to 1981, the system was stepwise tested in connection with a large number of simulator and flight tests. The flight path control system has the objective to enable the pilot to employ complex approach procedures without being subjected to additional stresses in connection with the execution of the control maneuvers. Methods were devised for relieving the pilot of subordinate control tasks, and possibilities were investigated for utilizing the pilot in operations corresponding to a higher plane of flight path management. The results of these efforts is an integrated flight path control system, in which the pilot, in accordance with his wishes and the flight situation, can select the hierarchical plane in which he will play an active part as a component of the control process. G.R.

A83-26478#
STRUCTURE AND MODE OF OPERATION OF AN INTERACTIVE ONBOARD FOUR-DIMENSIONAL FLIGHT PATH CONTROL SYSTEM [STRUKTUR UND FUNKTIONSWEISE EINES INTERAKTIVEN BORDSEITIGEN 4-D-BAHNFUEHRUNGSSYSTEMS]
P. SUNDERMEYER (Braunschweig, Technische Universitaet, Brunswick, West Germany) In: The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p 58-95. In German. refs

The present investigation is concerned with the development of a flight path control system which makes possible an onboard interactive manipulation of the approach path with respect to three-dimensional geometrical coordinates and time as the fourth coordinate. A continuous flight path extrapolation provides the basis for implementing an approach route according to ATC directions. In addition, it is feasible to pilot the aircraft along the four-dimensional (4-D) approach path in accordance with different stages of automatization. The performance capability of the considered system is illustrated with the aid of the results of flight tests. Attention is given to the task to be performed by the 4-D flight path control system, the requirements for an onboard flight path management, the computation of a approach path, the principles of operation used for flight path extrapolation and aircraft control, the operational modes of the flight path control system, and flight path representation and 4-D surveillance indication in a map display. G.R.

A83-26483#
THE DESIGN OF WIND SHEAR FILTERS [AUSLEGUNG VON SCHERWINDFILTERN]
H. JOERCK (Braunschweig, Technische Universitaet, Brunswick, West Germany) In: The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p 261-276. In German.

A number of aircraft accidents have been caused by the effects of wind shear In connection with efforts to eliminate or reduce hazards leading to such accidents, the possibility has been considered to improve aircraft control systems. However, the effective implementation of the considered approaches will only be possible if suitable filters can be designed for a separation of gusts, which involve higher frequencies, from low-frequency wind shear components Filters of appropriate design should be suited for an employment in connection with all flight conditions. Feasible approaches for obtaining such filters are discussed. A survey is provided regarding the order of magnitude of the improvements which can be achieved, taking into account the performance characteristics of the A300 controller. G.R.

A83-26503
A DISCRETE TRACKING CONTROL LAW FOR NONLINEAR PLANTS
J. B. PLANT, Y. T. CHAN, and D. A REDMOND (Royal Military College of Canada, Kingston, Ontario, Canada) In: Control science and technology for the progress of society; Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981. Volume 1 Oxford, Pergamon Press, 1982, p. 55-60. refs

A method using simultaneous linearization and discretization of a continuous, nonlinear differential equation allows the development of a discrete tracking control law based on the quadratic criterion. The control law is made up of two parts. One produces a nominal trajectory and the other controls the plant to follow the nominal trajectory. Simulation results from an aircraft stall recovery problem show that the controller can provide a larger range of stall recovery, as compared to the nonlinear controller in Garrard (1977). (Author)

A83-26544
STOCHASTIC CONTROL AND IDENTIFICATION ENHANCEMENT FOR THE FLUTTER SUPPRESSION PROBLEM
Y. BAR-SHALOM and J. MOLUSIS (Connecticut, University, Storrs, CT) In: Control science and technology for the progress of society; Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981. Volume 2. Oxford, Pergamon Press, 1982, p. 845-850. refs
(Contract AF-AFOSR-80-0098)

The topic of this paper is the application of some recent results in stochastic control to an aerospace problem where there are large uncertainties in the dynamics of the plant to be controlled. An approximation to the stochastic Dynamic Programming is considered that results in an adaptive control of the 'closed-loop' type: it utilizes feedback (latest state and parameter estimates and their uncertainties) as well as their anticipated future uncertainties - it anticipates (subject to causality) subsequent feedback. This algorithm has the feature that allows the control to enhance the parameter identification in real time. This is done using the control's dual effect: the control can affect the state as well as the (augmented) state uncertainty and thus can reduce the uncertainty about some parameters. A flight control application in which stochastic adaptive adaptive control appears to offer significant payoff is the active control of aircraft wing-store flutter. Improved flutter suppression can be accomplished with an adaptive controller that has the capability to learn and identify the flutter modes during the flight. (Author)

A83-26559
SYNTHESIS OF C [ASTERISK]
K. KANAI, T DEGAWA (Defense Academy, Dept. of Aeronautical Engineering, Yokosuka, Japan), P. N NIKIFORUK, and M M GUPTA (Saskatchewan, University, Saskatoon, Canada) In: Control science and technology for the progress of society; Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981 Volume 2. Oxford, Pergamon Press, 1982, p. 1027-1033.

This paper deals with the problem of designing a model-reference-adaptive flight controller with an observer for a linear dynamic flight system using only the input and output data The adaptive flight controller is synthesized such that the tracking error between the output of the short-period motion which combines a normal acceleration signal and a pitch rate signal, and that of a C(asterisk)-model, is regulated to zero, and the adaptive observer which is constructed by introducing unknown initial states into the recursive algorithm is employed to estimate parameters and state variables simultaneously. The computational results for a typical high performance aircraft are presented to demonstrate the effectiveness of the proposed scheme. (Author)

A83-26600
DEVELOPMENT OF ADAPTATION AND IDENTIFICATION ALGORITHMS IN ADAPTIVE DIGITAL AIRCRAFT CONTROL SYSTEMS
V D. BELONOGOV, E. D. TERIAEV, V. A. FURSOV, and B. M. SHAMRIKOV (Moskovskii Aviatsionnyi Institut, Moscow, USSR) In: Control science and technology for the progress of society; Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981. Volume 4. Part B Oxford, Pergamon Press, 1982, p. 2343-2347 refs

It is pointed out that adaptive digital control systems (ADCSs) for maneuverable aircraft that reflect combined adaptive control result in systems that employ logical adaptation. The structure and parameters of the digital control algorithms in the main loop are periodically readjusted during the flight by means of a two-level scheme. The block of identification algorithms includes algorithms for estimating the dynamic responses of the aircraft and for the functional monitoring of confident identification. The effectiveness of this approach to the design of aircraft ADCSs is illustrated by simulating the manual control of longitudinal flight. C R.

A83-26601
MULTIVARIABLE APPROACH TO THE PROBLEM OF STRUCTURAL CROSS COUPLING OF FORCE FEEDBACK ELECTROHYDRAULIC ACTUATORS
M. J. POPOV (Beograd, Univerzitet, Belgrade, Yugoslavia) In: Control science and technology for the progress of society; Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981. Volume 4. Part B. Oxford, Pergamon Press, 1982, p 2349-2355 refs

A loading system for the structural testing of aircraft and their components is developed which obtains the necessary structural loading in points of interest on the basis of the influence coefficients and the measured values of the external actuator forces. It is shown that the problem of structural cross coupling of load feedback actuators must be considered as a multivariable problem. By means of state feedback, the closed-loop transfer function of the actuator is reduced to approximately 1/s over the frequency domain of interest up to the lowest structural mode frequency. The stability of the complete loading system with a feedback controller is analyzed using this approximation It is found that the loading system has stable behavior if the flexibility and stiffness matrices of the structural system to be tested are nonsingular N.B.

A83-26603
SELF-TUNING FLY-BY-WIRE CONTROL SYSTEM
R. M. C. DE KEYSER and A VAN CAUWENBERGHE (Gent, Rijksuniversiteit, Ghent, Belgium) In: Control science and technology for the progress of society, Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981. Volume 4. Part B. Oxford, Pergamon Press, 1982, p. 2363-2370 refs

Several self-tuning control algorithms are applied to control the lateral motion dynamics of an aircraft. A comparison is made with the results obtained with a classical three-term controller. The aircraft dynamics are strongly time-variant due to the dependence on the aerodynamic properties of the air which change with altitude and velocity. Consequently this system is an excellent test-medium for the evaluation of adaptive controllers. The self-tuning controllers are obtained with one algorithm in which a number of design parameters can be altered. The algorithm is based on the combination of a self-tuning predictor and a feedforward-feedback regulator with feedforward from the pilot input and feedback from the predicted system output. This leads to an adaptive controller with direct estimation of the control parameters. (Author)

A83-26604* Virginia Polytechnic Inst. and State Univ., Blacksburg.
ALTITUDE TRANSITIONS IN ENERGY CLIMBS
A. R. WESTON, E. M. CLIFF, and H. J KELLEY (Virginia Polytechnic Institute and State University, Blacksburg, VA) In: Control science and technology for the progress of society; Proceedings of the Eighth Triennial World Congress, Kyoto, Japan, August 24-28, 1981 Volume 4 Part B Oxford, Pergamon Press, 1982, p. 2371-2375. refs
(Contract NAGI-52)

The aircraft energy-climb trajectory for configurations with a sharp transonic drag rise is well known to possess two branches in the altitude/Mach-number plane. Transition in altitude between the two branches occurs instantaneously, a 'corner' in the minimum-time solution obtained with the energy-state model. If the initial and final values of altitude do not lie on the energy-climb trajectory, then additional jumps (crude approximations to dives and zooms) are required at the initial and terminal points With a singular-perturbation approach, a 'boundary-layer' correction is obtained for each altitude jump, the transonic jump being a so-called 'internal' boundary layer, different in character from the initial and terminal layers The determination of this internal boundary layer is examined and some computational results for an example presented. (Author)

A83-26762#
STUDY ON LONGITUDINAL DYNAMIC CHARACTERISTICS OF PILOT-AIRPLANE SYSTEM - APPROACH TO THE METHOD FOR STUDYING PIO PROBLEM
T CHEN and C. LI (Air Force College of Engineering, People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol. 3, Dec. 1982, p. 12-20. In Chinese, with abstract in English. refs

A technique for studying pilot-induced oscillation (PIO) was developed, and a dynamic structure diagram and an analog structure diagram for the longitudinal motion of pilot-control-airframe with nonlinearity was devised. Computer calculations were also performed for the moment arm at a normal state, in a trouble state without pilot correction, and for a fighter flying at low altitude at high speed. The calculations were compared with actual flight data and good agreement was shown. It was also found that longitudinal oscillation with large amplitude in low-level high-speed flight is a PIO. M.S.K.

N83-18743# National Aerospace Lab, Tokyo (Japan). First Airframe Div

NUMERICAL SIMULATION OF TRANSONIC FLUTTER OF A SUPERCRITICAL WING

K. ISOGAI and K. SUETSUGU (Facom-Hitach, Inc.) Aug. 1982 34 p refs

(NAL-TR-726T; ISSN-0389-4010) Avail: NTIS HC A03/MF A01

The time marching three-dimensional unsteady transonic full potential code USTF3 is applied to the prediction of the flutter boundary of a supercritical wing for which reliable experimental data exist. The governing flow equation and the structural equations are integrated simultaneously to obtain the time dependent aeroelastic response of the wing The transonic dip of the flutter boundary is predicted by the present calculations but at about 0.05 Mach number lower than that of the experiment. Expect this, the flutter dynamic pressures and the flutter frequencies predicted by the present calculations show close agreement with those observed in the experiment. The behavior of the unsteady pressure distributions on the supercritical wing oscillating in pitch are also examined in detail. Author

N83-18744*# Integrated Systems, Inc., Palo Alto, Calif.

FLIGHT TEST TRAJECTORY CONTROL ANALYSIS Final Report

R. WALKER and N. GUPTA Feb 1983 138 p refs

(Contract NAS4-2906)

(NASA-CR-170395, NAS 1.26 170395; ISI-16) Avail NTIS HC A07/MF A01 CSCL 01C

Recent extensions to optimal control theory applied to meaningful linear models with sufficiently flexible software tools provide powerful techniques for designing flight test trajectory controllers (FTTCs) This report describes the principal steps for systematic development of flight trajectory controllers, which can be summarized as planning, modeling, designing, and validating a trajectory controller. The techniques have been kept as general as possible and should apply to a wide range of problems where quantities must be computed and displayed to a pilot to improve pilot effectiveness and to reduce workload and fatigue. To illustrate the approach, a detailed trajectory guidance law is developed and demonstrated for the F-15 aircraft flying the zoom-and-pushover maneuver. Author

N83-18745*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OPTIMAL FEEDBACK STRATEGIES FOR PURSUIT-EVASION AND INTERCEPTION IN A PLANE

N. RAJAN (NAS-NRC, Washington, D.C.) and M. D. ARDEMA Feb. 1983 34 p refs

(NASA-TM-84311; A-9177; NAS 1 15:84311) Avail: NTIS HC A03/MF A01 CSCL 01C

Variable-speed pursuit-evasion and interception for two aircraft moving in a horizontal plane are analyzed in terms of a coordinate frame fixed in the plane at termination. Each participant's optimal motion can be represented by extremal trajectory maps. These maps are used to discuss sub-optimal approximations that are independent of the other participant. A method of constructing sections of the barrier, dispersal, and control-level surfaces and thus determining feedback strategies is described. Some examples are shown for pursuit-evasion and the minimum-time interception of a straight-flying target. Author

N83-18746# Messerschmitt-Boelkow-Blohm G.m.b.H, Ottobrunn (West Germany).

DEVELOPMENT AND FLIGHT TEST OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM FOR THE F-4F WITH STORES. PART 1: DESIGN OF THE ACTIVE FLUTTER SUPPRESSION SYSTEM Final Report, Apr. 1977 - Mar. 1979

H HONLINGER, D. MUSSMAN, R. MANSER, and L. J. HUTTSELL (AFWAL) Wright-Patterson AFB, Ohio AFWAL Sep. 1982 91 p refs

(Contract AF PROJ. 2401)

(AD-A121485, AFWAL-TR-82-3040-PT-1) Avail: NTIS HC A05/MF A01 CSCL 20D

Extensive research programs have been conducted at MBB and at AFWAL to investigate the application of active controls for the suppression of wing/store flutter A flutter suppression system was developed and flight tested on an F-4F aircraft. The control law was designed by MBB using optimal control theory to minimize the control surface motion and to provide the required stability margins. During the test it was found that the dynamic behavior of the wing-pylon-store changed considerably with excitation amplitude due to free play and preload. The active flutter suppression system worked well and provided an increase in flutter speed. Author (GRA)

N83-19756*# Old Dominion Univ, Norfolk, Va. School of Mechanical Engineering and Mechanics.

FLUTTER: A FINITE ELEMENT PROGRAM FOR AERODYNAMIC INSTABILITY ANALYSIS OF GENERAL SHELLS OF REVOLUTION WITH THERMAL PRESTRESS Final Report, period ending 30 Sep. 1982

D. J. FALLON and E A. THORNTON Mar 1983 18 p refs

(Contract NSG-1167)

(NASA-CR-170013; NAS 1.26:170013) Avail: NTIS HC A02/MF A01 CSCL 01C

Documentation for the computer program FLUTTER is presented The theory of aerodynamic instability with thermal prestress is discussed. Theoretical aspects of the finite element matrices required in the aerodynamic instability analysis are also discussed. General organization of the computer program is explained, and instructions are then presented for the execution of the program. S.L.

N83-19757*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HIGH-ANGLE-OF-ATTACK STABILITY CHARACTERISTICS OF A 3-SURFACE FIGHTER CONFIGURATION

S. B. GRAFTON, M. A. CROOM, and L T. NGUYEN Mar. 1983 60 p refs

(NASA-TM-84584; L-15551; NAS 1.15 84584) Avail: NTIS HC A04/MF A01 CSCL 01C

A wind tunnel investigation was conducted to study the low speed, high angle of attack stability characteristics of a three surface fighter concept based on the F-15 configuration. Static force data were measured over angle of attack and side-slip ranges of 0 to 85 and -10 and 10 deg, respectively. A force oscillation technique was used to obtain dynamic derivatives at angles of attack from 0 to 60 deg. The tests were conducted for several canard deflections and with the canards removed to investigate the effects of the close coupled canard on the high angle of attack stability characteristics of the configuration. A fuselage strake was developed which significantly improved static lateral directional stability characteristics at high angles of attack while also increasing the maximum lift of the configuration. Author

N83-19758*# George Washington Univ, Hampton, Va.

DETERMINATION OF AIRPLANE MODEL STRUCTURE FROM FLIGHT DATA USING SPLINES AND STEPWISE REGRESSION

V. KLEIN (George Washington Univ., Hampton, Va.) and J. G. BATTERSON Mar. 1983 52 p refs

(NASA-TP-2126; L-15541; NAS 1.60:2126) Avail: NTIS HC A04/MF A01 CSCL 01C

A procedure for the determination of airplane model structure from flight data is presented. The model is based on a polynomial

spline representation of the aerodynamic coefficients, and the procedure is implemented by use of a stepwise regression. First, a form of the aerodynamic force and moment coefficients amenable to the utilization of splines is developed. Next, expressions for the splines in one and two variables are introduced. Then the steps in the determination of an aerodynamic model structure and the estimation of parameters are discussed briefly. The focus is on the application to flight data of the techniques developed.

Author

N83-19759# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio Flight Dynamics Lab.

DESIGN CRITERIA FOR THE FUTURE OF FLIGHT CONTROLS Interim Report, Mar. 1980 - Mar. 1982

S. G. FULLER, comp. and D. W. POTTS, comp. Jul 1982 722 p Proc. of the Flight Dyn. Lab. Flying Qualities and Flight Control Symp., Dayton, Ohio, 2-5 Mar. 1982

(Contract AF PROJ 2403)

(AD-A121423; AFWAL-TR-82-3064) Avail: NTIS HC A99/MF A01 CSCL 01B

Proceedings are reported of a symposium held in Dayton, sponsored by the Flight Dynamics Laboratory during 2-5 March 1982. The symposium was planned and ran by the Flight Control Division, specifically the Flying Qualities Group and the Control Techniques Group as part of an ongoing effort to revise and upgrade both MIL-F-8785C, Military Specification, Flying Qualities of Piloted Airplanes, and MIL-F-9490D, Flight Control System-Design, Installation and Test of Piloted Aircraft, General Specification For Specialists from both the flying qualities and flight control system disciplines were gathered in Dayton from both industry and government agencies. Formal and informal presentations, plus workshop discussions, were structured around proposed draft versions of the new Flying Qualities MIL-Standard and Handbook and the new Flight Control Systems MIL-Specification and Handbook. This report contains a record of the presentations and discussions as submitted by the individual authors. GRA

N83-19760# Aircraft Research and Development Unit, Edinburg (Australia). Aircraft Research and Development Unit.

