



Aeronautical
Engineering
A Continuing
Bibliography
with Indexes

NASA SP-7037(159)
March 1983

(NASA-SP-7037(159)) AERONAUTICAL
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Aeronautics and Space Administration) 98 p
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National Aeronautics and
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Aeronautical Engineering with Indexes

Pages 75-125

March 1983

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Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)	N83-12038 - N83-14060
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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 159)

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 February 1983 in

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

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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 347 reports, journal articles, and other documents originally announced in January 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.

Six indexes -- subject, personal author, corporate source, contract number, report number, and accession number -- are included.

An annual cumulative index will be published.

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All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies of accessions are available at \$8.00 per document. Microfiche⁽¹⁾ of documents announced in *IAA* are available at the rate of \$4.00 per microfiche on demand, and at the rate of \$1.35 per microfiche for standing orders for all *IAA* microfiche.

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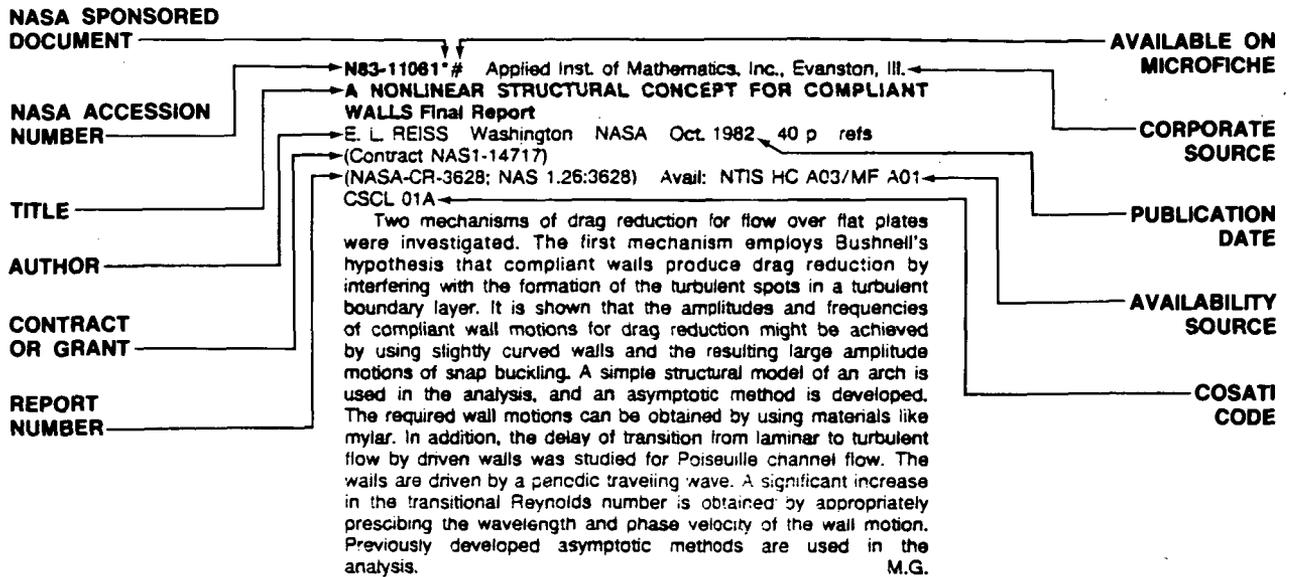
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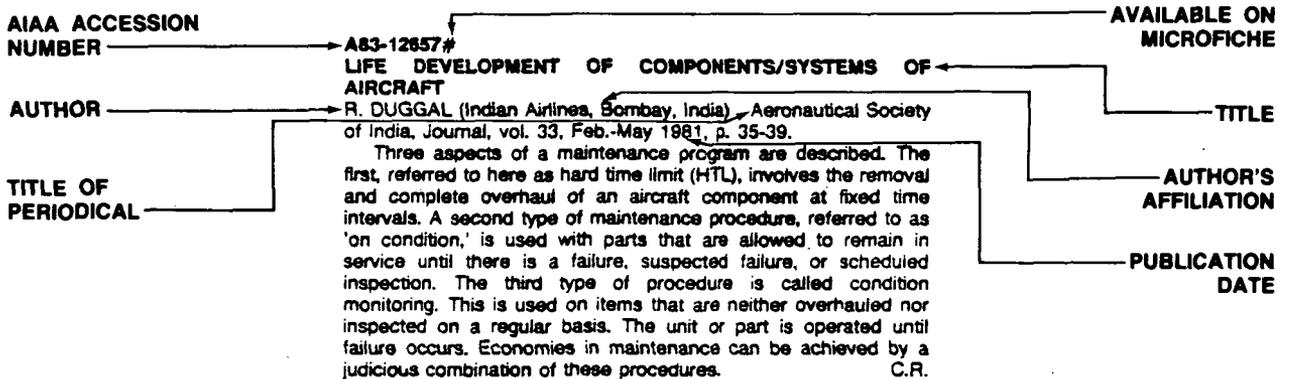
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 159)

MARCH 1983

01

AERONAUTICS (GENERAL)