EVALUATION OF IROQUOIS UH-1B STABILITY AND CONTROL

L R. WARD Sep. 1982 57 p refs

(AD-A122302; ARDU-TI-783) Avail: NTIS HC A04/MF A01 CSCL 01C

The purpose of this investigation was to evaluate the forward flying qualities of the Iroquois UH-1B helicopter for the Training and SAR missions as conducted by the Royal Australian Air Force. Several unsatisfactory handling characteristics were identified. Highly undesirable features included the rapidly divergent longitudinal long term response in maximum power climbs; excessive vibration levels; coupling of sideslip to pitching moments; excessive trim changes when transitioning from climb to descent; and non-linearities in the collective fixed static longitudinal stability gradients in maximum power climbs Undesirable features included the level flight gust response; longitudinal control response in level flight; lateral-directional oscillation; and adverse yaw. Possible causes of the extremely divergent longitudinal long term response in high powered climbs and the sideslip-pitch coupling are discussed. GRA

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RESEARCH AND SUPPORT FACILITIES (AIR)

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

A83-23676#

THE NEW HYDRODYNAMIC VISUALIZATION LABORATORY OF THE AERODYNAMICS DIVISION

H. WERLE and M. GALLON (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) La Recherche Aerospatiale (English Edition), no. 5, 1982, p. 1-23. refs

The characteristics and test procedures for the recently installed ONERA water tunnel and static tests tank at Chatillon are described, together with sample visualizations acquired with the new equipment. The water tunnel is intended for studying low-speed flows, and operates, as do the first tunnel and the static tank, with vertical feed and no return circuit. The new TH2 has a 6600 l reservoir and a high contraction coefficient convergent aperture, as well as a normal and high speed exit circuits, both equipped for instantaneous flow rate measurements. The static tests tank has a 2000 l reservoir Control for the tanks and instrumentation are centralized. The tanks can be used for testing air intakes, jets, and motorized models. The circuits are fitted with apparatus for streakline dyes, air bubble emulsifiers, and Fresnel lens projectors for air bubble visualization Samples of profile flows, vortex breakdown, and separation on ellipsoids are presented.

M.S.K.

A83-24173#

THE GERMAN-DUTCH WIND TUNNEL AS AN AID IN AIRCRAFT DEVELOPMENT [DER DEUTSCH-NIEDERLAENDISCHE WINDKANAL ALS HILFSMITTEL DER FLUGZEUGENTWICKLUNG]

D ECKERT (Duits-Nederlandse Windtunnel, Emmeloord, Netherlands) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 14 p In German. refs

(DGLR PAPER 82-050)

Aerodynamic advances with respect to civil aircraft design are primarily evaluated on the basis of the amount of drag and noise emission which has to be tolerated in connection with the satisfaction of given flight performance requirements. A wide spectrum of supplementary theoretical numerical and experimental methods is used by the aircraft designer The large wind tunnel plays, in this connection, a vital role for experimental tests at subsonic speeds A description is presented of the methods and the equipment which are used in the German-Dutch wind tunnel to provide the data for modern aircraft design. The conduction of aerodynamic measurements is discussed, taking into account simulation quality and measurement accuracy. The performance of aeroacoustic measurements is also considered. G.R.

A83-25766

A HYBRID FACILITY FOR THE SIMULATION, DEVELOPMENT, AND VALIDATION OF ECS MICROPROCESSOR BASED CONTROLS

B. N EMDE and A. J. P. LLOYD (Boeing Commercial Airplane Co., Systems Research Group, Seattle, WA) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 12th, San Diego, CA, July 19-21, 1982, SAE 9 p

(SAE PAPER 820867)

This paper presents an overview of digital microprocessor-based Environmental Control System (ECS) controller development and validation at Boeing. The application of a hybrid computer simulation laboratory to the development of real-time simulation capability for ECS is described. The approach used to develop microprocessor-based ECS controllers is illustrated by describing the steps which led to the implementation of a fully automatic

cabin pressure control system. The approach to validating ECS digital controllers is also discussed. (Author)

A83-26127
REVIEW OF SHOCK TUBE AND SHOCK TUNNEL ADVANCEMENTS AT NAL
K. SOGA and I. WADA (National Aerospace Laboratory, Tokyo, Japan) In: Shock tubes and waves; Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981 Albany, NY, State University of New York Press, 1982, p. 21-31. refs

The Shock Tube Research Group of the Japanese National Aerospace Laboratory has since its organization in 1960 studied the aerodynamic problems of high altitude hypersonic flight by means of a shock tunnel, electrically heated shock tubes, and a gun tunnel. Attention is presently given to a novel short duration wind tunnel operational method which employs a large orifice plate and high speed valves. The method's application to the gun tunnel has yielded experimental results which demonstrate that the obviation of the standard piston, and the use of high speed valves to replace the conventional diaphragms, can result not only in the elimination of flow dust contamination, but also in the reduction of tunnel reset time O C.

A83-26128
CURRENT STUDIES AT CALSPAN UTILIZING SHORT-DURATION FLOW TECHNIQUES
M. G. DUNN (Calspan Advanced Technology Center, Buffalo, NY) In Shock tubes and waves; Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p. 32-40. refs

A brief review of current shock-wave related research projects within the Aerodynamic Research Department at the Calspan Corporation is given. The subject areas discussed are divided into three basic groups: (1) application of conventional shock-tube/shock-tunnel techniques to obtain heat-flux distributions on flight vehicles, to study transonic shock/boundary-layer interactions, and to obtain rate-coefficient measurements; (2) relatively new applications of established shock-tube/shock-tunnel techniques; and (3) discussion of new techniques specifically developed to improve the accuracy of shock-tunnel simulations. (Author)

A83-26130
A SHOCK TUBE DRIVER WITH A 'CYCLONE' SEPARATOR
R. J. STALKER (Queensland, University, Brisbane, Australia) and R. P. FRENCH (Australian National University, Canberra, Australia) In: Shock tubes and waves; Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p 81-88. Research supported by the Australian Research Grants Committee. refs

Shock tube operation is experimentally investigated for the case of the 'cyclone' effect's use to separate diaphragm fragments from the driver gas, which is injected into the shock tube at right angles to the axis and with a circumferential velocity component. This technique reduces model and test section damage and therefore extends the shock tube's experimental versatility. Shock speeds were increased up to values of 16 km/sec at high diaphragm pressure ratios. Satisfactory shock wave-contact surface separation was maintained despite the circumferential motion of the driver gas. O.C

A83-26131
A NEW, DIAPHRAGMLESS, FLEXIBLE, LUMINOUS SHOCK TUBE
Y. W. KIM (Lehigh University, Bethlehem, PA) In. Shock tubes and waves; Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p. 89-97.

The present pressure-driven shock tube uses a spring-loaded ball valve rather than a diaphragm, and a rigid driver section is used to simultaneously generate shock waves in one or more flexible driven sections. Luminous shocks have been successfully produced in air, argon and xenon, for tubing internal diameters as small as 1.78 mm and length/radius aspect ratio values of over 1000. In addition, it is found that the arbitrary bending of the tubing, with curvature radii as small as 10 tube radii, does not measurably degrade shock tube performance A large portion of the driver gas is recovered after each shot, and the driven section remains free of contamination from exposure to either diaphrams or the atmosphere, making this shock tube well suited for quantitative spectroscopic applications. O.C.

A83-26132
A POWDER-INJECTION SHOCK-TUBE FACILITY
M. W. P. CANN, J. B. SHIN, and R. W. NICHOLLS (York University, Downsview, Ontario, Canada) In: Shock tubes and waves; Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p. 98-106. Research supported by the National Research Council of Canada, Defence Research Board of Canada, and Natural Sciences and Engineering Research Council of Canada.

A conventional, pressure-driven shock tube has been modified to provide the powder-injection capability needed for the volatilizing of powders in spectroscopic studies of molecules. Experimental reproducibility from one run to the next was improved through the automation and timing of the injection and firing sequence. Additional features incorporated include safety checks, a monitor to reduce human errors during experiment preparation, and a range of operating options which includes manual or automatic modes with one or two diaphragms, operation overrides, sequence interrupt on the external trigger, and remote operation and reset features. O.C.

A83-26133
THE TESTING IN BIA HYPERSONIC GUN TUNNEL
F. G. ZHUANG, M. X. ZHAO, B. P HE, and X. J. XU (Beijing Institute of Aerodynamics, Beijing, People's Republic of China) In· Shock tubes and waves; Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p. 107-115. refs

The Beijing Institute of Aerodynamics hypersonic gun tunnel is capable of test Mach numbers in the 8-15 range, and test Reynolds numbers of 1 9-26 million/m. The tunnel is equipped with a three-component semiconductor strain gage balance, piezoelectric and strain gage pressure transducers, thermocouple calorimeters, thin film platinum resistance thermometers, a schlieren system, and a high speed drum camera. This equipment suite allows the measurement of forces, pressures, heat transfer, and temperature distributions on a static model, as well as free flight tests and flow visualization. Representative experimental results are presented for a 10-deg semiapex angle cone, and the heat-transfer distribution on a hemisphere-cylinder model. O.C.

N83-18748*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CRYOGENIC WIND TUNNEL MODELS. DESIGN AND FABRICATION
C. P. YOUNG, JR., comp. and B. B. GLOSS, comp. Mar. 1983 254 p refs Proc of workshop held in Hampton, Va., 5-9 May 1982
(NASA-CP-2262; L-15567; NAS 1.55:2262) Avail: NTIS HC A12/MF A01 CSCL 14B

The principal motivating factor was the National Transonic Facility (NTF). Since the NTF can achieve significantly higher Reynolds numbers at transonic speeds than other wind tunnels in the world, and will therefore occupy a unique position among ground test facilities, every effort is being made to ensure that model design and fabrication technology exists to allow researchers to take advantage of this high Reynolds number capability. Since a great deal of experience in designing and fabricating cryogenic wind tunnel models does not exist, and since the experience that does exist is scattered over a number of organizations, there is a need to bring existing experience in these areas together and

share it among all interested parties. Representatives from government, the airframe industry, and universities are included.

N83-18749*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
MODEL SYSTEMS CRITERIA
C. P. YOUNG, JR *In its* Cryogenic Wind Tunnel Models p 11-17 Mar. 1983
Avail NTIS HC A12/MF A01 CSCL 14B

Design criteria were developed specifically for model systems to be tested at high Reynolds number in a cryogenic environment. More specifically, the criteria are aimed at identifying those special requirements and alternate criteria for utilizing the high Reynolds number facility (the National Transonic Facility). Author

N83-18750*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NTF USER OPERATIONS REQUIREMENTS
D. E. FULLER *In its* Cryogenic Wind Tunnel Models p 19-30 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

A procedure to be followed for a model to be accepted for testing in the NTF is outlined. Planning meeting; pre-test conference; model receipts, assembly, and checkout; and model installation and test are discussed. Author

N83-18753*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL METHODS WITH APPLICATION TO THE PATHFINDER 1 MODEL
W. F. HUNTER *In its* Cryogenic Wind Tunnel Models p 47-61 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

Thermal and stress analyses, elastic math models, verification testing, deformation and aeroelastic analyses, and integrated computer programs are addressed. Author

N83-18754*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATUS OF NTF MODELS
J. F. BRADSHAW *In its* Cryogenic Wind Tunnel Models p 63-81 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

Eight wind tunnel models to be tested in the National Transonic Facility are discussed Author

N83-18755*# Lockheed-Georgia Co., Marietta.
LANN WING DESIGN
G. C. FIRTH *In* NASA. Langley Research Center Cryogenic Wind Tunnel Models p 83-85 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

The LANN wing is the result of a joint effort between Lockheed, the Air Force, NASA, and the Netherlands to measure unsteady pressures at transonic speeds It is a moderate-aspect-ratio transport wing configuration. The wing was machined from NITRONIC 40 and has 12 percent thick supercritical airfoil sections. Author

N83-18756*# Grumman Aerospace Corp , Bethpage, N Y.
NTF MODEL CONCEPT FOR THE X-29A. PART 1: REQUIREMENTS, GUIDELINES, AND DESIGN LOADS
G. DAFORNO *In* NASA. Langley Research Center Cryogenic Wind Tunnel Models p 91-102 Mar 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

A few Charpy samples containing a transverse EB weld at the V-notch location were produced Three tensile specimens containing a transverse weld were also produced. These samples were tested at cryogenic temperatures. The welded Charpy samples resulted in average impact values of 20 ft-lb. This average value is as good as the NASA test samples with the base metal The tensile specimens broke at slightly higher loads than had been calculated. The Charpy specimens did not come up to the prescribed level of 25 ft-lb. The results of the specimen tests are presented. Author

N83-18757*# Grumman Aerospace Corp., Bethpage, N.Y.
NTF MODEL CONCEPT FOR THE X-29A. PART 2: DESIGN AND FABRICATION CONCEPT
G. TOSCANO *In* NASA Langley Research Center Cryogenic Wind Tunnel Models p 103-113 Mar. 1983
Avail NTIS HC A12/MF A01 CSCL 14B

The first concept was done to determine if a small model to fit the NASA Langley sizing criteria could accommodate aerodynamic and mechanical requirements. For a model wing span of 1.7 ft (and a length of 3 ft), the model is 6 25 percent (1/16 scale). The results were encouraging enough for Grumman to request, in early December 1981, that the design concept be refined at NASA Langley, where up-to-date cryogenic model design information was available. This working session was completed by a Grumman designer by mid-December. In its present form, the concept will be the basis for any continued effort. Author

N83-18758*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ENGINEERING AND FABRICATION COST CONSIDERATIONS FOR CRYOGENIC WIND TUNNEL MODELS
R. M. BOYKIN, JR. and J B. DAVENPORT, JR. *In its* Cryogenic Wind Tunnel Models p 129-137 Mar 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

Design and fabrication cost drivers for cryogenic transonic wind tunnel models are defined. The major cost factors for wind tunnel models are model complexity, tolerances, surface finishes, materials, material validation, and model inspection The cryogenic temperatures require the use of materials with relatively high fracture toughness but at the same time high strength. Some of these materials are very difficult to machine, requiring extensive machine hours which can add significantly to the manufacturing costs. Some additional engineering costs are incurred to certify the materials through mechanical tests and nondestructive evaluation techniques, which are not normally required with conventional models. When instrumentation such as accelerometers and electronically scanned pressure modules is required, temperature control of these devices needs to be incorporated into the design, which requires added effort. Additional thermal analyses and subsystem tests may be necessary, which also adds to the design costs. The largest driver to the design costs is potentially the additional static and dynamic analyses required to insure structural integrity of the model and support system. M.G.

N83-18759*# Southampton Univ. (England).
DIMENSIONAL STABILITY CONSIDERATIONS FOR CRYOGENIC METALS
D. WIGLEY *In* NASA. Langley Research Center Cryogenic Wind Tunnel Models p 139-143 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

Work performed as part of an effort to identify, and where possible separate out, some of the factors that contribute to dimensional stability in cryogenic wind tunnel models is reported. Initial problems were encountered with two dimensional models made of 15-5 PH stainless steel, which warped significantly after being subjected to cryogenic testing in the 0.3 Meter Transonic Cryogenic Tunnel. Subsequently, an effort was undertaken to investigate the mechanisms that could cause model warpage during cryogenic testing. The two basic mechanisms that can lead to warpage are (1) metallurgical structural instability in which one phase transforms partially or fully into a second phase which has a different crystal structure and volume, and (2) deformation due to the creation, or relief, of unbalanced induced or residual stresses. In the case of the 15-5 PH airfoils, it is highly probable that metallurgical instability was responsible for most of the observed warpage. A particular specimen configuration was established for use in the systematic evaluation of the factors influencing warpage. Preliminary studies of a specimen made of VASCOMAX 200 suggest the possibility of manipulating the stresses in the surface layers by appropriate combinations of milling and grinding steps. This opens up the possibility of correcting or establishing the required surface profile of an airfoil. M.G.

N83-18760*# Lockheed-Georgia Co , Marietta
METALLIC ALLOY STABILITY STUDIES
G. C. FIRTH *In* NASA. Langley Research Center Cryogenic Wind Tunnel Models p 145-153 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

The dimensional stability of candidate cryogenic wind tunnel model materials was investigated. Flat specimens of candidate materials were fabricated and cryo-cycled to assess relative dimensional stability Existing 2-dimensional airfoil models as well as models in various stages of manufacture were also cryo-cycled The tests indicate that 18 Ni maraging steel offers the greatest dimensional stability and that PH 13-8 Mo stainless steel is the most stable of the stainless steels. Dimensional stability is influenced primarily by metallurgical transformations (austenitic to martensitic) and manufacturing-induced stresses. These factors can be minimized by utilization of stable alloys, refinement of existing manufacturing techniques, and incorporation of new manufacturing technologies. M.G.

N83-18765*# National Bureau of Standards, Washington, D.C.
SURFACE FINISH MEASUREMENT STUDIES
E. C. TEAGUE *In* NASA. Langley Research Center Cryogenic Wind Tunnel Models p 205-214 Mar. 1983 refs
Avail. NTIS HC A12/MF A01 CSCL 14B

The performance of stylus instruments for measuring the topography of National Transonic Facility (NTF) model surfaces both for monitoring during fabrication and as an absolute measurement of topography was evaluated. It was found that the shop-grade instruments can damage the surface of models and that their use for monitoring fabrication procedures can lead to surface finishes that are substantially out of range in critical areas of the leading edges. The development of a prototype light-scattering instrument which would allow for rapid assessment of the surface finish of a model is also discussed. M.G.

N83-18766*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRAIN GAGE BALANCES AND BUFFET GAGES
A. T. FERRIS *In its* Cryogenic Wind Tunnel Models p 215-225 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

One-piece strain gage force balances were developed for use in the National Transonic Facility (NTF). This was accomplished by studying the effects of the cryogenic environment on materials, strain gages, cements, solders, and moisture proofing agents, and selecting those that minimized strain gage output changes due to temperature. In addition, because of the higher loads that may be imposed by the NTF, these balances are designed to carry a larger load for a given diameter than conventional balances. Full cryogenic calibrations were accomplished, and wind tunnel results that were obtained from the Langley 0-3-Meter Transonic Cryogenic Tunnel were used to verify laboratory test results. M.G.

N83-18767*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MODEL DEFORMATION SYSTEM
H. K. HOLMES *In its* Cryogenic Wind Tunnel Models p 227-232 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

The development of a system to measure model deflections encountered in the National Transonic Facility is discussed. The goal is to be able to measure peak deflections of up to 3 in. with accuracies to within 0.0025 in. over an area 1 m square as the model pitches through an included angle of 30 deg. Stereophotogrammetric techniques are being implemented, with the initial system being an extension of standard techniques. A second system, which will be all electronic, is under development. Both techniques require targets to be strategically placed on the model. Active targets are being developed for location in the model in order to maximize the signal-to-noise ratio and to approximate a point source. Image processing techniques and stereophotogrammetric data reduction programs are being implemented to perform the data reduction tasks. M.G.

N83-18768*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NTF MODEL PRESSURE MEASUREMENTS
F. A. KERN *In its* Cryogenic Wind Tunnel Models p 233-243 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

Pressure measurements on the National Transonic Facility models will be made using electronically scanned pressure instrumentation. The system consists of pressure modules, a pressure calibration standard, and a system controller. The pressure modules, which must be operated above -18 C, will be housed in model-integrated designed thermally controlled containers. The Pathfinder 1 192-channel pressure package is described. Recent and planned developments to reduce the pressure module's volume per channel ratio are discussed, including the 48-channel module and a proposed 32-channel module that would be 2.54 by 2.54 by 8.13 cm. Pressure transducers capable of operating at cryogenic temperatures for dynamic and static pressure measurements are discussed. M G.

N83-18769*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va
ANGLE OF ATTACK SYSTEM
T. D. FINLEY *In its* Cryogenic Wind Tunnel Models p 245-256 Mar 1983
Avail: NTIS HC A12/MF A01 CSCL 14B

The development of systems for measuring model pitch and roll attitude in the National Transonic Facility (NTF) is discussed. The effort is divided between two approaches: (1) an inertial measurement that is an extrapolation of existing technology into a cryogenic environment, and (2) an optical technique based on a holographic angle sensor. M.G.

N83-18770*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A METHOD FOR MODIFYING TWO-DIMENSIONAL ADAPTIVE WIND-TUNNEL WALLS INCLUDING ANALYTICAL AND EXPERIMENTAL VERIFICATION
J. L. EVERHART Feb. 1983 48 p refs
(NASA-TP-2081; L-15491; NAS 1 60:2081) Avail: NTIS HC A03/MF A01 CSCL 14B

The theoretical development of a simple and consistent method for removing the interference in adaptive-wall wind tunnels is reported A Cauchy integral formulation of the velocities in an imaginary infinite extension of the real wind-tunnel flow is obtained and evaluated on a closed contour dividing the real and imaginary flow. The contour consists of the upper and lower effective wind-tunnel walls (wall plus boundary-layer displacement thickness) and upstream and downstream boundaries perpendicular to the axial tunnel flow. The resulting integral expressions for the streamwise and normal perturbation velocities on the contour are integrated by assuming a linear variation of the velocities between data-measurement stations along the contour. In an iterative process, the velocity components calculated on the upper and lower boundaries are then used to correct the shape of the wall to remove the interference. Convergence of the technique is shown numerically for the cases of a circular cylinder and a lifting and nonlifting NACA 0012 airfoil in incompressible flow. Experimental convergence at a transonic Mach number is demonstrated by using an NACA 0012 airfoil at zero lift. Author

N83-18771*# National Aeronautics and Space Administration, Washington, D. C.
CONSTRUCTION AND TEST OF FLEXIBLE WALLS FOR THE THROAT OF THE ILR HIGH-SPEED WIND TUNNEL
Y. IGETA Feb. 1983 59 p refs Transl. into ENGLISH of "Konstruktion und Erprobung von Flexiblen Waended fuer die Messtrecke des ILS-Hochgeschwindigkeits-Windkanals" rept Inst for Aerodynamics and Aeonautics, Technische Univ., Berlin, Sep. 1978 p 1-57 Transl. by Kanner (Leo) Associates, Redwood City, Calif
(Contract NASW-3541)
(NASA-TM-77005; NAS 1 15.77005) Avail: NTIS HC A04/MF A01 CSCL 14B

Aerodynamic tests in wind tunnels are jeopardized by the lateral limitations of the throat. This influence expands with increasing size of the model in proportion to the cross-section of the throat. Wall interference of this type can be avoided by giving the wall the form of a stream surface that would be identical to the one observed during free flight To solve this problem, flexible walls that can adapt to every contour of surface flow are needed
Author

N83-18772# Army Aeromedical Research Unit, Fort Rucker, Ala Biomedical Applications Research Div.
PURSUIT ROTOR TRACKING PERFORMANCE IN CONJUNCTION WITH EXTENDED FLIGHT OPERATIONS IN A HELICOPTER SIMULATOR Final Report
L. W. STONE, G. P. KRUEGER, and W. R HOLT Aug. 1982 42 p refs
(Contract DA PROJ. 3E1-62777-A-879; DA PROJ. 3E1-62773-A-819)
(AD-A119237; USAARL-82-6) Avail: NTIS HC A03/MF A01 CSCL 05J

Six US Army Initial Entry Rotary Wing School graduates participated as subjects in a week-long study to examine the effects of extended simulated helicopter operations on pursuit tracking skills. Using a photoelectric rotary pursuit device, three fixed patterns (a square, a circle, and a triangle) were presented to each subject three times daily for 5 days. An analysis of the results revealed a significant difference in subject performance between patterns It also revealed a statistically significant difference in performance over days on one of the patterns--the triangle. The thread woven through these results seemed to be one of the relative complexity. It suggested that the effects of sustained operations interfered with the aviator's ability to fully integrate his mental and psychomotor skills in order to meet the requirements of a more complex task. GRA

N83-19762# Illinois Univ., Urbana. Dept. of Civil Engineering
LONGITUDINAL JOINT SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS. VOLUME 5: SUMMARY OF FIELD TEST RESULTS FROM CHICAGO O'HARE INTERNATIONAL AIRPORT Final Report
E. J. BARENBERG Feb. 1983 64 p refs
(Contract DOT-FH-11-8474)
(FAA-RD-79-4-5; FR-5) Avail: NTIS HC A04/MF A01

A summary of test finding on the design and construction of longitudinal joints in slip-formed concrete pavements was presented Tests performed include nondestructive tests performed with several types of vibrator and impulse loading devices, and loading with commercial aircraft. Pavement responses under the various loading conditions were measured using the geophones normally used with the NDT type equipment, and with deflection gages and strain meters installed in the pavement slabs. In these tests particular emphasis was placed on measuring the load transfer efficiency across transverse and longitudinal joints and the effect of load transfer efficiency on the behavior of the pavement system. Results from these tests clearly show the importance of load transfer on certain types of distress in concrete pavements, as loss of load transfer efficiency can lead directly to corner breaks and pavement faulting. B.G.

N83-19763# Aeronautical Research Labs, Melbourne (Australia)
AERODYNAMIC TEST FACILITY REQUIREMENTS FOR DEFENCE R AND D TO 2000 AND BEYOND
N. POLLOCK and M. L. ROBINSON Sep 1982 43 p refs
(AD-A122096, ARL-GD-005; WSRL-0287-SD) Avail: NTIS HC A03/MF A01 CSCL 14B

Existing Australian aerodynamic test facilities are reviewed with respect to their suitability to meet current and projected defense needs. The deficiencies of the existing facilities are identified and new facilities proposed This document is a compilation of views of the authors and of senior staff engaged in the management and practice of aerodynamics at the Aeronautical Research Laboratories and the Weapons Systems Research Laboratory.
GRA

N83-19764# Office of Technology Assessment, Washington, D C
REVIEW OF THE FAA 1982 NATIONAL AIRSPACE SYSTEM PLAN
Aug. 1982 74 p refs
(PB83-102772; OTA-STI-176; LC-82-600595) Avail: NTIS HC A04/MF A01 CSCL 01B

In January 1982, shortly after OTA had concluded an assessment of the airport and air traffic control system, the Federal Aviation Administration released the 1982 National Airspace System (NAS) Plan. The Transportation Subcommittee of the House Committee on Appropriations asked that OTA undertake a review of the NAS Plan, building on the results of the assessment that had been carried out at their request. OTA's approach to conducting this review was to examine the NAS Plan at two levels--the adequacy of the plan as a whole and the appropriateness of the specific technologies selected by FAA for implementation.
Author (GRA)

11

CHEMISTRY AND MATERIALS

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

A83-23615
SEALANTS - USES IN COMPOSITE STRUCTURES
B. SILVERMAN and A. NORRBOM (Products Research and Chemical Corp., Glendale, CA) In: Material and process advances '82; Proceedings of the Fourteenth National SAMPE Technical Conference, Atlanta, GA, October 12-14, 1982. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 190-203.

After considering the ways in which sealants have been used to protect graphite-reinforced composite and aluminum structural assemblies against environmental degradation from salt water and various contaminants, recommendations are made toward the establishment of sealing policies applicable to a range of aerospace structures Attention is given to recent experience with sealants in aluminum-to-graphite c

A83-23616
ADHESIVE STRESS-STRAIN PROPERTIES RELATIVE TO FATIGUE LIFE OF TITANIUM BONDED TO GRAPHITE REINFORCED PLASTIC
R. B. KRIEGER, JR. (American Cyanamid Co , Engineered Materials Dept., Havre de Grace, MD) In: Material and process advances '82; Proceedings of the Fourteenth National SAMPE Technical Conference, Atlanta, GA, October 12-14, 1982 Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p 204-210. refs

Adhesive stress vs strain curves for predicting relative performance in fatigue are evaluated for the cases of FM 400 and FM 300K adhesives. The data discussed relates to shear stress strain curves, fatigue screening tests with double lap shear specimens of Ti bonded to graphite-reinforced plastic, and full scale specimen fatigue tests representing the joint of a graphite-reinforced polymer wing cover skin to Ti fuselage fittings. O.C.

A83-23642
FRACTURE TOUGH COMPOSITES - THE EFFECT OF TOUGHENED MATRICES ON THE MECHANICAL PERFORMANCE OF CARBON FIBER REINFORCED LAMINATES
G D. M. DISALVO and S. M. LEE (Ciba Geigy Corp., Composite Materials Dept., Ardsley, NY) In: Material and process advances '82; Proceedings of the Fourteenth National SAMPE Technical Conference, Atlanta, GA, October 12-14, 1982. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 491-502. Research supported by Ciba Geigy Corp.

The fracture toughess behavior of a series of toughened resins was investigated in neat resin form and as matrices in unidirectional carbon fiber reinforced composites. It was found using compact tension tests on the resin and double torsion tests on the composite that the resin fracture toughness is significantly translated to the unidirectional laminate However, this translation of resin to laminate fracture toughness was not proportional for this resin system. In addition, the longitudinal strain-to-failure of the composite was shown to be related to the resin fracture toughness. No significant reduction in other critical performance requirements was found to accompany this increase in fracture toughness. It is concluded that there is a strong and direct relationship between resin and composite fracture toughness and strain-to-failure. N.B.

A83-23643
THE PREPARATION AND PROPERTIES OF MESOPHASE PITCH-BASED CARBON FIBERS
O. C. TRULSON and H. F. VOLK (Union Carbide Corp., Danbury, CT) In: Material and process advances '82; Proceedings of the Fourteenth National SAMPE Technical Conference, Atlanta, GA, October 12-14, 1982. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 503-512. refs

The present investigation is concerned with the current production status and the properties of 'Thornel' mesophase pitch-based carbon fibers. Research on pitch-based carbon fibers has been conducted in an American chemical company since 1970 One major application for pitch-based fibers is for carbon/carbon composites for aircraft brakes. These brakes are in production for major military aircraft. Recently, they have also become of interest for civilian aircraft. It is pointed out that pitch-based carbon fibers have completed the transition from laboratory curiosity through pilot plant product in short supply and with changing properties to standard production grades which are readily available. Pitch-based fibers have established clear superiority in a number of markets, particularly those related to carbon/carbon, metal matrix, and high and ultra-high modulus composites. G R.

A83-23849*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THERMAL PERFORMANCE OF AIRCRAFT POLYURETHANE SEAT CUSHIONS
D. A. KOURTIDES and J. A. PARKER (NASA Ames Research Center, Moffett Field, CA) Society of the Plastics Industry, Annual Technical Conference on Polyurethane, 27th, Bal Harbour, FL, Oct. 19-22, 1982, Paper. 11 p FAA-sponsored research. refs

Measurements were conducted on 7 6 x 7.6 cm samples of polyurethane seat cushion material in a modified National Bureau of Standards smoke density chamber to simulate real life conditions for an onboard aircraft fire or post-crash fire. In this study, a non-flaming heat radiation condition was simulated. Two aluminized polymeric fabrics (Norfab 11HT-26-A and Preox 1100-4) and one neoprene type material in two thicknesses (Vonar 2 and 3) were tested as heat blocking layers to protect the urethane foam from rapid heat degradation. Thermogravimetric analysis and differential scanning calorimetry were performed to characterize thermally the materials tested It was found that Vonar 2 or 3 provided approximately equal thermal protection to F R urethane as the aluminized fabrics, but at a significant weight penalty The efficiency of the foams to absorb heat per unit mass loss when protected with the heat blocking layer decreases in the heating range of 2.5-5.0 W/sq cm, but remains unchanged or slightly increases in the range of 5.0-7.5 W/sq cm. The results show that at all heat flux ranges tested the usage of a heat blocking layer in aircraft seats significantly improves their thermal performance. A.L W.

A83-23877#
RADIATION AND SMOKE FROM THE GAS TURBINE COMBUSTOR USING HEAVY FUELS
Y. S. H NAJJAR (Yarmouk University, Irbid, Jordan) and E. M. GOODGER (Cranfield Institute of Technology, Cranfield, Beds., England) ASME, Transactions, Journal of Heat Transfer, vol. 105, Feb. 1983, p 82-88 refs

Broadening of aviation fuel specifications has been simulated using blends of gas oil and residual fuel oil. Radiation, smoke, and temperature measurements in an experimental combustor at various air pressure, inlet temperature, and air/fuel ratios showed a diminishing rate of increase of radiation with soot concentration and reduced sensitivity of smoke to fuel hydrogen content at higher combustor pressures. (Author)

A83-23931
SURFACE NOTCHES IN COMPOSITES
G. P. SENDECKYJ (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In: Fracture of composite materials; Proceedings of the Second USA-USSR Symposium, Bethlehem, PA, March 9-12, 1981. The Hague, Martinus Nijhoff Publishers, 1982, p. 115-127. USAF-supported research. refs

The predictions of simple mechanics analyses for static strength for surface-notched resin matrix composite laminates are compared with available experimental results and found to be in excellent agreement The strength predictions, which take into account the ply-by-ply heterogeneity of the composite, provide a lower bound for glass-epoxy surface-notched laminates that are by contrast in poor agreement with the data, due to the extreme delamination/matrix cracking observed prior to failure. This damage is in turn due to the violation of one of the present model's underlying assumptions. O.C.

A83-24035#
DEGRADATION AND CHARACTERIZATION OF ANTIMISTING KEROSENE
R. J. MANNHEIMER (Southwest Research Institute, San Antonio, TX) Journal of Aircraft, vol. 20, Apr. 1983, p 350-358. U.S. Department of Transportation refs
(Contract DOT-FA79WA-4310)

(Previously cited in issue 19, p. 3326, Accession no. A81-40867)

A83-24201#
FUTURE FUELS FOR TURBOJET ENGINES AND THEIR IMPACTS ON COMBUSTION CHAMBERS AND FUEL SYSTEMS [KUENFTIGE BRENNSTOFFE FUER TURBOFLUGTRIEBWERKE UND IHRE AUSWIRKUNGEN AUF BRENNKAMMERN UND BRENNSTOFFSYSTEME]
G. WINTERFELD (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Antriebstechnik, Cologne, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 25 p. In German. refs
(DGLR PAPER 82-089)

Expected problem areas in the future development of jet engine fuels are surveyed, in particular soot or smoke formation, liner cooling, atomization and evaporation, and the thermal stability of the fuel and fuel system. The development of fuels with superior specifications is discussed, and the influence of combustion characteristics on combustion and the combustion chamber is considered The influence of future developments in fuels on fuel systems is examined in the light of factors such as the thermal decay of the fuel, the fuel's freezing point, and viscosity problems. C.D.

A83-25269*# General Electric Co., Cincinnati, Ohio.
NASA CLEAN CATALYTIC COMBUSTOR PROGRAM
E. E. EKSTEDT, T. F. LYON, P. E. SABLA, W J. DODDS (General Electric Co., Cincinnati, OH), and A. J. SZANISZLO (NASA, Lewis Research Center, Cleveland, OH) American Society of Mechanical Engineers, Joint Power Generation Conference, Denver, CO, Oct. 17-21, 1982, 12 p. refs
(ASME PAPER 82-JPGC-GT-11)

The successful operation of an aircraft gas turbine combustion system incorporating a state-of-the-art catalytic reactor as the main stage, along with a conventional pilot stage for low power operation, is reported to have been achieved with high combustion efficiency at moderate engine pressure ratios. The extremely low nitrogen oxides emission level taken by the program as its goal has also been achieved It is noted that significant improvements in the operating temperature capability of catalytic reactor materials will be required for the successful application of such devices to the very high pressure ratio, high temperature engines assumed to be the ultimate application of the devices studied O.C.

A83-25317
APPLICATION OF FRACTURE MECHANICS FOR SELECTION OF METALLIC STRUCTURAL MATERIALS
J. E. CAMPBELL, (ED.), W. W. GERBERICH (University of Minnesota, Minneapolis, MN), and J H. UNDERWOOD (U.S. Army, Benet Weapons Laboratory, Watervliet, NY) Metals Park, OH, American Society for Metals, 1982. 384 p
$72

This monograph contains state-of-the-art information on the fracture mechanics of structural metals and on the application of fracture mechanics data to selection of metals for critical structural components. A brief historical background is given on the development of fracture mechanics, the principal fracture mechanics concepts are explained, and standard fracture mechanics testing methods are reviewed. Data are then presented on the fracture properties of alloy steels, stainless steels, aluminum alloys, titanium alloys, and nickel-base superalloys. The effects of testing and service environments on fracture properties are considered, including the effects of chemical environments, temperature, and loading conditions. Finally, examples of case histories are presented which illustrate how the data presented here may be used in calculating the critical flaw sizes and fatigue crack growth rates, in designing critical structures, and in analyzing fractures in failed components. V L.

A83-25325
DESIGN, MATERIALS SELECTION AND FAILURE ANALYSIS
W. W. GERBERICH (Minnesota, University, Minneapolis, MN) and A. W. GUNDERSON (USAF, Materials Laboratory, Wright-Patterson AFB, OH) In Application of fracture mechanics for selection of metallic structural materials. Metals Park, OH, American Society for Metals, 1982, p. 311-365. refs

The basic principles of fracture toughness and subcritical crack growth approaches are briefly reviewed, and procedures that are required when these principles are used in designing cost-effective and reliable high-performance components are discussed. The procedures examined include nondestructive evaluation, failure analysis, and materials selection Several case studies using either fracture toughness or subcritical crack growth approaches are then presented which cover postfailure analysis and fracture control methodologies implemented to select safe materials and designs for critical components V.L

A83-25686#
IMPACT-RESISTANT TRANSPARENCIES FOR MARINE SERVICE
R A. HUYETT (Goodyear Aerospace Corp , Transparent Products Engineering Dept., Litchfield Park, AZ) American Society of Mechanical Engineers, Winter Annual Meeting, Phoenix, AZ, Nov 14-19, 1982, 8 p.
(ASME PAPER 82-WA/OCE-4)

The impact resistance of a broad spectrum of tough transparency materials of both monolithic and laminated composite forms is examined for use in marine systems. Among the materials studied are thermally tempered glass, wire-reinforced glass, stretched acrylic polycarbonates, and laminates. These materials afford protection which ranges from breakage, intrusion, and vandal resistance to bullet-resisting capabilities. The characteristics of these materials, such as composition, density, break resistance, approximate cost, durability, typical usage areas, and special features, are analyzed. The best features and liabilities inherent to each material are presented N.B.