A83-13912

FATIGUE LIFE EVALUATION OF THE A-7E ARRESTING GEAR HOOK SHANK

D. J. WHITE, J. R. ELLIS, C. E. DUMESNIL, and T. D. GRAY (Vought Corp., Dallas, TX) In: *Low-cycle fatigue and life prediction*. Philadelphia, PA, American Society for Testing and Materials, 1982, p. 572-584

(Contract NAVY TASK LTV-78-5)

This paper describes a program conducted to develop criteria, based on test results, to safely extend the service life of the A-7E arresting gear hook shank. Fracture mechanics techniques provided a method for assessing the significance of proof testing and correlating proof loads with remaining life under operating loads. Additional tests were performed to validate the proof-test criteria. The proof load developed in this program defined the maximum possible flaw size that could exist in the structure and provided data for establishing remaining life under operating loads. In addition, local yielding resulted in residual stresses that maximized crack growth retardation. As a result, an increase in fatigue life was produced by periodically inserting the proof load into the operating load spectrum. The primary impact of this program was to demonstrate that the proof test interval for the hook shank could be extended from 100 to 550 arrested landing cycles, and that the total service life could be extended from 500 to an indeterminate number of arrestments. (Author)

A83-14325

THE CLEANING OF THE EXTERIOR OF THE AIRCRAFT [FLUGZEUGAUSSENREINIGUNG]

T. DAEMMRICH (Interflug Gesellschaft fuer Internationalen Flugverkehr mbH, Berlin, East Germany) *Technisch-oekonomische Information der zivilen Luftfahrt*, no. 3, 1982, p. 107-111, 118. In German.

The cleaning of the external surface areas of an aircraft represents a difficult problem. The cleaning procedure for aircraft in the case of all aviation enterprises involves currently more or less manual activities. Reasons for washing aircraft are related to the prevention of corrosion, the psychological effect of a clean aircraft on the passengers, and reductions in fuel consumption in connection with an employment of clean aircraft. The washing of aircraft involves a cleaning of varnished surfaces which are very hard. There are hardly any differences concerning washing technologies for different airlines, only the employed accessories differ. Details regarding the washing procedure are discussed for Air France, Swissair, and Interflug. Manual washing has a number of drawbacks. Various approaches for the design of improved washing procedures are discussed along with tests regarding an employment of automatic washing procedures. G.R.

A83-16326

FLIGHT SIMULATION - AVIONIC SYSTEMS AND AERO MEDICAL ASPECTS; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, LONDON, ENGLAND, APRIL 6, 7, 1982

Conference sponsored by the Royal Aeronautical Society. London, Royal Aeronautical Society, 1982. 104 p.

The role of simulation in the prevention of spatial disorientation in flight is considered along with the perception of color on electrooptical displays, the assessment of pilot performance and mental workload in training simulators, the significance of texture of simulator training, the characteristics of flight simulator visual systems, and questions of simulation versus stimulation in connection with the design of a mission simulator for an avionic system. Attention is also given to the simulation of a terrain following system, simulator studies to develop and improve flight attitude information, color flight deck displays, A.O.I. displays in simulation, aerial combat simulation, and a simple CIG providing an approach to visual simulation for procedure training. Pilot judgements of distance, height, and glide slope angle from computer generated landing scenes are also discussed. G.R.

A83-16374#

HIGHLIGHTS OF THE NEW NATIONAL AERONAUTICAL RESEARCH AND TECHNOLOGY POLICY

V. H. REIS and L. T. MONTULLI (Executive Office of the President, Office of Science and Technology Policy, Washington, DC) *Astronautics and Aeronautics*, vol. 20, Dec. 1982, p. 10, 12, 13, 16, 129.

N83-12040# Operations Research, Inc., Silver Spring, Md.

AIRCRAFT FLIGHT PROCEDURE PROGRAM: DATA BASE DEVELOPMENT Final Report

L. A. RONK, T. A. GATES, and W. S. WILKINSON Mar. 1981
162 p refs

(Contract EPA-68-01-6151)

(PB82-183740; EPA/DF-82-003A; ORI-TR-1799) Avail: NTIS

HC A08/MF A01 CSCL 01B

Performance and operational data and information required to construct flight paths and performance schedules for selected commercial aircarrier aircraft types powered by low-by-pass ratio and high-by-pass ratio turbofan engines was identified and collected. The performance and operational data and information can be used to determine the flight paths and performance schedules for aircraft operating accordance with specified flight procedures, and over a range of airport temperatures and airport pressure altitudes. In addition, an evaluation of available flight procedures computer programs developed by various organizations such as aircraft manufacturers, consultants, and the Federal government is included. The purpose of evaluating these programs was to identify existing analytical and computer programming work which can be used in developing a modified computer program model to generate aircraft flight path and performance schedule data which was compatible with the input data requirements of the FAA's integrated noise model and the USAF's model. GRA

01 AERONAUTICS (GENERAL)

N83-12041# Operations Research, Inc., Silver Spring, Md.
**AIRCRAFT FLIGHT PROCEDURE PROGRAM: MODIFIED
COMPUTER PROGRAM MODEL, USER'S MANUAL Final
Report**

Dec. 1981 85 p refs
(Contract EPA-68-01-6267)
(PB82-183757; EPA/DF-82-003B) Avail: NTIS HC A05/MF A01
CSCL 01B

An aircraft flight procedures model used to construct aircraft flight paths and performance schedules for specified operational procedures is described. The computer model algorithms were derived from fundamental aircraft and engine performance relationships or from operational characteristics applicable to specific aircraft types. The flight path and performance schedule data generated by the model are compatible with the input data requirements of the FAA's integrated noise and the USAF's model. The flight procedures model was developed and installed on an IBM 370/168MP computer system. The program was written in FORTRAN IV language and executed interactively. GRA

N83-13059*# National Aeronautics and Space Administration,
Washington, D. C.