A83-25690*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
APPLICATION OF DIGITAL IMAGE ANALYSIS TECHNIQUES TO ANTIMISTING FUEL SPRAY CHARACTERIZATION
R. FLEETER, R. TOAZ, and V. SAROHIA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) American Society of Mechanical Engineers, Winter Annual Meeting, Phoenix, AZ, Nov 14-19, 1982, 8 p. U.S. Department of Transportation refs
(Contract DOT-FA03-80-A-00215)
(ASME PAPER 82-WA/HT-23)

Pulsed ruby laser sheet illumination of the spray is used for the initial recording of data on very-high-resolution photographic film. The digitization of mosaic elements is effected with a vidicon and video digitizer whose output is stored in computer RAM memory for processing. Highly nonspherical elements and a broad range of drop diameters (8-2000 microns) resulting from the unusual rheological properties of the fuel-additive system are accommodated by the device configuration and algorithms. It is found that the generation of two-dimensional images by means of scattered light also eliminates errors resulting from variations in the index of refraction and from the submicron scattering sites that are often present within the modified fuel. No a priori information on the drop size distribution or on the system response to various drop sizes is required. C R.

A83-26199
A STUDY ON THE HYDROGEN-OXYGEN DIFFUSION FLAME IN HIGH SPEED FLOW
S. TAKAHASHI, Y. YOSHIZAWA, T. MINEGISHI (Ministry of International Trade and Industry, Mechanical Engineering Laboratory; Tokyo Institute of Technology, Tokyo, Japan), and H. KAWADA In: Shock tubes and waves, Proceedings of the Thirteenth International Symposium, Niagara Falls, NY, July 6-9, 1981. Albany, NY, State University of New York Press, 1982, p. 843-850 refs

A shock tube/detonation tube combination is used for the study of hydrogen-oxygen diffusion flames in high speed flows, where the flow behind the incident shock wave that propagates into an O2-Ar mixture, and the burned gas behind the detonation wave, which travels into a fuel-rich H2-O2-Ar mixture, were used to produce the fuel and oxidizer flows, respectively. Diffusion flame formation was investigated by both schlieren and interferometric photography, and the ignition distances of the diffusion flames in a quasi-steady state were measured by direct photographic methods. The detonation tube is shown by the results to provide a useful high speed, high temperature flow, and it isconfirmed that the ignition distance is significantly affected by both velocity difference and hydrogen concentration. O.C

A83-26922
OPTIMIZATION OF THE OIL-CHANGE PERIOD FOR AIRCRAFT SYSTEMS AND UNITS [OPTIMIZATSIIA PERIODICHNOSTI ZAMENY MASEL V SISTEMAKH I AGREGATAKH AVIATSIONNOI TEKHNIKI]
B. G. BEDRIK, G. T. NOVOSARTOV, I. S. KRICHINSKII, and T D. TARAKANOVA Khimiia i Tekhnologiia Topliv i Masel, no. 3, 1983, p 20, 21. In Russian

It is suggested that the service period of aviation oils, greases, and special liquids can be optimized by monitoring their actual condition during service. For this purpose, it is essential that the permissible limits be defined for changes in the lubricant properties and that the relationship be established between changes in the lubricant quality and the engine condition. With reference to experimental data obtained for the motor oil MS-8P, it is shown that its service period can be extended from the standard 25 hr to at least 50 hr without any negative effects on the engine performance. V L.

N83-18851*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF AIRCRAFT LAVATORY COMPARTMENTS WITH IMPROVED FIRE RESISTANCE CHARACTERISTICS. PHASE 4: SANDWICH PANEL DECORATIVE INK DEVELOPMENT Final Report
A. JAYARAJAN, G. A. JOHNSON, G. L KORVER, and R. A. ANDERSON Jan. 1983 82 p refs
(Contract NAS2-9864)
(NASA-CR-166432; NAS 1.26:166432, D6-51768) Avail. NTIS HC A05/MF A01 CSCL 11D

Five chemically different resin systems with improved fire resistance properties were studied for a possible screenprinting ink application. Fire resistance is hereby defined as the cured ink possessing improvements in flammability, smoke emission, and thermal stability. The developed ink is for application to polyvinyl fluoride film. Only clear inks without pigments were considered. Five formulations were evaluated compared with KC4900 clear acrylic ink, which was used as a baseline. The tests used in the screening evaluation included viscosity, smoke and toxic gas emission, limiting oxygen index (LOI), and polyvinyl fluoride film (PVF) printability. A chlorofluorocarbon resin (FPC461) was selected for optimization studies. The parameters for optimization included screenprinting process performance, quality of coating, and flammability of screenprinted 0.051-mm (0.002-in.) white Tedlar. The quality of the screenprinted coating on Tedlar is dependent on viscosity, curing time, adhesion to polyvinyl fluoride film, drying time (both inscreen and as an applied film), and silk screen mesh material and porosity. S.L.

N83-18858# Army Aviation Research and Development Command, St. Louis, Mo. Applied Technology Lab.
IMPACT BEHAVIOR OF FIBROUS COMPOSITION AND METAL SUBSTRUCTURES
A. J. GUSTAFSON, G. S. NG, and G. T. SINGLEY, III Oct. 1982 24 p refs
(Contract DA PROJ. 1L2-62209-AH-76)
(AD-A121618; USAAVRADCOM-TR-82-D-31) Avail: NTIS HC A02/MF A01 CSCL 11D

This program was conducted to determine the differences in nonlinear load-defection characteristics between a typical helicopter ventral substructure fabricated with aluminum and one designed to the same loads criteria fabricated with fiber composite materials The feasibility of applying the analytical and testing techniques developed under contract for a metal structure to a composite structure was investigated. The composite structure was designed as a one-for-one replacement of the metal structure to meet the same design loads that were used for the metal structure. Because full-scale specimen testing could not be performed using existing in-house equipment, a scale model test was conducted. A dimensional analysis procedure based on the scaling laws of the Buckingham theorem was used to define the scaling approach. The feasibility of testing scaled helicopters for proofing crash survivability requirements were also examined. Test results obtained were in agreement with those reported under the contractual effort and demonstrated that fuselage structures can be scaled for impact testing The composite structure showed slightly lower energy absorption than the metal structure. GRA

N83-18894*# Lockheed-California Co., Burbank.
DEVELOPMENT OF POWDER METALLURGY AL ALLOYS FOR HIGH TEMPERATURE AIRCRAFT STRUCTURAL APPLICATIONS, PHASE 2 Final Technical Report, 16 Jul. 1980 - 15 Aug. 1981
D. J. CHELLMAN Nov. 1982 73 p refs
(Contract NAS1-16048)
(NASA-CR-165965, NAS 1.26:165965) Avail: NTIS HC A04/MF A01 CSCL 11F

In this continuing study, the development of mechanically alloyed heat resistant aluminum alloys for aircraft were studied to develop higher strength targets and higher service temperatures. The use of higher alloy additions to MA Al-Fe-Co alloys, employment of prealloyed starting materials, and higher extrusion temperatures were investigated. While the MA Al-Fe-Co alloys exhibited good retention of strength and ductility properties at elevated temperatures and excellent stability of properties after 1000 hour exposure at elevated temperatures, a sensitivity of this system to low extrusion strain rates adversely affected the level of strength achieved. MA alloys in the Al-Li family showed excellent notched toughness and property stability after long time exposures at elevated temperatures A loss of Li during processing and the higher extrusion temperature 482 K (900 F) resulted in low mechanical strengths. Subsequent hot and cold working of the MA Al-Li had only a mild influence on properties. S.L

N83-18904# National Bureau of Standards, Washington, D.C. National Measurement Lab.
PHYSICAL PROPERTIES DATA COMPILATIONS RELEVANT TO ENERGY STORAGE. PART 5: MECHANICAL PROPERTIES DATA ON ALLOYS FOR USE IN FLYWHEELS
H. M. LEDBETTER 1982 38 p refs
(PB82-232919, NSRDS-NBS-61-PT-5, LC-81-14053) Avail: NTIS HC A03/MF A01 CSCL 11F

The physical and mechanical properties of twenty-one commercial alloys that are candidates for flywheel rotors used as inertial-energy-storage are described. Based metals include aluminum, iron and titanium. Alloys vary in complexity from simple carbon steels to superalloys. Properties include: mass density, Young's modulus, shear modulus, bulk modulus, Poisson's ratio, yield strength, ultimate strength, fatigue strength, fracture toughness, and creep strength. Property values were collected from many types of sources and were analyzed statistically to detect possible outlying values. For each alloy, there is given

typical chemical composition, typical heat treatment, metallurgical descriptions, and typical property values. GRA

N83-19815*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT SERVICE EVALUATION OF COMPOSITE COMPONENTS ON BELL 206L AND SIKORSKY S-76 HELICOPTERS
D. J. BAKER Mar. 1983 14 p refs Presented at AHS Natl Specialist's Meeting: Composite Structures, Philadelphia, 23-25 Mar. 1983 Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo
(NASA-TM-84637; NAS 1 15 84637; AVRADCOM-TR-83-B-1)
Avail: NTIS HC A02/MF A01 CSCL 11D

Progress on two programs to evaluate composite structural components in flight service on commercial helicopters is described. Thirty-six ship sets of composite components that include the litter door, baggage door, forward fairing, and vertical fin were installed on Bell Model 206L helicopters that are operating in widely different climatic areas Four horizontal stabilizers and ten tail rotor spars that are production components on the S-76 helicopter were tested after prescribed periods of service to determine the effects of the operating environment on their performance. Concurrent with the flight evaluation, specimens from materials used to fabricate the components were exposed in ground racks and tested at specified intervals to determine the effects of outdoor environments Results achieved from 14,000 hours of accumulated service on the 206L components, tests on a S-76 horizontal stabilizer after 1600 hours of service, tests on a S-76 tail rotor spar after 2300 hours service, and two years of ground based exposure of material coupons are reported. Author

N83-19820# North Carolina Agricultural and Technical State Univ., Greensboro. School of Engineering.
IMPACT-INITIATED DAMAGE IN LAMINATED COMPOSITES Final Report
V. S. AVVA 30 Sep. 1982 104 p refs
(Contract F49620-80-C-0050; AF PROJ. 2303)
(AD-A122166; AFOSR-82-1038TR) Avail: NTIS HC A06/MF A01 CSCL 11D

Due to the advantage of high strength to weight ratio, composite materials are being increasingly used in the design of aircraft components and structures. One of the problems that needs to be studied in detail in such applications is the effect of projectile impact on the strength carrying ability of composite structures. The mechanism of impact-induced crack propagation is not fully understood, yet. In the past few years, numerous efforts have been made to predict theoretically the residual strength of the high performance fiber composite materials subjected to foreign object damage (FOD). GRA

N83-19921*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUELS RESEARCH STUDIES AT NASA LEWIS
A. C ANTOINE 1982 19 p refs Presented at the 54th Ann. Conv. of the National Technical Association, Inc., Baltimore, 2-7 Aug. 1982
(NASA-TM-83003; E-1439; NAS 1.15:83003) Avail: NTIS HC A02/MF A01 CSCL 21D

Fuels research studies carried out in a variety of areas related to aviation propulsion, ground transportation, and stationary power generation systems are discussed. The major efforts are directed to studies on fuels for jet aircraft. These studies involve fuels preparation, fuels analysis, and fuel quality evaluations. The scope and direction of research activities in these areas is discussed, descriptions of Lewis capabilities and facilities given, and results of recent research efforts reported. Author

N83-19922# Southwest Research Inst., San Antonio, Tex. Mobile Energy Div.
DEGRADATION AND CHARACTERIZATION OF ANTIMISTING KEROSENE (AMK) Final Report, Jul. 1980 - Nov. 1981
R. J MANNHEIMER Atlantic City, N.J FAA Dec. 1982 86 p refs
(Contract DOT-FA79WA-4310)
(MED-132, FAA-CT-82-93) Avail NTIS HC A05/MF A01

Experiments are described which demonstrate the feasibility of degrading AMK in a single pass with a system consisting of a hydraulic fuel pump from a TF30 engine and several types of flow restrictors such as packed tubes or needle valves The performance of the degraded AMK was evaluated with full-scale aircraft filters (JT8D and CF6), a T63 combustor and laboratory scale tests including filtration, ignition, and gel permeation chromatography. Rheological experiments indicated that while the shear viscosity of AMK increases above a critical shear rate, the magnitude of the shear viscosity is not large enough to explain the effectiveness of the FM-9 additive. However, it was shown that, associated with the critical shear rate, AMK exhibits strong viscoelastic effects that are not evident at low shear rates or in flow through an orifice. Author

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ENGINEERING

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

A83-23329
THE DESIGN OF BONDED STRUCTURE REPAIRS
K B. ARMSTRONG (British Airways, Hounslow, Middx., England) International Journal of Adhesion and Adhesives, vol. 3, Jan. 1983, p 37-52 refs

This paper illustrates the problems of the repair engineer in the field when no stress analysis or structural repair manual is available. In this extreme situation he can only seek to restore the original strength of the damaged part whether or not all of that strength is actually required. Two major design factors are considered, i.e. overlap shear joints and core to skin bond strength. Back-up by rivets or bolts is discussed and also sealing the repair with a fabric overlay to prevent or minimize water ingress. The paper concludes with a practical example of a repair using the data provided. (Author)

A83-23366
STRAIN MEASUREMENT OF ACOUSTICALLY EXCITED AIRCRAFT STRUCTURES AT ELEVATED TEMPERATURES
K. EGAWA (National Aerospace Laboratory, Chofu, Tokyo, Japan) In: Measurements in hostile environments; Proceedings of the International Conference, Edinburgh, Scotland, August 31-September 4, 1981. Newcastle-upon-Tyne, England, British Society for Strain Measurement, 1981. 17 p.; Discussion, 2 p. Research supported by the Kyowa Electric Instruments Co.

'Reversible' or unused strain gauges were used to accurately measure the strain in acoustically excited test structures at high temperatures, and the results were compared with ones for used gauges. Preliminary tests to determine the apparent strain, the gauge factor change, and the creep in reversible and shim gauges showed that the recorded strain responses of both types of gauge were almost the same. Almost all the gauges were broken at their leads within an hour. Consequently, in the endurance test the leads were completely covered with soft RTV coating. The creep and drift with repeated heat cycles were measured, and it was found that they would not affect the strain measurement. The gauge factor and other performance indices of used gauges

were checked, along with their strain output and time lag under cyclic loading. The gauge factors for these used gauges were found to be the same as for reversible gauges. C D.

A83-23596* Carnegie-Mellon Univ., Pittsburgh, Pa.
ELECTRO-OPTICAL PROCESSOR FOR OPTIMAL CONTROL
D. CASASENT, C NEUMAN, and M. CARLOTTO (Carnegie-Mellon University, Pittsburgh, PA) In: Control and communication technology in laser systems; Proceedings of the Twenty-fifth Annual International Technical Symposium, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 176-183. refs
(Contract NAG3-5)

An iterative optical processor has been developed for applications in the optimal control of advanced sensor systems. The processor is designed for the realization of the Richardson algorithm on bipolar data, using as input a linear array of LEDs. The usefulness of the processor has been demonstrated by the solution of the linear quadratic regulator problem for the optimal control signals of the F100 turbofan engine. In this case study, the algebraic Riccati equation matrix was solved by the use of a modified Kleinman algorithm along with the Richardson algorithm applied to a system of linear algebraic equations. Preliminary experimental results demonstrate the gradual convergence of the processor A.L.W.

A83-23706
A NOTE ON ROTOR-BEARING STABILITY
M. L. ADAMS (Case Western Reserve University, Cleveland, OH) Journal of Sound and Vibration, vol. 86, Feb. 8, 1983, p. 435-438.

Reference is made to a study by Adams and Padovan (1981) in which an unconventional approach to rotor-bearing stability was taken. This approach is thought to be more accurate than conventional approaches and is seen as holding promise for significantly advancing the study of the subject. It is noted, however, that the experiment that was proposed for implementing the approach has since been found to contain a fundamental flaw The flaw is discussed, and another experiment is proposed in which the approach is correctly implemented. C R.

A83-23920
RETHINKING AUTOMATION IN NDT APPLICATIONS
A. B. SMITH (Automated Chemical Systems Corp , Meriden, CT) Materials Evaluation, vol 41, Mar 1983, p. 276-280.

An assessment is presented of the development status of automated fluorescent penetrant inspection (FPI) methods for the nondestructive testing of aerospace mechanical elements and structures. Automated systems are defined as those which, although requiring manual loading and unloading of the parts to be tested, relegate all chemical processing, including the applications and removal of the chemicals, rinsing, and drying, to mechanical devices. The automation of an entire FPI system or of several process stations within a semiautomated system offers higher reliability during inspection through either the elimination or the more precise control of variables. It also offers lower operating costs with moderate capital investment. The five key variables controlled are chemical composition, parts configuration, materials temperature, processing time and penetrant-applying nozzle pressure. O.C.

A83-24049
HYDRAULICS OF A CHANNEL WITH A LINEAR JET ARRAY
L. V. ARSENEV and I. B. MITRIAEV (Leningradskii Politekhnicheskii Institut, Leningrad, USSR) Fluid Mechanics - Soviet Research, vol. 10, Mar.-Apr. 1981, p. 95-101. Translation. refs

Hydraulic drag was investigated in channels with length/width ratios of 25 and 41.8 in order to quantify the heat transfer coefficient enhancement produced by longitudinal transpiration cooling in the presence of pressure drops. Experiments were performed using channels of different heights to identify optimal Euler numbers for jet injection cooling on the inlet edges of turbine blades Varying numbers of jets in linear arrays on the channel walls were studied. The pressure drop penalty in the channels was found to be moderate, while the heat transfer coefficients were doubled with the transpiration cooling Alternatively, the pressure drop reduction was doubled for a given heat transfer coefficient Temperature was also shown to effect the pressure drop. D.H K.

A83-24648
THE LATERAL BUCKLING-FRACTURE STABILITY OF THIN-SHEET STRUCTURAL COMPONENTS WITH DEEP CRACKS [UEBER DAS KIPP-BRUCHVERHALTEN EBENER BAUTEILE MIT LANGEN RISSEN]
H -P. ROSSMANITH (Wien, Technische Universitaet, Vienna, Austria) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol. 7, Jan.-Feb. 1983, p 29-33. In German. Research supported by the Fonds zur Foerderung der Wissenschaftlichen Forschung refs
(Contract FFWF PROJECT 3864)

The analytical interdependence between lateral buckling and cracks for thin, flat, structural components loaded at their surfaces and for fracture specimens with mathematically thin, sharp, normal edge fracture is investigated. A relationship between the lateral load and the length of the edge fracture is derived. The temporal sequence of tilting and cracking in the structural components under different degrees of local crack point plasticization is analyzed using an example of a thin, leaf-shaped double strip test specimen. C.D

A83-24719
ILLUSTRATION OF THE APPLICABILITY OF COMPUTER AIDED DESIGN PACKAGES
N. MUNRO (University of Manchester Institute of Science and Technology, Manchester, England) In: Conference on Decision and Control, 20th, and Symposium on Adaptive Processes, San Diego, CA, December 16-18, 1981, Proceedings. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1981, p. 413-419. refs

Interactive CAD facilities for the analysis, design, and simulation of control systems are introduced and described briefly The use of these facilities is illustrated by their application to a selection of industrial control problems previously solved. Problem areas are highlighted and future developments are indicated. (Author)

A83-24832* Boeing Vertol Co., Philadelphia, Pa
DEVELOPMENTS IN THE DESIGN, ANALYSIS, AND FABRICATION OF ADVANCED TECHNOLOGY TRANSMISSION ELEMENTS
R. J. DRAGO and J. W. LENSKI, JR. (Boeing Vertol Co., Philadelphia, PA) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 18 p Army-NASA-sponsored research. refs

Over the last decade, the presently reported proprietary development program for the reduction of helicopter drive system weight and cost and the enhancement of reliability and survivability has produced high speed roller bearings, resin-matrix composite rotor shafts and transmission housings, gear/bearing/shaft system integrations, photoelastic investigation methods for gear tooth strength, and the automatic generation of complex FEM models for gear/shaft systems. After describing the design features and performance capabilities of the hardware developed, attention is given to the prospective benefits to be derived from application of these technologies, with emphasis on the relationship between helicopter drive system performance and cost. O.C.

A83-24833
REPORT ON ADVANCED TRANSMISSION SYSTEM INTEGRATION TESTS
J. H. MANCINI and H K. FRINT (United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 9 p.

Advanced components developed for high temperature helicopter drivetrain operation, including a fabricated stainless steel transmission housing, an advanced input pinion bearing, and advanced gear materials and geometries, have undergone systems

integration and dynamic testing in a Blackhawk helicopter main gearbox assembly. Full speed and full load condition evaluation tests have shown that the use of a stainless steel housing as a replacement for the standard magnesium housing did not result in an increase in internal gearbox component operating temperatures. Oil cooler bypass tests have also demonstrated that, under limited power conditions, gearbox components will achieve a stabilized temperature despite the lack of cooling. O C

A83-24835
FAULT DETECTION/LOCATION SYSTEM FOR INTERMEDIATE AND TAIL ROTOR GEARBOXES
W. A. KOELSCH (Chadwick-Helmuth Co, Inc, El Monte, CA) American Helicopter Society, Specialists Meeting on Rotary Wing Propulsion Systems, Williamsburg, VA, Nov. 16-18, 1982, Preprint. 9 p.

Some of the major problems of Failure Detection/Location Systems for helicopter drive systems are discussed, focusing on the particular problems posed by the AH-64A Apache attack helicopter. Topics concerning these Failure Detection/Location Systems examined include vibration monitoring systems, the vibration spectrum analyzer, scant true failure data, the carrier-modulation technique, and threshold levels. The test and design efforts which led to the vibration-monitoring system for the tail rotor drive on the Apache are considered in detail. In addition, several avenues for the further development of the techniques used in the vibration-monitoring system for the Apache are discussed. N.B.

A83-25621
THE RELIABILITY OF AVIATION SYSTEMS [NADEZHNOST' AVIATSIONNYKH SISTEM]
E. IU. BARZILOVICH, V G MEZENTSEV, and M. V. SAVENKOV Moscow, Izdatel'stvo Transport, 1982. 184 p. In Russian. refs

The statistical methods used in analyzing the reliability of aviation systems are discussed. Examples are cited in recommending that the methods of statistical analysis be used to describe the condition and reliability of the systems. In addition, it is shown how the results from monitoring the aviation systems while in operation can be used to predict certain parameters Statistical tests that can be used in evaluating the aging of parts are included. C.R

A83-25622
RADIO-ELECTRONIC GUIDANCE SYSTEMS [RADIOELEKTRONNYE SISTEMY SAMONAVEDENIIA]
M. V. MAKSIMOV and G. I. GORGONOV Moscow, Izdatel'stvo Radio i Sviaz', 1982. 304 p. In Russian. refs

The theory underlying radio-electronic guidance systems is reviewed, along with the basic design principles. Particular attention is given to the synthesis of guidance systems on the basis of current concepts of optimum control, target detection techniques, and determination of target motion parameters relative to the guided objects by radar, electron-optic, and complex radio-electronic means with analog and digital signal processing. The discussion also covers automatic control systems for guided objects, dynamic structural schemes of guidance systems, and, finally, the stability and accuracy of radio-elect

A83-25700#
RELIABILITY OF AIRCRAFT SPLINES WITH OR WITHOUT A WEAR INDUCTION PERIOD
D. KECECIOGLU (Arizona, University, Tucson, AZ) and A. KOHARCHECK (Bently Nevada Corp., Minden, NV) American Society of Mechanical Engineers, Winter Annual Meeting, Phoenix, AZ, Nov. 14-19, 1982, 8 p refs
(ASME PAPER 82-WA/DE-4)

Mathematical models are developed for the wear-life distributions of aircraft splines which provide equations for predicting their reliability when spline-tooth wear is the failure mode under consideration. The procedure for determining the distributions of wear for specified operating times and of time for specified amounts of spline-tooth wear is presented. Five examples on the use of these distributional data to predict the reliability of aircraft splines and their maintenance schedules are given. (Author)

A83-26418#
COMPARISON BETWEEN PROBE AND LASER MEASUREMENTS AT THE OUTLET OF A CENTRIFUGAL IMPELLER
A. VOUILLARMET and G. BOIS (Lyon, Ecole Centrale, Ecully, Rhone, France) In: Measuring techniques in transonic and supersonic flows in cascades and turbomachines; Proceedings of the Symposium, Ecully, Rhone, France, October 15, 16, 1981. Ecully, Rhone, France, Ecole Centrale de Lyon, 1982, p. 10-1 to 10-23.

A cobra probe and a straight probe were used to measure static pressures and temperatures around an axial transonic compressor and a vaneless diffusor part of a centrifugal impeller. The probes were calibrated in free jet flows with Mach nos. 0.2-0.8, and calibration parameters were calculated for each probe. Wall static pressure measurements were also performed, along with laser velocimetry. The probe measurements displayed good agreement in the axial transonic compressor, but diverged in the vaneless diffusor and agreed only with increasing distance from the diffusor Good agreement was found for all measurements in the downstream region of a radial compressor impeller. M.S K.

A83-26420#
THREE DIMENSIONAL HOLOGRAPHIC FLOW VISUALIZATION
P J. BRYANSTON-CROSS In: Measuring techniques in transonic and supersonic flows in cascades and turbomachines; Proceedings of the Symposium, Ecully, Rhone, France, October 15, 16, 1981 Ecully, Rhone, France, Ecole Centrale de Lyon, 1982, p. 13-1 to 13-17. refs

Holographic flow visualization of the leading edge shock structure in a compressor fan is described A laser provides the light source, which is expanded onto the internal surface of the engine casing. The surface, painted white, reflects the slight at a 90 deg angle. The laser pulses are in the 1-10 microsec range, and reveal only movements at the rotating blades. The inward moving pulse passes through one part of the flow, then reflects through the same flow after it has slightly rotated. Shock oscillations alter the pathlength and yield interferometric fringe data. A beam splitter redirects part of the laser ray to form the reference light on the holographic film A relationship has been defined between the interferometric fringe formation and densityhange. Shallow viewing angles allow detection of small density changes. The results of several applications to rotating cascades are presented. Finally, the use of laser holography for flow visualization in nonrotating cascades is discussed. M.S.K.

A83-26471
CHARACTERIZATION OF THE DYNAMICAL RESPONSE OF RECEIVERS TO FADING
R. M. HARRIS (Royal Aircraft Establishment, Radio and Navigation Dept, Farnborough, Hants., England) Radio and Electronic Engineer, vol. 53, Jan. 1983, p. 13-20. refs

The general behavior of radio receivers with feedback automatic gain control is examined for a range of fading conditions. Mathematical modeling of the a.g.c. system as a nonlinear servo-loop goes part of the way to characterizing the dynamical response. It is shown that the characteristics of practical aircraft receivers for uhf voice communications are too complex for representation by simple models and extensive measurements are needed to assess their behavior under realistic operational conditions. A measurement strategy is formulated and has been applied to several types of radio receiver. It is recommended that dynamical performance clauses be included in receiver specifications (Author)

A83-26487#
ESTIMATION REGARDING THE FEASIBILITY OF USING LARGER DISTANCES IN MEASUREMENTS WITH L2F SYSTEMS IN FLIGHT TESTS [ABSCHAETZUNG UEBER DIE MOEGLICHKEITEN GROESSERER MESSENTFERNUNGEN BEI L2F-SYSTEMEN IM FLUGVERSUCH]
M. NEZEL In: The Special Research Area of Flight Control, Colloquium, Brunswick, West Germany, September 9, 10, 1981, Reports. Brunswick, West Germany, Technische Universitaet Braunschweig, 1982, p. 342-361 In German. refs

An approach for the calibration of air data systems can be based on the employment of laser anemometers. The present investigation is concerned with the possibility to employ 'laser-two-focus (L2F) systems' on board of aircraft The results of laboratory and flight tests involving an L2F system utilizing a distance of 60 cm in the measurements are employed as a basis to obtain an estimate regarding the parameters for a 10-m measuring system. The power requirements for a system with an objective diameter of 200 mm are estimated It is found that an input power of 40 kW would be required for continuous wave operation The required power cannot be provided on board of an aircraft, and a pulsed laser system was considered. The obtained results show that for pulsed operation the power requirements for a 10-m system can be satisfied by an onboard power system of the aircraft. Approaches for the implementation of the considered system are discussed, taking into account the installation of a capacitor battery in the aircraft. G R.

A83-26761#
STATE-SPACE AEROELASTIC MODELING AND ITS APPLICATION IN FLUTTER CALCULATION
S. LU (Nanjing Aeronautical Institute, Nanjing, People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol. 3, Dec 1982, p. 1-11. In Chinese, with abstract in English. refs

Indices were developed for assaying the accuracy of Roger's (1977), Pade's, and Karpel's (1980) approximations of unsteady loads in the design of the control law of an active flutter suppression system. The accuracy of the Pade approximation was found to be highest due to the independent determination of elements in the same matrix. A matrix transformation was defined to reduce a complex nonlinear fitting problem to a linear one, i.e., by improving Karpal's formulation. A matrix similar to Roger's approximation was also developed, but with a lower order, and a higher fitting accuracy was demonstrated. The method was used to obtain the first and second derivatives of the flutter determinant eigenvalues in state space with respect to velocity. Flutter calculations were carried out to demonstrate the new model's capability to automatically identify modals. M.S.K.

A83-26763#
STATISTICAL DETERMINATION OF A FLAW DETECTION PROBABILITY CURVE
F. LIN and Y HUANG (Northwestern Polytechnical University, Xian, Shaanxi, People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol. 3, Dec. 1982, p 21-27. In Chinese, with abstract in English. refs

A statistical method for determining the flaw detection probability curve for reliability prediction and damage tolerance analysis of aircraft structures is presented, together with a technique of obtaining independent flaw detection data. The statistical method is shown to permit the calculation of the confidence lower limit of the flaw detection probability at the given confidence level for an arbitrary sized sample using an F-distribution table. An example is provided in terms of a curve at the 95% level developed after inspection of corner flaws at holes in steel specimens. The inspection was carried out with a magnetic particle nondestructive technique. Finally, a simplified method for generating the flaw detection probability curve is defined. M.S.K.

A83-26764#
MULTI-LEVEL SUBSTRUCTURAL ANALYSIS IN MODAL SYNTHESIS - TWO IMPROVED SUBSTRUCTURAL ASSEMBLING TECHNIQUES
G. LIU, J LI (Aircraft Structural Mechanics Research Institute, People's Republic of China), and D ZHANG (Beijing Institute of Structure and Environment Engineering, Beijing, People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol 3, Dec. 1982, p. 28-35. In Chinese, with abstract in English. refs

Multi-level and successive synthesis techniques are presented for dynamic analysis of substructural assemblies of large complex structures. The multi-level synthesis method is an extension of a single-level synthesis, while the successive synthesis covers two substructures in each synthesis step, with one substructure synthesized by means of the generalized form of the motion equation. An example is presented in terms of a dynamic substructure model of an aircraft, and a frequency criterion is introduced for ensuring the accuracy of the two methods. M S.K.

A83-26765#
APPLICATION OF LASER HOLOGRAPHIC INTERFEROMETRY TO VIBRATION ANALYSIS OF AEROCRAFT BEAM STRUCTURE MODEL
G. JIN (Quinghua University, Beijing, People's Republic of China), S WANG, G CHEN, and P SHEN (Hongan Corp., People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol. 3, Dec 1982, p. 41-46. In Chinese, with abstract in English.

Vibration modes for three-beam and five-beam models of an aircraft wing were evaluated using laser holographic interferometry The natural frequencies and node distributions were determined theoretically and experimentally and good agreement was found. A simplified version of the five-beam model was demonstrated to be more effective than the three-beam model. M.S.K.

A83-26767#
THREE-DIMENSIONAL ELASTOPLASTIC FINITE ELEMENT ANALYSIS
W. LIU (Jilin University, Changchun, People's Republic of China) and C. XIONG (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol. 3, Dec. 1982, p 53-60. In Chinese, with abstract in English refs

A spatial, 20-node isoparametric element was chosen in combination with a Front Solver numerical solution method to obtain accurate elastoplastic characterizations of aircraft engines. A cubic fourteen point gaussian integral was applied to the finite element calculations in order to shorten computing time and necessary memory Details of the constitutive equations, solution algorithm, and large problem strategy are provided. Examples were worked out for instances of a notched thick plate featuring higher local stresses than the nominal applied stresses, and of a thick plate with a central hole and a stress distribution higher on the inside edges than globally. Comparisons with experimental data showed good agreement. M.S K.

A83-26885
THE DEVELOPMENT OF A CENTRAL ELECTRICAL GENERATING SYSTEM FOR TRANSPORT VEHICLES [O SINTEZE EDINOI ELEKTROENERGETICHESKOI SISTEMY TRANSPORTNYKH SREDSTV]
I. A LAZAREV, A. V ROZANOV, and IU. A. IANYSHEV Akademiia Nauk SSSR, Izvestiia, Energetika i Transport, Jan.-Feb. 1983, p. 124-133 In Russian. refs

The paper deals with the development of a systems approach for designing a central energy-generating unit comprising electrical, hydraulic, pneumatic, and other on-board systems for supplying the auxiliary power needs of the vehicles (trains, aircraft, ships, motor vehicles) used in transport. The approach outlined here uses machine methods of synthesizing a variety of possible solutions for designing the central energy unit; it uses existing resources and seeks the solution that best accords with performance parameters By way of example, the approach is applied to the electrical generating system of a four-engine

transport aircraft designed to transport cargoes of 90 tons over distances of 8000 km. C.R

N83-18731# Minnesota Univ., Austin. Dept. of Mechanical Engineering.
INTRODUCTION TO FILM COOLING; THREE DIMENSIONAL FILM COOLING; CURVATURE EFFECTS AND FILM COOLING
R J. GOLDSTEIN *In* Von Karman Inst. for Fluid Dyn. Film Cooling and Turbine Blade Heat Transfer, Vol. 1 53 p 1982 refs
Avail: NTIS HC A11/MF A01

Graphs and tables show the geometry and range of test conditions used in early two dimensional film cooling studies as well as the requirements for heat sink models of film cooling. Measurements of film cooling effectiveness computed by various investigators are correlated and compared. The effects of injection velocity and the influences of free stream turbulence and of laminar flows on film cooling effectiveness are discussed. Full coverage film cooling on flat surfaces with different injection systems and the effects of convexity and concavity on turbulent boundary layers are illustrated. Film cooling on over curved surface with and without pressure gradients, the recovery region, and gas turbine measurement are also covered. A.R.H.

N83-18953# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
JOURNAL OF ENGINEERING THERMOPHYSICS (SELECTED ARTICLES)
4 Nov. 1982 119 p refs Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 1, no. 2, May 1980 p 110-155, 165-175 and 185-194 Proc. of the Second Natl. Eng. Thermophys. Conf., Hangzhon, China, Nov. 1978
(AD-A122037; FTD-ID(RS)T-1011-82) Avail: NTIS HC A06/MF A01 CSCL 13G

The fundamental equations are presented for three dimensional flow in turbomachines in non-orthogonal curvilinear coordinates. Mathematical methods are used to calculate flow in transonic turbomachine with shocks and also in an axial flow compressor. An experiment to improve the surge margin by use of cascade with splitter blades is described. The finite element method is applied to the solution of a transient two dimensional temperature field for air-cooled turbine blades. Gas turbine combustors and turbine airfoils are investigated in terms of airflow and cooling distribution. Finally, a pulsed laser technique to measure thermal diffusivity is described.

N83-18958# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPLICATION OF THE FINITE ELEMENT METHOD TO THE SOLUTION OF TRANSIENT TWO-DIMENSIONAL TEMPERATURE FIELD FOR AIR-COOLED TURBINE BLADE
G. KUAN-LIANG, G. XIN-SHI, and S. ZIAO-LAN *In its* J. of Eng. Thermophys (Selected Articles) (FTD-ID(RS)T-1011-82) p 51-62 4 Nov. 1982 refs Transl into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 1, no. 2, May 1980 p 140-146
Avail NTIS HC A06/MF A01 CSCL 20D

To assure air-cooled turbine blade of being able to operate safely and reliably during continuous variation of mechanical, particularly thermal loads, it is necessary to calculate the transient temperature field of blades. In this paper the finite element method for computation of transient two dimensional temperature distribution is discussed, the calculation of transient temperature field for a middle cross section of air-cooled blade is made and discussed. Author

N83-19018*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY ROTOR WAKE MEASUREMENTS WITH A LASER VELOCIMETER
D R. HOAD (Army Aviation Research and Development Command), D. B. RHODES, and J. F. MEYERS Mar 1983 92 p refs
(Contract DA PROJ. 1L2-62209-AH-76)
(NASA-TM-83246; L-15080; NAS 1.15:83246; AVRADCOM-TR-82-B-7) Avail: NTIS HC A05/MF A01 CSCL 20D

A laser velocimeter (LV) was used to determine rotor wake characteristics. The effect of various fuselage widths and rotor-fuselage spacings on time averaged and detailed time dependent rotor wake velocity characteristics was defined. Definition of time dependent velocity characteristics was attempted with the LV by associating a rotor azimuth position with each velocity measurement. Results were discouraging in that no apparent time dependent velocity characteristics could be discerned from the LV measurements. Since the LV is a relatively new instrument in the rotor wake measurement field, the cause of this lack of periodicity is as important as the basic research objectives. An attempt was made to identify the problem by simulated acquisition of LV-type data for a predicted rotor wake velocity time history Power spectral density and autocorrelation function estimation techniques were used to substantiate the conclusion that the primary cause of the lack of time dependent velocity characteristics was the nonstationary flow condition generated by the periodic turbulence level that currently exists in the open throat configuration of the wind tunnel. B.G.