**AERONAUTICS RESEARCH AND TECHNOLOGY PROGRAM
AND SPECIFIC OBJECTIVES**

1981 189 p
(NASA-TM-85163; NAS 1.15:85163) Avail: NTIS HC A09/MF
A01 CSCL 01B

Aeronautics research and technology program objectives in fluid and thermal physics, materials and structures, controls and guidance, human factors, multidisciplinary activities, computer science and applications, propulsion, rotorcraft, high speed aircraft, subsonic aircraft, and rotorcraft and high speed aircraft systems technology are addressed. N.W.

N83-13060# Joint Publications Research Service, Arlington, Va.
USSR REPORT: TRANSPORTATION, NO. 98

22 Oct. 1982 96 p Transl. into ENGLISH from various Russian articles
(JPRS-82053) Avail: NTIS HC A05

Advances in air, rail, motor vehicle and marine transportation are reported. The construction, repair and efficiency of transportation systems are discussed.

N83-13062# Joint Publications Research Service, Arlington, Va.
**MINISTER REVIEWS PLANS FOR RAISING EFFICIENCY OF
CIVIL AVIATION**

I. Y. MASHKIVSKIY *In its* USSR Rept.: Transportation, No. 98
(JPRS-82053) p 12-17 22 Oct. 1982 Transl. into ENGLISH
from *Grazhdanskaya Aviats.* (Moscow), no. 8, Aug. 1982 p 14-15
Avail: NTIS HC A05

Efforts to raise the efficiency and quality of work by the civil aviation sector are discussed. This means that the efforts of employees should be aimed at broad introduction of scientific-technical advances, at rational, truly proprietary use of production potential, and at all possible economies of means. The principal challenge that follows from the policy of raising production efficiency may be formulated as follows: The final results of the work must grow faster than expenditures for it. The material base which makes it possible to meet the needs of the economy and the population for air transport is the fixed capital of the sector. The fleet of aircraft is its principal component. Already today it constitutes more than half of all fixed productive capital. That is why significant reserves for raising the efficiency and quality of all work are concealed in rational use of airplanes and helicopters. B.W.

N83-13064# Joint Publications Research Service, Arlington, Va.
AVIATION REPAIR ASSOCIATION CHIEF INTERVIEWED

M. GASANALIYEV *In its* USSR Rept.: Transportation, No. 98
(JPRS-82053) p 24-27 22 Oct. 1982 Transl. into ENGLISH
from *Vozdushnyy Transport* (Moscow), 17 Jul. 1982 p 2
Avail: NTIS HC A05

The repair of aviation equipment is discussed in detail. Productivity, labor and cost effectiveness are investigated. B.W.

N83-13065*# Sikorsky Aircraft, Stratford, Conn.
**PREDESIGN STUDY FOR A MODERN 4-BLADED ROTOR FOR
RSRA Final Report**

S. J. DAVIS Mar. 1981 176 p refs
(Contract NAS2-10691)
(NASA-CR-166155; NAS 1.26:166155) Avail: NTIS HC A09/MF
A01 CSCL 01C

The feasibility of providing a modern four-bladed rotor for flight research testing on a rotor system aircraft was evaluated. The capabilities of a state of the art rotor system and the contributions of key design parameters to these capabilities were investigated. Three candidate rotors were examined: the UH-60A BLACK HAWK rotor with and without root extenders and the H-3 composite blade rotor. It was concluded that the technical/cost objectives could best be accomplished using the basic BLACK HAWK rotor (i.e. without root extenders). Further, the availability of three existing sets of blade tip of varying design, together with a demonstrated capability for altering airfoil geometry should provide early research information on important design variables at reduced cost. S.L.

N83-13066# Air Force Academy, Colo.
**AIR FORCE ACADEMY AERONAUTICS DIGEST, FALL/WINTER,
1981 Final Report**

A. M. HIGGINS, J. M. KEMPF, E. J. JUMPER, J. DEJONGH, and
K. KNOLL Jun. 1982 163 p refs
(AD-A119168; USAFA-TR-82-3) Avail: NTIS HC A08/MF A01
CSCL 20D

The lifting surface wakes of a conard and forward swept wing configuration are discussed. Flow field measurements of three dimensional square cross section missiles at moderate angles of attack are presented. The frequency response characteristics of a redesigned seven hole pressure probe are also discussed. S.F.

N83-13067# Federal Aviation Administration, Washington, D.C.
Office of Management Systems.