N83-19062# McDonnell-Douglas Research Labs., St. Louis, Mo.
VISCOUS FLOWFIELDS INDUCED BY THREE-DIMENSIONAL LIFT JETS IN GROUND EFFECT Final Technical Report, 22 Sep. 1980 - 30 Jan. 1982
W. W. BOWER 30 Jan 1982 72 p refs
(Contract N00014-80-C-0454)
(AD-A121026; MDC-Q0769) Avail: NTIS HC A04/MF A01 CSCL 20D

The turbulent flowfields associated with single and multiple jets impinging on a ground plane are relevant to the aerodynamics of VTOL aircraft in ground effect. These flowfields are computed using the Reynolds equations and a two-equation turbulence model to describe an isolated jet and two interacting jets with fountain formation. Coordinate transformations are employed to apply the boundary conditions for the governing equations in the far field, and a third-order-accurate upwind-difference scheme is used to discretize the resulting system. Flowfield properties calculated for these impinging-jet configurations are presented and compared with experimental data. GRA

N83-19124*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF A SYSTEMATIC FINITE-ELEMENT MODEL MODIFICATION TECHNIQUE TO DYNAMIC ANALYSIS OF STRUCTURES
J. C. ROBINSON Jan. 1983 16 p refs Presented at 23rd AIAA/ASME/ASCE/AHS Structures, Structural Dyn and Mater. Conf., New Orleans, 10-12 May 1982 Document previously announced in AIAA as A82-30178
(NASA-TM-83292; NAS 1.15:83292; AIAA-0730) Avail: NTIS HC A02/MF A01 CSCL 20K

For abstract see A82-30178.

N83-19129# Cambridge Univ. (England). Dept. of Engineering.
VIBRATION IN TURBOMACHINERY: A BIBLIOGRAPHY OF RESEARCH REPORTS (1966 - 1981)
P M. E PERCIVAL 1982 25 p refs Sponsored by Rolls Royce Ltd.
(CUED/A-TURBO-TR-109; ISSN-0309-6521) Avail: NTIS HC A02/MF A01

This bibliography covers work published in the 15 year period since 1966. It is concerned with the aerodynamic aspects of vibration in turbomachinery and the list of authors shows a world

wide coverage. The main papers were written in English or are available in English translation. E A.K.

N83-19135# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
DEVELOPMENT OF FRACTURE MECHANICS CONCEPTS APPLICABLE TO AIRCRAFT STRUCTURES Final Scientific Report
H. LIEBOWITZ 5 Nov. 1981 44 p refs
(Contract N00019-79-C-0491)
(AD-A121900) Avail: NTIS HC A03/MF A01 CSCL 01C

The feasibility of using an accelerated fatigue test program to predict constant amplitude fatigue lives of precracked specimens was examined. An analytical basis for the fracture mechanics approach was developed The predicted curves from the accelerated test data were found to provide a good fit for the constant amplitude results in 2024-T3 and 7075-T6 aluminum alloys. These results indicate that the accelerated test data can be effectively employed to predict constant amplitude fatigue lives, while also providing a considerable reduction in testing time. Part B of this relates to effects of thickness and microstructure on nonlinear toughness parameters on CORONA-5. The variation of several linear and nonlinear fracture toughness parameters with thickness was studied in CORONA-5 titanium alloy which has two different microstructures The microstructure containing fine needles of alpha particles was found to have higher toughness than that containing globular alpha particles. This may be due to the difference in the shape of the particles or in the size of the particles GRA

N83-19434# Naval Biodynamics Lab., New Orleans, La.
INSTRUMENTATION REQUIREMENTS FOR ASSESSING OCCUPANT RESPONSE TO THREE DIMENSIONAL HIGH ACCELERATION ENVIRONMENTS
G. D. FRISCH and L. A. DAULERIO (NADC) *In* AGARD Impact Injury Caused by Linear Acceleration: 9 p Oct. 1982 refs
Avail: NTIS HC A21/MF A01

Instrumentation standardization for ejection and crash testing is addressed, and the effectiveness of the proposed methology in assessing a series of fully instrumented ejections ranging from 0 to 600 KEAS is demonstrated The effects on seat performance attributable to canopy jettisoning or penetration, rocket ignition, and windblast are analyzed. Author

N83-19953# Hahn Associates, Northborough, Mass.
FEASIBILITY STUDY ON CNC MULTIOPERATION GRINDING OF JET ENGINE COMPONENTS USING FORCE SENSING ADAPTIVE CONTROL Final Report, 1 Apr. - 30 Sep. 1982
R. S. HAHN 30 Sep. 1982 89 p refs
(Contract F49620-82-C-0066; AF PROJ 2305)
(AD-A121725; AFOSR-82-0992TR) Avail NTIS HC A05/MF A01 CSCL 13H

This report describes methods for reducing costs in grinding jet engine components using computer control with grinding force sensors to obtain improved grinding performance. Multioperation grinding using two wheelheads on the same cross slide as well as on separate slides is discussed. A method for eliminating thermal size errors is presented. Formulas are given for estimating grinding cycles, stock removal rates and wheelwear rates for both normal workspeed grinding and creep feed grinding. The computer, with the force sensors, can monitor differential wheelwear and thereby prevent form errors. Wheel sharpness can also be monitored to avoid thermal damage Author (GRA)

N83-20007# Naval Air Engineering Center, Lakehurst, N.J.
THE 60-HZ TO 400-HZ ELECTRICAL POWER CONVERSION Final Report
F. V. KERN 8 Nov 1982 23 p refs
(Contract WF41461000)
(AD-A122040; NAEC-92-170) Avail: NTIS HC A02/MF A01 CSCL 10B

Report comments on present 400 Hz power distribution methods, presents a study to determine optimum 400 Hz power sources, and recommends a possible future source Author (GRA)

N83-20048# Air Force Geophysics Lab., Hanscom AFB, Mass.
HEATER-GENERATED INTERMEDIATE-SCALE IRREGULARITIES: SPATIAL DISTRIBUTION AND SPECTRAL CHARACTERISTICS Environmental Research Papers, Aug. 1980 - Jan. 1981
R. C. LIVINGSTON 22 Jun. 1982 33 p refs
(Contract AFGL PROJ. 4643)
(AD-A120866; AFGL-TR-82-0174; AFGL-ERP-781) Avail: NTIS HC A03/MF A01 CSCL 13A

The first extensive phase scintillation measurements during both over-and underdense heating are described. The data were collected from an aircraft, and by making repeated scans in the vicinity of the heated volume, the overall spatial distribution of intermediate-scale irregularities has been established. During overdense heating, the irregularities maximize in strength near the HF reflection height, but also map downward at least 100 km with only moderate weakening From the relative frequency shifts of the phase spectra measured for different directions of aircraft motion, the irregularity anisotropy and drift have also been estimated. The change in phase spectra shape between 6.2 MHz and 9.9 MHz overdose heating is consistent with thermal self-focusing irregularity generation. Underdense heating produces a different phase spectral signature than is theoretically predicted, although enhanced energy does occur at scintillation producing scale sizes. Author (GRA)

N83-20119*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED POWER TRANSMISSION TECHNOLOGY
G. K. FISCHER, ed. Jan. 1983 541 p refs Proc. of symp. held in Cleveland, Ohio, 9-11 Jun. 1981 Sponsored in cooperation with Army Aviation Research and Development Command
(NASA-CP-2210, E-817; NAS 1.55:2210;
AVRADCOM-TR-82-C-16) Avail: NTIS HC A23/MF A01 CSCL 13I

Technology overviews, advanced transmission concepts, rolling-element bearing technology, traction drive technology, spiral bevel gear technology, and spur gear technology are discussed.

N83-20120*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA HELICOPTER TRANSMISSION SYSTEM TECHNOLOGY PROGRAM
E. V. ZARETSKY *In its* Advanced Power Transmission Technol. p 15-34 Jan 1983 refs
Avail: NTIS HC A23/MF A01 CSCL 01C

The purpose of the NASA Helicopter Transmission System Technology Program is to improve specific mechanical components and the technology for combining these into advanced drive systems to make helicopters more viable and cost competitive for commerical applications. The history, goals, and elements of the program are discussed. Author

N83-20124*# United Technologies Corp., Stratford, Conn. Aircraft Div
AN OVERVIEW OF ADVANCEMENTS IN HELICOPTER TRANSMISSION DESIGN
J. H. MANCINI *In* NASA. Lewis Research Center Advanced Power Transmission Technol. p 109-122 Jan. 1983
(Contract NAS3-17859; DAAJ02-76-C-0044)
Avail: NTIS HC A23/MF A01 CSCL 01C

Development of a high temperature operating helicopter gearbox is discussed. Author

N83-20125*# Bell Helicopter Co., Fort Worth, Tex.
DESIGN OF AN ADVANCED 500-HP HELICOPTER TRANSMISSION
C. E. BRADDOCK and R. A BATTLES *In* NASA. Lewis Research Center Advanced Power Transmission Technol. p 123-140 Jan 1983 refs
(Contract NAS3-21595)
Avail. NTIS HC A23/MF A01 CSCL 01C

High contact ratio spar gears planetary, spiral besel gears, bearings, investment-cast planet carrier, and investment cast stainless-steel housings are discussed. Author

N83-20126*# Transmission Research, Inc., Cleveland, Ohio
HELICOPTER TRANSMISSION ARRANGEMENTS WITH SPLIT-TORQUE GEAR TRAINS
G. WHITE *In* NASA Lewis Research Center Advanced Power Transmission Technol. p 141-150 Jan. 1983 refs Presented at the 1st European Rotocraft and Powered Lift Aircraft Forum, Southampton, England, Sep 1975
Avail: NTIS HC A23/MF A01 CSCL 01C

As an alternative to component development, the case for improved drive-train configuration is argued. In particular, the use of torque-splitting gear trains is proposed as a practicable means of improving the effectiveness of helicopter main gearboxes. Author

N83-20127*# Transmission Technology Co., Inc , Fairfield, N J.
DESIGN STUDY OF SELF-ALINING BEARINGLESS PLANETARY (SABP) GEAR
D J. FOLENTA *In* NASA. Lewis Research Center Advanced Power Transmission Technol p 151-160 Jan. 1983 refs
(Contract NAS3-21604)
Avail: NTIS HC A23/MF A01 CSCL 13I

The feasibility of using the self alining, bearingless planetary (SABP) transmission in an uprated version of the OH-58 helicopter was evaluated, specific performance comparisons of this new transmission with contemporary helicopter transmission systems and with the uprated version of the OH-58 power transmission were made. Author

N83-20129*# General Electric Co., Cincinnati, Ohio
IMPACT OF NASA-SPONSORED RESEARCH ON AIRCRAFT TURBINE ENGINE BEARING SPECIFICATIONS
A. H NAHM *In* NASA. Lewis Research Center Advanced Power Transmission Technol. p 173-184 Jan. 1983 refs
Avail: NTIS HC A23/MF A01 CSCL 20E

The advancement of the state-of-the-art in aircraft bearing materials technology is reviewed. Current specifications and design practices resulting from NASA-sponsored programs are included. Author

N83-20134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE-BORE TAPERED-ROLLER BEARING PERFORMANCE AND ENDURANCE TO 2.4 MILLION DN
R. J. PARKER *In its* Advanced Power Transmission Technol. p 253-270 Jan. 1983 refs
Avail: NTIS HC A23/MF A01 CSCL 13I

The operating characteristics and experimental life estimates for 120.65 mm bore tapered roller bearings of two designs under combined radial and thrust loads were determined. A modified standard bearing design was tested at speeds up to 15,000 rpm. A computer optimized, high speed design was tested at speeds up to 20,000 rpm Both designs were tested at a combined load of 26,700 N (6000 lb) radial load and and 53,400 N (12,000 lb) thrust load. Advanced helicopter transmissions which require the higher-speed capability of tapered-roller bearings also require higher temperature capability (ref. 2). Thus, materials with temperature capabilities higher than the conventional carburizing steels are required EAK

N83-20165# Borg-Warner Corp., Carson, Calif. Pump Div.
FEED-PUMP HYDRAULIC PERFORMANCE AND DESIGN IMPROVEMENT. PHASE 1: RESEARCH PROGRAM DESIGN, VOLUME 1 Final Report
W. H BROWN, S. GOPALAKRISHNAN, R. FEHLAU, W E THOMPSON, and D G. WILSON Mar. 1983 149 p refs Sponsored by EPRI 2 Vol.
(Contract EPRI PROJ. 1884-6)
(DE82-903116; EPRI-CS-2323-VOL-1) Avail NTIS HC A07/MF A01

The design, procurement, testing, and operation of large feed pumps with increased reliability and stability over the full range of operating conditions was investigated. A research plan based on a review of the present state of the art and which defined the necessary R & D program and estimated the benefits and costs of the program is presented. Thirty interrelated tasks were designed to perform the needed research; to verify the results, to develop improved components; and to publish computer-aided design methods, pump specification guidelines, and a troubleshooting manual. Most of the technology proposed in the research plan is applicable to nuclear power plants as well as to fossil-fired plants. Design, performance and failures of feed pumps, and recommendations for research on pump dynamics, design, and specifications are discussed B.G.

N83-20166# Borg-Warner Corp., Carson, Calif. Pump Div.
FEED-PUMP HYDRAULIC PERFORMANCE AND DESIGN IMPROVEMENT. PHASE 1: RESEARCH PROGRAM DESIGN, VOLUME 2 Final Report
W. H. BROWN, S. GOPALAKRISHNAN, R. FEHLAU, W. E. THOMPSOM, and D. G. WILSON Mar. 1982 196 p refs Sponsored by EPRI 2 Vol.
(Contract EPRI PROJ. 1884-6)
(DE82-903304; EPRI-CS-2323-VOL-2) Avail NTIS HC A09/MF A01

An improved basis for the design, procurement, testing, and operation of large feed pumps with increased reliability and stability over the full range of operating conditions was implemented. A research plant based on a review of the present state of the art and which defined the necessary R & D program and estimates the benefits and costs of the program is discussed. It is designed to perform the needed research; to verify the results, to develop improved components; and to publish computer-aided design methods, pump specification guidelines, and a troubleshooting manual. Most of the technology proposed in the research plan is applicable to nuclear power plants as well as to fossil-fired plants. Appendixes on pump design, cavitation damage, performance testing, hydraulics, two phase flow in pumps, flow stability, and rotor dynamics are contained. B G.

N83-20180# Groupement des Industries Francaises Aeronautiques et Spatiales, Paris (France). Groupe de Travail Fiabilite-Maintenance.
RECOMMENDATIONS AS TO THE ELABORATION OF OPERATIONAL RELIABILITY, MAINTENANCE COST AND AVAILABILITY CLAUSES IN AERONAUTICAL EQUIPMENT SUPPLY CONTRACTS [RECOMMANDATIONS POUR L'ELABORATION DE CLAUSES DE FIABILITE OPERATIONNELLE, DE COUT DE MAINTENANCE, DE DISPONIBILITE DANS LES CONTRATS DE FOURNITURE D'EQUIPMENTS AERONAUTIQUES]
J. N. BASMAISON *In* ESA Reliability and Maintainability p 11-13 Sep. 1982 In FRENCH
Avail: NTIS HC A99/MF A01

The fundamental notions it is advisable to keep in mind during the negotiation of clauses covering reliability, availability, and even the cost of maintenance discussed include: (1) shared responsibilities of the equipment supplier, the aircraft manufacturer, and the user in an operational evaluation of a material; (2) necessary and sufficient knowledge of the operational environment, (3) precise definition of and aptitude for measuring characteristics whose operational control is the object of these clauses; and (4)

clarity of the contract in all technical, commercial, and administrative aspects. Transl. by A.R H.

N83-20212# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Dept. Electronique.
RESULTS OF A QUALITY PRINCIPLE ON THE MTBF OF AN EQUIPMENT DEVELOPED FOR THE A-300 [RESULTATS D'UNE ACTION QUALITE SUR LE MTBF D'UN EQUIPEMENT DEVELOPPE POUR L'A-300]
N. VOISIN *In* ESA Reliability and Maintainability p 249-254 Sep. 1982 In FRENCH
Avail: NTIS HC A99/MF A01

The structure of quality control at the level of the equipment supplier is presented and applied in studies of the MTBF of the master warning controller of the A-300 aircraft. A plan is included for following the quality and reliability of onboard digital equipment and software configuration management Transl. by A.R.H.

N83-20232# ANDERSA/GERBOIS, Palaiseau (France).
A FAILURE DIAGNOSIS METHODOLOGY [UNE METHODOLOGIE DE DIAGNOSTIC DE PANNES]
C. BASKIOTIS, J. P. BRAULT, and A RAULT *In* ESA Reliability and Maintainability p 383-388 Sep. 1982 refs In FRENCH Sponsored by the Pilot Project SURF
(Contract STAE-77.93304)
Avail: NTIS HC A99/MF A01

A method for diagnosing the internal state of physical systems is presented, compared with other approaches, and applied to the MARBORE 2 aircraft. The equipment used to acquire the measurements is described Transl. by A.R.H.

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GEOSCIENCES

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

A83-24037#
OPTIMUM SITING OF NEXRAD TO DETECT HAZARDOUS WEATHER AT AIRPORTS
P. R. MAHAPATRA, D. S. ZRNIC, and R J. DOVIAK (NOAA, National Severe Storms Laboratory, Norman, OK) Journal of Aircraft, vol. 20, Apr. 1983, p. 363-371. U.S. Department of Transportation refs
(Contract DOT-FA01-80-1-Y-10524)

The Federal Aviation Administration has been concerned for some time about the number of aircraft accidents during terminal flight in which weather has been identified as the cause or a contributing factor. The next generation weather radar (NEXRAD), for which final specifications are being worked out on a multiservice basis, offers the possibility of dedicated and detailed surveillance of hazardous weather in the terminal airspace. This paper outlines considerations for choosing a site for a NEXRAD installation to fulfill this role in an optimum manner. It is shown that the detection of low-level shear without precipitation imposes the most severe constraints on NEXRAD siting. Three general siting areas are considered: (1) within the airport area, (2) within the terminal area, but outside the airport area, and (3) outside the terminal area. When a single NEXRAD radar must cover all hazardous phenomena over the terminal area, siting within the airport area appears to be the best choice. Under certain conditions, a case exists for siting the NEXRAD outside the terminal area. (Author)

N83-20430# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering
DESIGN OF PLYWOOD AND PAPER FLYWHEEL ROTORS Final Report
A. G. ERDMAN, D. L. HAGEN, and S. A GAFF May 1982 133 p refs
(Contract W-7405-ENG-48)
(DE83-002276; UCRL-15504) Avail: NTIS HC A07/MF A01

Technical and economic design factors of cellulosic rotors are compared with conventional materials for stationary flywheel energy storage systems. Wood species, operation in a vacuum, assembly and costs of rotors are evaluated Wound kraft paper, twine and plywood rotors are examined Two hub attachments are designed. Support stiffness is shown to be constrained by the material strength, rotor configuration and speed ratio. Preliminary duration of load tests was performed on vacuum dried hexagonal birch plywood. Dynamic and static rotor hub fatigue equipment is designed Moisture loss rates while vacuum drying plywood cylinders were measured, and the radial and axial diffusion coefficients were evaluated. Diffusion coefficients of epoxy coated plywood cylinders were also obtained. Economics of cellulosic and conventional rotors were examined. Plywood rotor manufacturing costs were evaluated The optimum economic shape for laminated rotors is shown to be cylindrical. Vacuum container costs are parametrically derived and based on material properties and costs. Containment costs are significant and are included in comparisons The optimum design stress and wound rotor configuration are calculated for seventeen examples. Plywood rotors appear to be marginally competitive with the steel hose wire or E glass rotors. High performance oriented kraft paper rotors potentially provide the lowest energy storage costs in stationary systems. DOE

N83-20445*# Man-Acoustics and Noise, Inc , Seattle, Wash.
A STUDY OF NOISE METRIC AND TONE CORRECTION ACCURACY Final Report, Oct. 1979 - Feb. 1982
B. M SULLIVAN and J. E MABRY Apr. 1982 72 p refs
(Contract NAS1-15955)
(NASA-CR-165910; NAS 1.26:165910; MAN-106) Avail: NTIS HC A04/MF A01 CSCL 13B

Methods currently used to measure human response to aircraft flyover noise were investigated. Response to high level aircraft noise usually experienced outdoors was obtained. Response to aircraft flyover noise typical of indoor exposure was also investigated. It was concluded that current methods for evaluating response to aircraft flyover are more accurate for outdoor noise. Author

N83-20493# Committee on Science and Technology (U. S. House).
AVIATION WEATHER
Washington GPO 1982 219 p Hearing before the Subcomm. on Invest and Oversight and the Subcomm. on Transportation, Aviation and Mater. of the Comm. on Sci. and Technol , 97th Congr., 2d Sess., 11 Aug. 1982
(GPO-98-983) Avail. Subcommittee on Investigations and Oversight

Accurate detection of weather around an airport and the most effective means of transmitting that information to a pilot are discussed. Giving weather sufficient priority, detection technology for such phenomena as wind shear, and corrollaries to wind shear such as downbursts that might hinder takeoff and landings Author

N83-20500# Aeronautical Research Labs., Melbourne (Australia). Dept. of Mechanical Engineering.
MANUFACTURE OF A HOT WIRE TARGET ELEMENT FOR A CLOUD LIQUID WATER CONTENT METER
N. J. REPACHOLI Mar. 1982 25 p refs
(AD-A122111; ARL/MECH-ENG-TM-412; AR-002-348) Avail: NTIS HC A02/MF A01 CSCL 04B

An instrument has been developed to measure the liquid water content of artificially generated and naturally occurring icing clouds during ground and flight anti-icing trials of the Nomad N24 aircraft.