**CENSUS OF U.S. CIVIL AIRCRAFT, CALENDAR YEAR 1981
Annual Report**

31 Dec. 1981 315 p
(AD-A119358; FAA-AMS-220) Avail: NTIS HC A14/MF A01
CSCL 01C

This report presents information about the U.S. civil aircraft fleet. It includes detailed tables of air carrier aircraft and an inventory of registered aircraft by manufacturer and model, and general aviation aircraft by state and county of the owner.

Author (GRA)

02

AERODYNAMICS

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

A83-13126#
**NONEQUILIBRIUM FLOW OVER DELTA WINGS WITH
DETACHED SHOCK WAVES**

R. J. STALKER (Queensland, University, Brisbane, Australia) AIAA
Journal, vol. 20, Dec. 1982, p. 1633-1639. Research supported
by the Australian Research Grants Committee. refs

(Previously cited in issue 17, p. 3112, Accession no.
A80-41614)

A83-13127#

LARGE-SCALE VORTEX-LATTICE MODEL FOR THE LOCALLY SEPARATED FLOW OVER WINGS

J. KATZ (Technion - Israel Institute of Technology, Haifa, Israel) AIAA Journal, vol. 20, Dec. 1982, p. 1640-1646. refs

(Previously cited in issue 17, p. 2875, Accession no. A81-38106)

A83-13129#

NUMERICAL SIMULATION OF WING-FUSELAGE INTERFERENCE

J. S. SHANG (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) AIAA Journal, vol. 20, Dec. 1982, p. 1657, 1658. refs

(Previously cited in issue 07, p. 989, Accession no. A81-20564)

A83-13144#

VORTEX THEORY FOR HOVERING ROTORS

R. H. MILLER (MIT, Cambridge, MA) AIAA Journal, vol. 20, Dec. 1982, p. 1754-1756. refs

The apparent paradox resulting from the application of classical propeller vortex theory to a hovering rotor is shown to be due to the neglect of wake contraction. When wake contraction is included, simple models may be developed which are able to accurately predict blade load distributions and wake geometries to a reasonable degree of accuracy. O.C.

A83-13164#

A NEW APPROACH TO WEAPON SEPARATION AERODYNAMICS

F. A. TESSITORE, A. CENKO, R. C. MEYER (Grumman Aerospace Corp., Bethpage, NY), R. D. DYER, and J. D. WASKIEWICZ (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Journal of Aircraft, vol. 19, Dec. 1982, p. 1070-1075. refs

(Previously cited in issue 23, p. 3965, Accession no. A81-48416)

A83-13166*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

AIRFRAME EFFECTS ON A TOP-MOUNTED FIGHTER INLET SYSTEM

D. B. SMELTZER, W. P. NELMS (NASA, Ames Research Center, Moffett Field, CA), and T. L. WILLIAMS (Northrop Corp., Hawthorne, CA) Journal of Aircraft, vol. 19, Dec. 1982, p. 1083-1087. refs

(Previously cited in issue 07, p. 963, Accession no. A82-19212)

A83-13172#

HELICOPTER ROTOR PERFORMANCE EVALUATION USING OSCILLATORY AIRFOIL DATA

V. S. HOLLA (Indian Institute of Science, Bangalore, India), A. R. MANJUNATH, and J. NAGABHUSHANAM (Hindustan Aeronautics, Ltd., Bangalore, India) Journal of Aircraft, vol. 19, Dec. 1982, p. 1102-1104. refs

A blade response program for helicopters in the case of forward flight is examined using unsteady aerodynamic data, and the results are compared with an earlier analysis of this program using two-dimensional steady state aerodynamic data, which gave a conservative estimate of blade response (Nagabhushanam, 1976). Results show that, in general, over the major portion of the rotor disk, the lift coefficient calculated using unsteady aerodynamic data is less than this coefficient calculated using steady state data, and the incidence coefficient calculated using unsteady aerodynamic data is less than the incidence coefficient calculated using steady state data. The reduction in the lift coefficient with unsteady data is due to the reduction in the incidence coefficient as well as to the reduction in the lift curve slope due to unsteady effects. The analysis using the steady state data gives an overall increase in lift and shows a region of stall, while the results with unsteady data show no blade stalling and a reduction of overall lift. In addition, the reduction in the sectional lift coefficient at

some azimuthal positions (such as when the azimuth angle of the blade = 0) is of the order of 10%, which is not negligible N.B.

A83-14526#

CALCULATION METHOD FOR TRANSONIC SEPARATED FLOWS OVER AIRFOILS INCLUDING SPOILER EFFECTS

J. C. LE BALLEUR (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Conference Internationale sur les Methodes Numeriques en Dynamique des Fluides, 8th, Aachen, West Germany, June 28-July 2, 1982.) ONERA, TP no. 1982-66, 1982. 9 p. Research supported by the Direction des Recherches, Etudes et Techniques. refs (ONERA, TP NO. 1982-66)

On the basis of viscid-inviscid interaction concepts, composite numerical solutions have been developed for viscous flows, achieving the accuracy of boundary layer-like techniques without the limitations of boundary layer theory. The present composite solution assumes a defect formulation of viscous equations for viscid-inviscid splitting, introduces thin layer approximations, and solves the inviscid and viscous components in an uncoupled fashion. A coupling algorithm, based on direct and seminverse explicit coupling-like relaxation techniques, is then used to converge the viscid-inviscid interaction with consistent schemes at each coupling node. Progress is reported on a simple modelling technique which, in combination with the basic solution presented, provides flow simulation over transonic airfoils with either a trailing edge base or a spoiler flap. O.C.

A83-14605

COMPUTATION OF VORTEX FLOW AROUND WINGS USING THE EULER EQUATIONS

L.-E. ERIKSSON and A. RIZZI (Flygtekniska Forsoksanstalten, Bromma, Sweden) In: Conference on Numerical Methods in Fluid Mechanics, 4th, Paris, France, October 7-9, 1981, Proceedings. Brunswick, West Germany, Vieweg, 1982, p. 87-105. Research supported by the Forsvarets Materielverk. refs

The inviscid, compressible and rotational flow around the tip of a moderately swept trapezoidal wing and around a highly swept delta wing with a sharp leading edge is computed at both transonic and supersonic speeds by using meshes of 0-0 type, constructed by a generalized transfinite interpolation method, and by using a time-marching finite-volume procedure to obtain steady-state solutions to the Euler equations. Results of these computations, performed on a CYBER 203 vector processor, are compared with experimental results in terms of pressure distributions and velocity-vector fields. For the trapezoidal wing it is found that the computational model predicts the existence of a tip vortex, created by flow separation in the downstream region of the tip where the radius of curvature approaches zero. In the case of the delta wing, the numerical model simulates the leading-edge separation of the real physical flow and may even show some effect of the secondary vortex. A Kutta condition at the sharp leading edge has only a local effect on the computed flow. The results show that a unified computational approach is feasible for both large aspect ratio trapezoidal wings and small aspect ratio delta wings. (Author)

A83-14606

EXPLICIT AND IMPLICIT CORRECTED VISCOSITY SCHEMES FOR THE COMPUTATION OF STEADY TRANSONIC FLOWS

J. A. ESSERS (Institut von Karman de Dynamique des Fluides, Rhode-Saint-Genese, Belgium) In: Conference on Numerical Methods in Fluid Mechanics, 4th, Paris, France, October 7-9, 1981, Proceedings. Brunswick, West Germany, Vieweg, 1982, p. 106-116. refs

The artificial evolution technique developed by Essers (1979, 1980, 1981) is applied to the computation of steady transonic flows around lifting airfoils, and the results obtained with a finite volume explicit scheme are discussed. In addition, a novel, implicit corrected viscosity scheme is presented which can improve the convergence rate of time-dependent techniques for the computation of steady flows. The principle of this method is simple and general, and its implementation by existing computational

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programs employing a time-dependent technique is accordingly straightforward. O.C.

A83-15095

THE VORTEX THEORY OF ROTORS [K VIKHREVOI TEORII NESUSHCHEGO VINTA]

V. A. ANIKIN Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza, Sept.-Oct. 1982, p. 169-172. In Russian. refs

Formulas are presented for all the components of the time-averaged induced velocity of a rotor at an arbitrary point in space. The formulas can be used for investigating the aerodynamic characteristics of a combination of rotors and the interaction between a rotor and a wing in a linear formulation, and also for calculating the true induced velocities of a trailing vortex in linear and nonlinear formulations. V.L.

A83-15096

A STUDY OF THE EFFECT OF THE TRANSVERSE SWEEP OF DELTA WINGS ON THEIR VORTEX STRUCTURES AND AERODYNAMIC CHARACTERISTICS IN SEPARATED FLOWS AT LOW SUBSONIC VELOCITIES [ISSLEDOVANIIE VLIANIIA POPERECHNOI STRELOVIDNOSTI TREUGOL'NYKH KRYL'EV NA IKH VIKHREVYE STRUKTURY I AERODINAMICHESKIE KHARAKTERISTIKI PRI OTRYVNOI OBTEKANII NA MALYKH DOZVUKOVYKH SKOROSTIAXH]

V. A. APARINOV, A. A. KARASK, and M. I. NISHT Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza, Sept.-Oct. 1982, p. 173-175. In Russian. refs

The effect of the transverse sweep of low-aspect-ratio delta wings on their lifting characteristics and the stability of the vortex structures in separated flows is investigated theoretically and experimentally. The theoretical study makes use of the method of discrete vortices. The experimental part includes weighing tests and an investigation of vortex filaments using aerometric and shadowgraphic techniques. It is shown that in the case of low-aspect-ratio wings with a positive transverse sweep, the breakdown of vortex filaments formed at the leading edge occurs at larger angles of attack, compared with plane wings, whereas in the case of a negative transverse sweep, the breakdown of vortex filaments occurs at smaller angles of attack. V.L.