This report describes the techniques employed in the manufacture of the hot wire target elements used in the liquid water content meter. Author (GRA)

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MATHEMATICAL AND COMPUTER SCIENCES

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

N83-19487*# University of Southern California, Los Angeles.
A SYSTEM STUDY FOR THE APPLICATION OF MICROCOMPUTERS TO RESEARCH FLIGHT TEST TECHNIQUES Quarterly Interim Status Report, 1 Dec. 1982 - 28 Feb. 1983
R. K SMYTH 1983 149 p refs
(Contract NSG-4027)
(NASA-CR-169869; NAS 1 26:168869; SR-8302-FTT-512) Avail: NTIS HC A07/MF A01 CSCL 09B

The onboard simulator is a three degree of freedom aircraft behavior simulator which provides parameters used by the interception procedure. These parameters can be used for verifying closed loop performance before flight. The air to air intercept mode is a software package integrated in the simulation process that generates a target motion and performs a tracking procedure that predicts the most likely next target position, for a defined time step. This procedure also updates relative position parameters and gives adequate fire commands. A microcomputer based on an aircraft spin warning system periodically samples the assymetric thrust and yaw rate of an airplane and then issues voice synthesized warnings and /or suggests to the ilot how to respond to the situation. S.L.

N83-19496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
BASIC DATA MANIPULATION AND DISPLAY SYSTEM (BDMADS)
J. R. SZUCH Feb. 1983 61 p refs
(NASA-TM-83328; E-1575; NAS 1.15.83328) Avail: NTIS HC A04/MF A01 CSCL 09B

BDMADS, a BASIC Data Manipulation and Display System, is a collection of software programs that run on an Apple II Plus personal computer. BDMADS provides a user-friendly environment for the engineer in which to perform scientific data processing. The computer programs and their use are described. Jet engine performance calculations are used to illustrate the use of BDMADS. Source listings of the BDMADS programs are provided and should permit users to customize the programs for their particular applications. Author

N83-19562# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
IMPROVED DYNAMIC MODELS FOR AIR COMBAT ANALYSIS Final Report, 1 Dec. - 31 Jan. 1981
N. FARBER, M. NEGRIN, and J SHINAR Wright-Patterson AFB, Ohio AFWAL Jul. 1982 123 p refs
(Contract F33615-81-K-3007; AF PROJ. 2404)
(AD-A121379, AFWAL-TR-82-3057) Avail: NTIS HC A06/MF A01 CSCL 15G

This report summarizes a multi-year research effort to develop improved dynamic model for air combat analysis. Reaching this objective is demonstrated by providing a zero-order feedback solution to the three dimensional medium range air-to-air interception engagement, formulated as a zero-sum differential game. Using realistic aerodynamic and propulsion models, control strategies are expressed in a feedback form expressing explicitly the dependence on the measurable state variables and aircraft performance parameters. The successive analysis is based on an innovative, variable modelling approach applying the method of forced singular perturbations. An imaginary air defence scenario serves as an illustrative example, showing the efficiency and the usefullness of the method for a rapid systematical parametric study. The accuracy of the zero-order feedback approximation and for most cases higher order terms may not be needed. Such corrective terms can be obtained, if necessary, by additional off-line computation. Computing the zero-order feedback strategies requires a minimal effort and presents therefore an extremely attractive candidate for real time implementation onboard of advanced fighter aircraft. It is, therefore, recommended to incorporate the implementation of the FSPT algorithm for optimal medium range air combat strategy in a future flight test program. Author (GRA)

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PHYSICS

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

A83-23708* National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
A NOTE ON THE TIP NOISE OF ROTATING BLADES
F. FARASSAT and R. M. MARTIN (NASA, Langley Research Center, Hampton, VA) Journal of Sound and Vibration, vol. 86, Feb. 8, 1983, p. 449-453 refs

A possible cause is suggested for the discrepancies that have arisen between measured results and linear acoustic predictions (based on thickness noise alone), at least at the lower tip Mach number range of the tests. The blade tip is shown to be an effective noise generation area when Isom's thickness noise formula is studied numerically (Farassat and Nystrom, 1980). It is found that neglecting the sources on the airfoil-shaped cut at the very tip of the blade causes serious errors in the predicted thickness noise. It is also found that the tip area becomes less important as the tip speed is increased. The effect of the tip surface on the thickness noise indicates that it should be included in the calculation of the loading noise. C.R.

A83-24034*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GROUND EFFECTS ON AIRCRAFT NOISE FOR A WIDE-BODY COMMERCIAL AIRPLANE
W. L. WILLSHIRE, JR. (NASA, Langley Research Center, Acoustics and Noise Reduction Div., Hampton, VA) Journal of Aircraft, vol. 20, Apr 1983, p. 345-349. refs

(Previously cited in issue 24, p. 4128, Accession no. A81-48638)

A83-24333#
A THEORETICAL AND EXPERIMENTAL STUDY OF PROPELLER NOISE [CONTRIBUTION A L'ETUDE THEORIQUE ET EXPERIMENTALE DU BRUIT D'HELICE]
H. GOUNET and S. LEWY (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) ONERA, TP no. 1982-122, 1982. 24 p. In French
(ONERA, TP NO. 1982-122)

Studies to predict the noise emission from a propeller and its directivity as a function of the Mach number are presented. Attention was focused on the transonic regime. The analytical results indicated the noise source was due to monopolar and bipolar sources, and the directivity of both sources was mapped. The dependencies on the Mach number and the number of blades, as well as the rotational speed, were calculated. Experiments were carried out on a two-bladed propeller instrumented symmetrically with five pressure sensors. Pressure fluctuations and acoustic levels

are reported, showing that the acoustic contribution to the load on the blades is negligible. Tests were also run on the effects of the Mach number of the tip speed and of the rotational speed of the blade. Sound levels were highest in the plane of the blade. Increasing the speed of the blades into the transonic regime shifted the sound density relation to a dependence on the load on the blade, and the acoustic pressure became a significant factor to the fluctuating load on the blades. M.S K

A83-25913#
AN EXPERIMENTAL STUDY OF WINDTURBINE NOISE FROM BLADE-TOWER WAKE INTERACTION
E. N. MARCUS (Endeco, Inc., Marion, MA) and W. L HARRIS (MIT, Cambridge, MA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 10 p. refs
(Contract XE-1-1055-1)
(AIAA PAPER 83-0691)

A program of experiments has been conducted to study the impulsive noise of a horizontal axis windturbine These tests were performed on a 1/53 scale model of the DOE-NASA MOD-1 windturbine. Experiments were performed in the M I.T. 5 x 7-1/2 ft Anechoic Windtunnel Facility. The impulsive noise of a horizontal axis windturbine is observed to result from repeated blade passage through the mean velocity deficit induced in the lee of the windturbine support tower. The two factors which most influence this noise are rotation speed and tower drag coefficient The intensity of noise from blade tower wake interaction is predicted to increase with the fourth power of the RPM and the second power of the tower drag coefficient. These predictions are confirmed in experiments Further experiments are also presented in order to observe directionality of the acoustic field as well as the acoustic influence of tower shape and blade number.
(Author)

A83-25915*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va
NOISE TRANSMISSION CHARACTERISTICS OF ADVANCED COMPOSITE STRUCTURAL MATERIALS
L. A. ROUSSOS, C. A. POWELL (NASA, Langley Research Center, Hampton, VA), F. W. GROSVELD (Bionetics Corp., Hampton, VA), and L. R. KOVAL (Missouri-Rolla, University, Rolla, MO) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr 11-13, 1983, 12 p. refs
(AIAA PAPER 83-0694)

Theoretical and experimental results from a study of noise transmission properties of large unstiffened panels which simulated aircraft outer skins and interior trim are reported. The investigation was performed to define the effects of composite structures on fuselage noise transmission relative to the transmissivity of aluminum structures. One-third octave band measurements were obtained in a two-room facility for measuring transmission loss. Center frequencies of at least 100 Hz were used, and 14 different composite panels, including samples of Kevlar, fiberglass, and graphite, were examined. Details of the composites fabrication techniques are provided, and an infinite panel theory transmission loss model is defined The flexural rigidities of tape and fabric panels are calculated, as are the transmission losses, the coincidence frequency, and the critical frequency. The theory was determined to be accurate to within 1 dB of the measured transmission loss for mass-controlled specimens. M.S K.

A83-25916*#
NOISE TRANSMISSION THROUGH SIDEWALL TREATMENTS APPLICABLE TO TWIN-ENGINE TURBOPROP AIRCRAFT
F. W. GROSVELD (Bionetics Corp., Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 10 p refs
(Contract NAS1-16978)
(AIAA PAPER 83-0695)

The noise transmission loss characteristics of the sidewall treatment in the propeller plane of a twin-engine turboprop aircraft are experimentally investigated in the NASA Langley Research Center Transmission Loss Facility. The sound attenuation properties of the individual elements of this treatment are evaluated showing least noise transmission loss in the low frequencies (below 500 Hz) where the excitation levels at the propeller blade passage frequency and the first few harmonics are highest. It is shown that single and double wall resonances play an important role in the noise transmission loss values of the treatment at these low frequencies suggesting that a limp mass with a very low resonance frequency serves better as a trim panel than a trim panel having a high structural stiffness It is indicated that the window structures might be a potential noise control problem. (Author)

A83-25919#
ACOUSTIC WAVE PROPAGATION THROUGH THE SHEAR LAYER OF THE DNW LARGE OPEN JET WIND TUNNEL
R. ROSS (National Lucht- en Ruimtevaartlaboratorium, Emmeloord, Netherlands), K. J YOUNG, R. M. ALLEN (Boeing Commercial Airplane Co., Seattle, WA), and J. C A. VAN DITSHUIZEN (Duits-Nederlandse Windtunnel, Emmeloord, Netherlands) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 12 p. refs
(AIAA PAPER 83-0699)

The adequacy of the sound refraction theory corrections to measurements of the aeroacoustic signals obtained from models immersed in a jet shear in the German-Dutch wind tunnel were evaluated Four air horns and a speaker served as an aerodynamically shaped model for the calibrated noise source. The test channel is surrounded by an anechoic chamber to eliminate random noise. Data were taken with microphones traversing the flow, out of the flow, and in a stationary position. The Amiet shear layer corrections were determined to be valid in most applications However, with the presence of both high frequency and high Mach number, the refraction angle correction must be used to account for additional shear layer effects on the sound pressure level M.S K

A83-25923*# Florida State Univ , Tallahassee.
ON THE SHOCK CELL STRUCTURE AND NOISE OF SUPERSONIC JETS
C. K. W TAM (Florida State University, Tallahassee, FL) and J. A JACKSON American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 7 p. refs
(Contract NAG3-182)
(AIAA PAPER 83-0703)

A linear solution modeling the shock cell structure of an axisymmetric supersonic jet operated at off-design conditions is developed by the method of multiple-scales. The model solution takes into account the gradual spatial change of the mean flow in the downstream direction. Turbulence in the mixing layer of the jet has the tendency of smoothing out the sharp velocity and density gradients induced by the shocks. To simulate this effect, eddy viscosity terms are incorporated in the model. It is known that the interaction between the quasi-periodic shock cells and the downstream propagating large turbulence structures in the mixing layer of the jet is responsible for the generation of broadband shock associated noise. Experimentally, the dominant part of this noise has been found to originate from the part of the jet near the end of the potential core. Calculated shock cell spacing at the end of the jet core according to the present model is used to estimate the peak frequencies of the shock associated noise for a range of observation angles. Very favorable agreement with experimental measurements is found. (Author)

A83-25924*# North Carolina State Univ., Raleigh.
AN EXPERIMENTAL STUDY OF SUPERSONIC JET SHOCK-ASSOCIATED NOISE
R. T NAGEL and A. G. PAPATHANSIOU (North Carolina State University, Raleigh, NC) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 8 p. refs
(Contract NAG3-189)
(AIAA PAPER 83-0708)

A new method of screech tone reduction in underexpanded supersonic jets is utilized to determine if the amplitude of screech is related to the level of shock-associated broadband noise. Acoustic measurements show that as the screech tone is reduced, the broadband shock-associated noise may be increased by up to 4dB at some locations. Several experiments were conducted with disturbances put into the flow upstream of the final contraction. Results from these tests support the concept of linkage between the broadband shock noise and screech tones. Some interesting preliminary results were obtained with a disturbance of the flow at several locations downstream of the nozzle. These results are also discussed. (Author)

A83-25928*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
AN EXPERIMENTAL INVESTIGATION OF SOUND RADIATION FROM A DUCT WITH A CIRCUMFERENTIALLY VARYING LINER
C. R. FULLER and R. J SILCOX (NASA, Langley Research Center, Noise Control Branch, Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 7 p. Research supported by the National Research Council. refs
(AIAA PAPER 83-0712)

The radiation of sound from an asymmetrically lined duct is experimentally studied for various hard-walled standing mode sources. Measurements were made of the directivity of the radiated field and amplitude reflection coefficients in the hard-walled source section. These measurements are compared with baseline hardwall and uniformly lined duct data. The dependence of these characteristics on mode number and angular location of the source is investigated. A comparison between previous theoretical calculations and the experimentally measured results is made and in general good agreement is obtained. For the several cases presented an asymmetry in the liner impedance distribution was found to produce related asymmetries in the radiated acoustic field. (Author)

A83-25931#
NOISE SOURCE IDENTIFICATION IN AIRPLANE CABINS USING ACOUSTIC INTENSITY TECHNIQUE
G. A. DALAN and R L COHEN (Boeing Co., Seattle, WA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 8 p. refs
(AIAA PAPER 83-0716)

A technique to measure surface radiation from an airplane cabin in flight using a two microphone acoustic intensity system is described. The technique addressed the problems of high background levels, surface irregularity, and surface absorption that have complicated cabin radiation measurements. Two probe types were used: a bare probe for the reflective sidewall and ceiling regions, and a shielded probe for the absorptive carpet Laboratory tests were conducted to establish the accuracy and tolerance to background noise for the flight measurement system. From these tests the operating range for each probe was determined in terms of the ratio of pressure to intensity. This ratio, called the Signal-to-Noise Indicator (SNI), was used to screen out flight data saturated by the background field. From the cabin surveys several strong radiation areas, such as the ceiling panel and the air distribution and air return grills, were measured quantitatively. Small area sources were distinguished from adjacent areas and other weak sources were identified. (Author)

A83-25934*# Massachusetts Inst of Tech., Cambridge
A COMPARISON OF MODEL HELICOPTER ROTOR PRIMARY AND SECONDARY BLADE/VORTEX INTERACTION BLADE SLAP
J. E. HUBBARD, JR. and K. P. LEIGHTON (MIT, Cambridge, MA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr 11-13, 1983, 6 p. refs
(Contract NAS1-87416)
(AIAA PAPER 83-0723)

A study of the relative importance of blade/vortex interactions which occur on the retreating side of a model helicopter rotor disk is described. Some of the salient characteristics of this phenomenon are presented and discussed. It is shown that the resulting Secondary blade slap may be of equal or greater intensity than the advancing side (Primary) blade slap. Instrumented model helicopter rotor data is presented which reveals the nature of the retreating blade/vortex interaction. The importance of Secondary blade slap as it applies to predictive techniques or approaches is discussed When Secondary blade slap occurs it acts to enlarge the window of operating conditions for which blade slap exists. (Author)

A83-25949#
AN IMPROVED JET NOISE SCALING LAW WHICH INCORPORATES PHASE DIFFERENCES DUE TO FLIGHT EFFECTS
U. MICHEL (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Abteilung Turbulenzforschung, Berlin, West Germany) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 10 p. refs
(AIAA PAPER 83-0747)

The influence of flight velocity on the noise generation of a single stream shock free circular jet is studied. A previous scaling law is modified to improve the scaling of acoustical interference effects. In addition, it is shown that the Lighthill approach does consider the refraction processes known to occur in high speed jets. (Author)

A83-25962#
FRICTION DRAG AND OTHER DESIGN PARAMETERS FOR ACOUSTIC FACE SHEETS
P. M. ROSE and T. M LIU (Rohr Industries, Inc., Chula Vista, CA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 9 p.
(AIAA PAPER 83-0780)

Design changes and subsequent structural effects incurred in reducing jet noise are reviewed, together with test results from evaluations of the effects on aerodynamic drag produced by acoustic liner designs. The controlling factors in acoustic design are the face-sheet open area (POA), the face-sheet thickness, and the honeycomb thickness. Attention is given to the use of perforated materials of various types, the choice of hole diameters, and the application of a microporous cover on the POA-perforate. Design optimization is discussed, taking into account weight, the composites used, and the drag effects. Comparisons are made with test results for the drag coefficients of aluminum, titanium, porous and honeycomb liners for varying subsonic grazing speeds. M.S.K.