A83-15281#

THE USE OF AN ERROR INDEX TO IMPROVE NUMERICAL SOLUTIONS FOR UNSTEADY LIFTING AIRFOILS

S. ANDO and A. ICHIKAWA (Nagoya University, Nagoya, Japan) AIAA Journal, vol. 21, Jan. 1983, p. 47-54. refs

The numerical methods of the aerodynamic finite element method are investigated for airfoils in incompressible inviscid flow, using an 'error index parameter'. This method can compare large amounts of data in an efficient and precise manner. The first problem is a concentration of error at the airfoil edges, which occurs in all of the cases investigated. This difficulty can be solved by using the semicircular method of computation. The second problem results from the logarithmic singularity of the unsteady kernel function; the difficulty dramatically reduced through a special method for treating the logarithmic singularity. It is found that using the error index parameter has advantages for several schemes of quantizing lift distribution. (Author)

A83-15283#

A FAST ALGORITHM FOR THE CALCULATION OF TRANSONIC FLOW OVER WING/BODY COMBINATIONS

T. J. BAKER and C. R. FORSEY (Aircraft Research Association, Ltd., Bedford, England) (Computational Fluid Dynamics Conference, 5th, Palo Alto, CA, June 22, 23, 1981, Collection of Technical Papers, p. 189-198.) AIAA Journal, vol. 21, Jan. 1983, p. 60-67. Research supported by the Ministry of Defence (Procurement Executive). refs

(Previously cited in issue 16, p. 2685, Accession no. A81-37544)

A83-15290*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

NONLINEAR AERODYNAMIC MODELING OF FLAP OSCILLATIONS IN TRANSONIC FLOW - A NUMERICAL VALIDATION

W. J. CHYU and L. B. SCHIFF (NASA, Ames Research Center, Aerodynamics Research Branch, Moffett Field, CA) AIAA Journal, vol. 21, Jan. 1983, p. 106-113. refs
(AIAA PAPER 81-0073)

The regime of validity of a nonlinear aerodynamic force and moment formulation, based on concepts from nonlinear functional analysis and applicable to a transonic airfoil with a deflecting flap, is investigated. A time-dependent finite difference technique is used to evaluate the aerodynamic data of the formulation in terms of specified, characteristic motions. Flap-motion histories are generated from the flap inertial equations of motion, with aerodynamic reactions specified by the moment formulation. The motion histories depicting the cases of decaying and growing flap oscillations are compared with histories generated through simultaneous, coupled solution of the fluid-dynamic equations and flap inertial equations of motion. The range of applicability of the formulation is discussed. (Author)

A83-15313#

SOME RECENT APPLICATIONS OF HIGH-LIFT COMPUTATIONAL METHODS AT BOEING

J. H. MCMASTERS and M. L. HENDERSON (Boeing Commercial Airplane Co., Seattle, WA) Journal of Aircraft, vol. 20, Jan. 1983, p. 27-33. refs

(Previously cited in issue 20, p. 3458, Accession no. A81-43940)

A83-15315#

REDUCTIONS IN PARACHUTE DRAG DUE TO FOREBODY WAKE EFFECTS

C. W. PETERSON and D. W. JOHNSON (Sandia National Laboratory, Albuquerque, NM) Journal of Aircraft, vol. 20, Jan. 1983, p. 42-49. Research sponsored by the U.S. Department of Energy. refs

(Previously cited in issue 01, p. 2, Accession no. A82-10417)

A83-15322#

MODULAR ASYMMETRIC PARACHUTE FOR WIND TUNNEL TESTING

P. C. KLIMAS, H. E. WIDDOWS, and R. H. CROLL (Sandia National Laboratory, Albuquerque, NM) Journal of Aircraft, vol. 20, Jan. 1983, p. 89, 90.

(Contract DE-AC04-76DP00789)

(Previously cited in issue 01, p. 2, Accession no. A82-10414)

A83-15324#

AERODYNAMIC CHARACTERISTICS OF A SLOTTED VS SMOOTH-SKIN SUPERCritical WING MODEL

W. F. GROSSER (Lockheed-Georgia Co., Marietta, GA) Journal of Aircraft, vol. 20, Jan. 1983, p. 92-94.

(Previously cited in issue 13, p. 2015, Accession no. A82-30139)

A83-15543#

RELAXATION COMPUTATION OF TRANSONIC FLOWS AROUND WINGS WITH BLUNT LEADING-EDGE AND DISCUSSION ON ITS STABILITY AND CONVERGENCE

Y. ZHENG and S. LUO (Northwestern Polytechnical University, Xian, Shaanxi, People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol. 3, Sept. 1982, p. 1-14. In Chinese, with abstract in English. refs

A difference equation, using the leading edge of a wing as the region of the mesh point, is employed to perform a relaxation analysis of transonic flows around wings with blunt leading edges. An exact velocity potential equation with the central difference scheme and the exact boundary conditions are used at the leading edge. The approximate velocity potential equation, assuming small perturbation in the transverse plane and allowing large perturbations

in the longitudinal direction, is used with the corresponding boundary conditions in other areas. Numerical examples are provided for a NACA 0012 airfoil in a Mach 0.63 flow and a NACA 64A010 airfoil at Mach 0.4, 0.8, and 0.9. Pressure distributions observed in experiments are shown to agree well with the predicted values. Examination of the stability of the difference equation in line relaxation with Seidel iteration was performed using the von Neumann method. The relaxation was found to be unstable at all locally subsonic points, which was not predicted by the numerical methods. M.S.K.

A83-16394
PROBLEMS CONCERNING SUPERSONIC FLOW PAST BODIES OF PRISMATIC CONFIGURATIONS [ZADACHI OBTEKANIIA SVERKHZVUKOVYIM POTOKOM TEL PRIZMATICHESKOI KONFIGURATSII]

N. F. VOROBEV PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki, Sept.-Oct. 1982, p. 107-114. In Russian. refs

The direct and the inverse problems of supersonic flow past prismatic bodies are examined in a linear formulation with allowance for diffraction and reflection. A method is proposed for solving problems concerning flow past a wing with prismatic superstructures whereby a complex domain is divided into subdomains, so that the Green's functions can be obtained for each subdomain, and the solutions are sewn at the subdomain boundaries. The Green's functions are derived for dihedral-angle domains of a strip, a halfstrip, and trigonal and tetragonal prisms. V.L.

N83-12043# National Aerospace Lab., Tokyo (Japan).
FLOW QUALITY OF NAL TWO-DIMENSIONAL TRANSONIC WIND TUNNEL. PART 1: MACH NUMBER DISTRIBUTIONS, FLOW ANGULARITIES AND PRELIMINARY STUDY OF SIDE WALL BOUNDARY LAYER SUCTION

S. SAKAKIBARA, K. TAKASHIMA, H. MIWA, Y. OGUNI, M. SATO, and H. KANDA 1982 80 p refs In JAPANESE; ENGLISH summary (NAL-TR-693; ISSN-0389-4010) Avail: NTIS HC A05/MF A01

Experimental data on the flow quality of the National Aerospace Laboratory two dimensional transonic wind tunnel are presented. Mach number distributions on the test section axis show good uniformity which is characterised by the two-sigma(standard deviation) values of 0.0003 to 0.001 for a range of Mach numbers from 0.4 to 1.0. Flow angularities, which were measured by using a wing model with a symmetrical cross section, remained within 0.04 degree for Mach numbers from 0.2 to 0.8. Side wall boundary layer suction was applied through a pair of porous plates. The variation of aerodynamic properties of the model due to the suction mass flow rate change is presented with a brief discussion. Two dimensionality of the flow over the wing span is expected to be improved by applying the appropriate suction rate, which depends on the Mach number, Reynolds number, and lift coefficient. M.G.

N83-12046*# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
AN INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A NEW GENERAL AVIATION AIRFOIL IN FLIGHT Final Report, 1 May 1975 - 31 Aug. 1977

G. M. GREGOREK, M. J. HOFFMANN, and G. S. WEISLOGEL Oct. 1982 57 p refs (Contract NAS1-184) (NASA-CR-169477; NAS 1.26:169477) Avail: NTIS HC A04/MF A01 CSCL 01A

A low speed airfoil, the GA(W)-2, - a 13% thickness to chord ratio airfoil was evaluated. The wing of a Beech Sundowner was modified at by adding balsa ribs and covered with aluminum skin, to alter the existing airfoil shape to that of the GA(W)-2 airfoil. The aircraft was flown in a flight test program that gathered wing surface pressures and wake data from which the lift drag, and pitching moment of the airfoil could be determined. After the base line performance of the airfoil was measured, the drag due to surface irregularities such as steps, rivets and surface waviness

was determined. The potential reduction of drag through the use of surface coatings such as KAPTON was also investigated. S.L.

N83-12048*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN EXPERIMENTAL STUDY OF DYNAMIC STALL ON ADVANCED AIRFOIL SECTION. VOLUME 2: PRESSURE AND FORCE DATA

K. W. MCALISTER, S. L. PUCCI, W. J. MCCROSKEY, and L. W. CARR 22 Nov. 1982 646 p Prepared in cooperation with Army Aviation Research and Development command (NASA-TM-84245-VOL-2; A-8925-VOL-2; NAS 1.15:84245-VOL-2; USAAVRADCOR-TR-82-A-8-VOL-2) Avail: NTIS HC A99/MF A01 CSCL 01A

Experimentally derived force and moment data are presented for eight airfoil sections that were tested at fixed and varying incidence in a subsonic two dimensional stream. Airfoil incidence was varied through sinusoidal oscillations in pitch over a wide range of amplitude and frequency. The surface pressure distribution, as well as the lift, drag, and pitching moment derived therefrom, are displayed in a uniform fashion to delineate the static and dynamic characteristics of each airfoil both in and out of stall. S.L.