A83-25966*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRFOIL SELF NOISE - EFFECT OF SCALE
T. F. BROOKS and M. A MARCOLINI (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 18 p. refs
(AIAA PAPER 83-0785)

Key data from a comprehensive airfoil broadband self-noise study are reported. Attention here is restricted to two-dimensional sharp trailing-edge models. The models include seven NACA 0012 airfoil sections and five 'flat plate' sections with chordlengths

ranging from 2 54 to 60.96 cm Testing parameters include flow velocity, angle of attack to the flow, and boundary layer turbulence through natural transition and through tripping. Detailed aerodynamic measurements, of pertinence to the scaling problem of airfoil self-noise, were conducted in the near-wake of the trailing edges Presented are mean and rms turbulent velocity profiles as well as boundary layer thicknesses and integral thickness parameters for a large range of conditions The noise spectra of the self-noise sources were determined by the use of a cross-spectral technique. The spectra were normalized using the measured aerodynamic parameters in order to evaluate the most common scaling law now in use. An examination of the Reynolds number dependence of the overall self-noise levels has revealed a new and useful scaling result. This result appears to quantify the transition between turbulent-boundary-layer trailing edge noise and laminar-boundary-layer vortex shedding noise. (Author)

A83-26448#
SOUND PROPAGATION THROUGH FLUCTUATING FLOWS - ITS SIGNIFICANCE IN AEROACOUSTICS
A. M. CARGILL (Rolls-Royce, Ltd., Derby, England) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr 11-13, 1983, 14 p. refs
(AIAA PAPER 83-0697)

The paper begins with a review of the principles of sound scattering by unsteady flows, highlighting those areas that apply to aeroacoustics and showing what theoretical methods are applicable. The main areas where scattering is important are then discussed: long range propagation from aircraft flyovers, short range propagation from test beds and propagation through shear layers, affecting jet shielding, jet noise and the spectral broadening of turbine tones. In each case the conclusions are illustrated by previously unpublished data. Scattering has proven importance in outdoor source location measurements and spectral broadening, but its significance in jet noise remains an open question.
(Author)

A83-26449*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NEARFIELD OBSERVATIONS OF TONES GENERATED FROM SUPERSONIC JET FLOWS
J. C. YU and J. M. SEINER (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 18 p. refs
(AIAA PAPER 83-0706)

The physics of discrete tone generation (screech) from improperly expanded supersonic jets have been investigated experimentally. Both nearfield acoustic survey and phase-averaged schlieren flow visualization were conducted. The dominant mode of flow oscillation that occurred during intense screech and its coupling with the internal shock structure and external sound field were established Deductions made from the observed coupling mechanism revealed the importance of Helmholtz number and shock cell spacing in the maintenance of screech. Measured amplitude variation of screech are compared with computed amplitude variation of the dominant instability. The results suggest that jet instability plays a direct role in the generation of screech.
(Author)

A83-26450*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF MEASURED AND PREDICTED FLIGHT EFFECTS ON HIGH-BYPASS COAXIAL JET EXHAUST NOISE
J. R. STONE (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr. 11-13, 1983, 19 p. refs
(AIAA PAPER 83-0749)

A recently developed semi-empirical model for predicting the noise generated by conventional-velocity-profile coaxial jets is compared with full-scale flight data and model-scale simulated flight data for high-bypass nozzles. The prediction model has been shown to agree with small-scale static data for primary jet velocities from 215 to 795 m/s for a wide range of area, temperature and velocity ratios between streams However, there were insufficient model nozzle, simulated flight data available at that time to permit validation of the flight effects prediction The comparisons presented in this paper demonstrate that the prediction method is also valid in flight (Author)

N83-18651# Southampton Univ. (England) Dept. of Aeronautics.
PROPELLER NOISE PREDICTION AND RESEARCH TECHNIQUES
J WILLIAMS *In* Von Karman Inst. for Fluid Dyn. Propeller Performance and Noise, Vol. 1 113 p 1982 refs
Avail: NTIS HC A17/MF A01

The purpose and scope of propeller noise research are discussed. The basic concepts and practical origins of propeller acoustic signature characteristics are discussed Windtunnel and flight research techniques are discussed with special attention to their usage and application to provide propeller noise data and understanding for reliable noise prediction and reduction. Finally, some applied theoretical prediction treatments and some empirical parametric prediction procedures, together with typical correlations of theoretical and windtunnel spectra for full-scale propeller noise are discussed. R.J.F

N83-18655*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED THEORETICAL TREATMENT OF PROPELLER NOISE
F. FARASSAT *In* Von Karman Inst. for Fluid Dyn. Propeller Performance and Noise, Vol. 1 72 p 1982 refs
Avail: NTIS HC A17/MF A01 CSCL 20A

Current formulations used for the prediction of the noise of propellers are derived by a unified approach. The approach is based on various forms of the solution of Ffowcs Williams-Hawkings equation. The Ffowcs Williams-Hawkings equation is derived and the method of solving the equation in various forms using the Green's function approach is discussed. To understand the procedure in deriving these results, relevant facts of the generalized function theory are discussed The power of this theory is demonstrated by several examples. The theoretical formulas by various researchers for propeller noise prediction and a new result by the author are derived and discussed. The emphasis is on time domain methods. The relation of the acoustic theory to linear aerodynamic lifting surface theories is discussed. It is shown that treating linear aerodynamic theory from the point of view of acoustics can lead to new and useful results. R.J.F.

N83-18657# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Abteilung Technische Akustik.
PROPELLER AIRCRAFT NOISE-CERTIFICATION AND FLIGHT TESTING
H. H. HELLER *In* Von Karman Inst. for Fluid Dyn. Propeller Performance and Noise, Vol 2 121 p 1982 refs
Avail: NTIS HC A18/MF A01

Specifications for controlling aircraft noise emission and emission as developed by the ICAO and presently entitled International Standards and Recommended Practices - Environmental Protection, ANNEX 16 to the Convention on International Civil Aviation/ Volume 1, Aircraft Noise are elaborated. Those portions dealing with the noise certification of heavy (commuter and transport) and light (sports and recreational) propeller driven aircraft are discussed. Some information on the practice of noise certification data acquisition and evaluation, based on several hundred measurements, are provided. Current ideas towards changing, consolidating, and improving the present schemes and procedures are described Specific acoustic problem areas in flight testing and analysis are also covered. A.R.H.

N83-18658# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
PROPELLER AIRCRAFT INTERIOR NOISE
J. F WILBY *In* Von Karman Inst. for Fluid Dyn Propeller Performance and Noise, Vol 2 147 p 1982 refs
Avail NTIS HC A18/MF A01

The current state of the art technology for predicting and controlling noise levels inside propeller driven aircraft is reviewed. Wider aspects of aircraft interior noise than just propeller noise are discussed because work performed with various noise sources in mind is being applied to propeller driven aircraft. The dominant characteristic of propeller noise, a series of discrete frequency harmonic components, creates a unique problem in that the cabin noise levels can depend critically on the precise frequencies associated with the propeller noise and the resonances of the transmitting structure and receiving cavity. Steps to be taken before the transmission of noise into propeller driven aircraft can be fully understood and a successful noise control program established are listed A.R.H.

N83-19576*# Syracuse Univ., N. Y. Dept. of Mechanical and Aerospace Engineering.
AEROACOUSTICS OF A POROUS PLUG SUPERSONIC JET NOISE SUPPRESSOR Status Report, 1 Aug. 1982 - 31 Jan. 1983
D. S. DOSANJH, T. J. MATAMBO, and I. S DAS 14 Feb 1983 15 p refs
(Contract NAG1-129)
(NASA-CR-169977; NAS 1.26:169977) Avail: NTIS HC A02/MF A01 CSCL 20A

The aeroacoustics of a porous plug supersonic jet noise suppressor was investigated. The needed modifications of the existing multistream coaxial jet rig; the compressed air facility and pressure controls; the design, the fabrication, and the installation of the plenum chamber for the plug nozzle, and the design and the machining of the first contoured plug nozzle were completed. The optical and the aeroacoustic data of the contoured plug nozzles and of the conical convergent nozzle alone were discussed S L.

N83-19578# Internacional de Engenharia, Sao Paulo (Brazil)
RECOMMENDATIONS FOR THE ACOUSTIC TREATMENT OF CUMBICA INTERNATIONAL AIRPORT
21 Jan. 1983 70 p refs In PORTUGUESE, ENGLISH summary
(IESA-144-83) Avail: NTIS HC A04/MF A01

The report presents the various alternatives that are recommended to keep the noise level in the airport terminal areas within acceptable values Discussions on the acoustic isolation and absorption materials are presented indicating which ones should be used and which ones should not Adequate materials for use in noise isolation are discussed. B.W.

N83-19579# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 160: KC-10A AIRCRAFT, NEAR AND FAR-FIELD NOISE
R. G. POWELL Sep. 1982 194 p
(Contract AF PROJ. 7231)
(AD-A121301; AMRL-TR-75-50-VOL-160) Avail NTIS HC A09/MF A01 CSCL 01B

The USAF KC-10A aircraft is an advanced tanker/cargo aircraft powered by three CF6-50C2 turbofan engines This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runup pad for eight engine/power configurations. Near-field data are reported for one location in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference levels, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors Far-field data measured at 15 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to Volume 1 of this handbook, USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application, AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Author (GRA)

N83-20692# National Academy of Sciences - National Research Council, Washington, D. C Committee on Human Factors
THREE-DIMENSIONAL DISPLAYS: PERCEPTUAL RESEARCH AND APPLICATIONS TO MILITARY SYSTEMS Final Report, 1 Aug. 1981 - 30 Sep. 1982
D. J. GETTY, ed. (Bolt, Beranek and Newman, Inc., Cambridge, Mass.) 1982 191 p refs Symp. held in Washington, D C., 29 Jan. 1982
(Contract N00014-81-C-0017, NR PROJ. 196-167; RR0420901)
(AD-A122577) Avail: NTIS HC A09/MF A01 CSCL 20F

The edited proceedings of a symposium on the design and applications of three-dimensional displays are presented. The symposium was held at the National Academy of Sciences Building in Washington, D.C on January 29, 1982. The symposium contained three parts The first consisted of a series of five papers that discussed basic perceptual research on, and relating to, the design and use of three-dimensional displays. The second part of the symposium was a panel discussion on the topic: Critical Research Issues in 3-D displays The third and final part of the symposium was a discussion by a second panel of the topic: The applicability of 3-D Display Research to Military Operational Needs.

N83-20699# Perceptronics, Inc., Woodland Hills, Calif.
ISSUES IN THE EVALUATION OF 3-D DISPLAY APPLICATIONS
J O. MERRIT *In* NAS-NRC Three-Dimensional Displays p 145-149 1982 refs
Avail: NTIS HC A09/MF A01 CSCL 20F

The potential benefits of 3-D or stereoscopic visual displays have not been fully appreciated in a number of important application areas. This may be due to problems in the way stereo systems have been evaluated with respect to non-stereo displays. Only a few experimental evaluations have shown performance advantages for stereoscopic displays, whereas most comparisons have shown little or no stereo benefit In some cases, performance with stereo was worse than with a non-stereo system Proper experimental evaluation of 3-D visual display systems requires attention to the following factors: Equal display quality in the stereo and non-stereo systems; performance measurement with tasks that realistically represent the perceptual complexity of the operational environment, and the learning, time constraints, and error penalties present in the real world; appreciation of the several side benefits obtained with stereoscopic visual displays, such as improved image interpretability and wider field of view, as well as better system reliability, reconsidering the practicality of stereoscopic techniques in applications where stereo has previously been through to be of little value, as in flight simulator displays. L.F M.

N83-20704 Royal Aircraft Establishment, Farnborough (England). Human Engineering Div
MEASUREMENTS OF THE ATTENUATION OF AN ARMY HEADSET
M. K. COGGER and S. A. WOOD Jan 1982 13 p
(BR84535; RAE-TM-FS-449) Avail: Issuing Activity

Acoustic attenuation measurements have been made on a headset currently in use in British armoured military vehicles, which is reported to demonstrate good low-frequency noise attenuation. The results of the tests are reported and discussed with reference to the use of this form of earmuff assembly in a helicopter crew helmet, since helicopter cabin noise is predominantly low-frequency in nature. Author

N83-20707 Royal Aircraft Establishment, Farnborough (England).
THE INFLUENCE OF HELICOPTER OPERATING CONDITIONS ON ROTOR NOISE CHARACTERISTICS AND MEASUREMENT REPEATABILITY
M. R. P. LAW and J. WILLIAMS Apr. 1982 44 p refs
(AD-A121426; RAE-TR-82030; AERO-3525; BR84664) Avail: Issuing Activity

Following on exploratory developments in flight testing techniques and data analysis procedures for helicopter external noise, extensive measurements of noise characteristics and associated flight path data were made on several helicopters in various operational modes, with repeated flight trajectories over longitudinal and lateral arrays of ground based microphones under quiet airfield conditions. This analysis presents some experimental results from Lynx aircraft with standard rotor configurations, being concerned primarily with the influence of different operating procedures on both main rotor and tail rotor noise characteristics and on measurement repeatability during level flight, oblique landing approach, and oblique take off. Some tail rotor near field noise signatures were also derived for correlation purposes, using a microphone mounted with a forward facing nose cone just outside the fuselage skin on the tail boom S.L

N83-20758# Twente Univ. of Technology, Enschede (Netherlands)
MODERN DISPLAY TECHNOLOGIES AND APPLICATIONS
D. BOSMAN, ed. Neuilly-Sur-Seine, France AGARD Oct. 1982 219 p refs
(AGARD-AR-169; ISBN-92-835-1438-6) Avail: NTIS HC A10/MF A01

Analysis of both current and anticipated requirements for information displays in military avionics, identification of display applications where new technologies in visual displays have the greatest impact on military avionics, and survey the present status and potential for further development of a wide range of modern display technologies are presented. An engineering view on vision and displays explained the technical factors affecting the perception of displayed data, sampling and addressing, the human factors affecting display design and use, and the use of color in displays. A description of technologies included the cathode ray tube, vacuum fluorescent tubes, liquid crystal displays, light emitting diodes, electro-luminescent displays, electrochemical displays and other display technologies. The application of display technologies to military avionics was examined in the areas of classifications, head up displays, head down displays, helmet mounted systems, keyboard displays, and alphanumeric modules. An assessment is made of modern display technology potential Author

N83-20835*# Textron Bell Helicopter, Fort Worth, Tex. Acoustics Group.
HELICOPTER NOISE
C. M. COX *In* American Planning Association Proc. of the Monterey Conf. on Planning for Rotorcraft and Commuter Air Transportation p 84-87 Feb. 1983 refs
Avail: NTIS HC A09/MF A01 CSCL 20A

Strategies for the reduction of noise at and around heliports are discussed. Heliport planning and operations and piloting techniques are addressed. M.G.

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SOCIAL SCIENCES

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

N83-19652*# System Design Concepts, Inc., Washington, D. C
PLANNING FOR ROTORCRAFT AND COMMUTER AIR TRANSPORTATIONN
W. L. STOCKWELL (American Planning Assoc) and J. STOWERS Aug. 1981 150 p refs
(Contract NAS2-10815)
(NASA-CR-166453, NAS 1.26:166453) Avail: NTIS HC A07/MF A01 CSCL 12B

Community planning needs, criteria, and other considerations such as intermodal coordination and regulatory requirements, for rotorcraft and fixed wing commuter air transportation were identified A broad range of community planning guidelines, issues, and information which can be used to: (1) direct anticipated aircraft technological improvements; (2) assist planners in identifying and evaluating the opportunities and tradeoffs presented by rotorcraft and commuter aircraft options relative to other modes; and (3) increase communication between aircraft technologists and planners for the purpose of on going support in capitalizing on rotorcraft and commuter air opportunities are provided The primary tool for identifying and analyzing planning requirements was a detailed questionnaire administered to a selected sample of 55 community planners and other involved in planning for helicopters and commuter aviation. S.L.

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GENERAL

A83-24188#
NEW TECHNOLOGIES FROM DEVELOPMENTS IN AIR TRANSPORT AND SPACE TRAVEL [NEUE TECHNOLOGIEN, LUFT- UND RAUMFAHRT, TECHNOLOGIETRANSFER]
C.-J WINTER (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Stuttgart, West Germany, Oct. 5-7, 1982, 23 p. In German.
(DGLR PAPER 82-074)

Examples of successful conversions of air transport and space travel technology to more general use are discussed Nontechnical aspects such as patents and contracts are considered, and recommendations are made for improving the accelerating conversion of air transport and space technology. The technical areas treated include heating and industrial processing, electromechanics and plasma dynamics, microelectronics and communications technology. Both civilian and military uses of converted technology are addressed. C.D.

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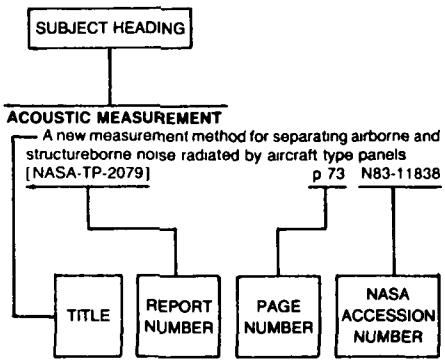

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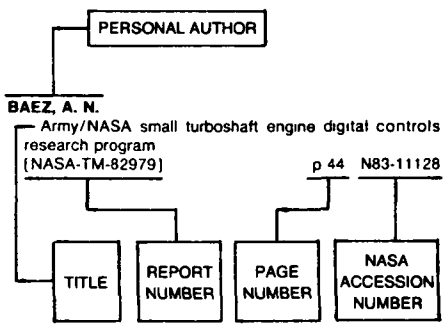

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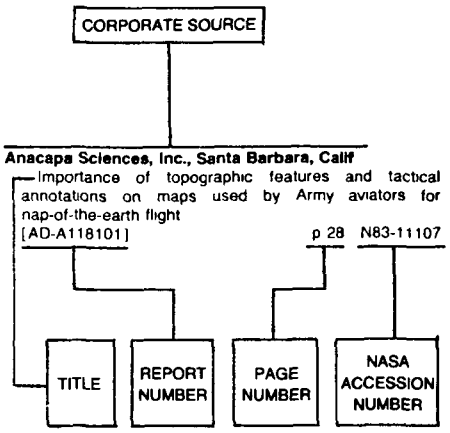

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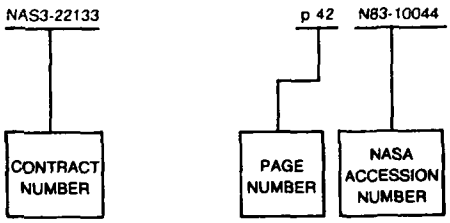

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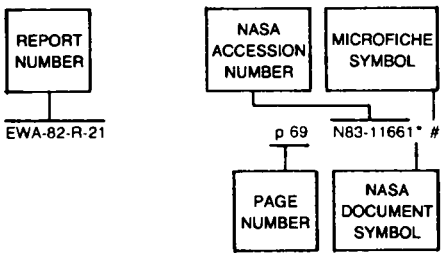

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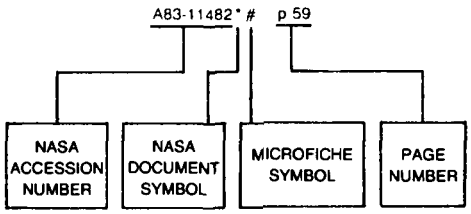

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