N83-12049*# Kentron International, Inc., Hampton, Va.
WIND-TUNNEL INVESTIGATION OF EFFECTS OF WING-LEADING-EDGE MODIFICATIONS ON THE HIGH ANGLE-OF-ATTACK CHARACTERISTICS OF A T-TAIL LOW-WING GENERAL-AVIATION AIRCRAFT Final Report

E. R. WHITE NASA Washington Nov. 1982 24 p refs (Contract NAS1-16000) (NASA-CR-3636; NAS 1.26:3636) Avail: NTIS HC A02/MF A01 CSCL 01A

Exploratory tests have been conducted in the NASA-Langley Research Center's 12-Foot Low-Speed wind Tunnel to evaluate the application of wing-leading-edge devices on the stall-departure and spin resistance characteristics of a 1/6-scale model of a T-tail general-aviation aircraft. The model was force tested with an internal strain-gauge balance to obtain aerodynamic data on the complete configuration and with a separate wing balance to obtain aerodynamic data on the outer portion of the wing. The addition of the outboard leading-edge droop eliminated the abrupt stall of the windtip and maintained or increased the resultant-force coefficient up to about $\alpha = 32$ degrees. This change in slope of the resultant-force coefficient curve with angle of attack has been shown to be important for eliminating autorotation and for providing spin resistance. Author

N83-12050# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mathematics.

HEREDITARY MODELS FOR AIRFOILS IN UNSTEADY AERODYNAMICS, NUMERICAL APPROXIMATIONS AND PARAMETER ESTIMATION Final Report, 15 Dec. 1979 - 15 Mar. 1981

J. A. BURNS and E. M. CLIFF Wright-Patterson AFB, Ohio AFWAL Feb. 1982 82 p refs (Contract AF-AFOSR-0068-80; AF PROJ. 2307) (AD-A118446; VPI-E-81-18; AFWAL-TR-81-3173) Avail: NTIS HC A05/MF A01 CSCL 01A

This report is concerned with the development of a general mathematical model for the motion of a two dimensional airfoil in unsteady aerodynamics and with the study of numerical schemes for estimating parameters in this model. The equations of motion are a set of coupled ordinary and functional differential equations. Approximating Wagner functions are used to construct state space models that retain the hereditary nature of unsteady fluid flow. The results of some simple numerical experiments are presented including a preliminary analysis of wind-tunnel data. Author (GRA)

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N83-12051# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

ROTOR AERODYNAMICS IN GROUND EFFECT AT LOW ADVANCE RATIOS Final Report, 10 Sep. 1978 - 28 Feb. 1982
H. C. CURTISS, JR., W. F. PUTMAN, and E. J. HANKER, JR.
27 Jul. 1982 163 p refs
(Contract DAAG29-80-K-0098; DAAG29-78-G-0194)
(AD-A118609; MAE-1571; ARO-16061.2-EG) Avail: NTIS HC A08/MF A01 CSCL 20D

The results of an experimental study of the aerodynamic characteristics of a helicopter rotor operating in ground effect at low advance ratios are presented. Flow visualization studies were conducted along with measurement of the forces and moments acting on the rotor as a function of advance ratio, height above ground and collective pitch. Steady state experiments as well as non-steady experiments involving translational acceleration were conducted. Three distinct flow regimes were noted from the flow visualization studies. At the low end of the advance ratio range a recirculating flow was present, at intermediate advance ratios a horseshoe shaped vortex formed under the rotor, and at the high end of the advance ratio range studied, the rotor wake flows entirely downstream. At test conditions were the recirculating flow or ground vortex is present there are marked departures from classical ground effect theory. Translational acceleration was found to have a significant effect on the rotor forces and moments indicating that some appreciable time is required for the establishment of the ground effect flow field when a recirculating flow or ground vortex exists in the steady state. The results indicate that magnitude of the ground effects experienced by a helicopter are sensitive to the flight path of the helicopter. Author (GRA)

N83-12053# Air Force Academy, Colo. Dept. of Aeronautics.
MEASUREMENT OF WAKE INTERACTIONS OF A CANARD AND A FORWARD SWEEP WING

K. E. GRIFFIN 6 Jul. 1982 101 p refs
(AD-A118756; USAFA-TN-82-4) Avail: NTIS HC A06/MF A01 CSCL 01A

Experimental lifting surface wake data were taken from a canard/forward-swept wing reflecting plane wind tunnel model. The data include distributions of total, dynamic, and static pressures as well as cross velocity magnitudes and directions for an array of points around the model, both near the model and in its freestream wake. The model was tested as a body alone, as a wing/body combination, and as a wing/body/canard combination in order to compare wing wakes to wing/canard wakes. GRA

N83-13068 Rensselaer Polytechnic Inst., Troy, N. Y.
PASSIVE SHOCK WAVE/BOUNDARY LAYER CONTROL FOR TRANSONIC SUPERCRITICAL AIRFOIL DRAG REDUCTION Ph.D. Thesis

L. BAH1 1982 205 p
Avail: Univ. Microfilms Order No. DA8223311

An investigation of the passive shock wave/boundary layer interaction control aiming at reducing the drag for conventional and supercritical airfoils at transonic, Mach numbers is presented. A 3x 15.4-inch Transonic Wind Tunnel was designed, constructed and calibrated to achieve this objective. Modifications were made in the initial constant area test section to accommodate for the boundary layer growth along the tunnel walls. The passive drag control concept, consisting of a porous surface with a cavity beneath it, was investigated with a 12 percent thick circular arc and a 14 percent thick supercritical airfoil mounted on the test section bottom wall. The porous surface was positioned in the shock wave/boundary layer interaction region. The flow circulating through the porous surface, from the downstream to the upstream of the termination shock wave location, produced a lambda shock wave system and a pressure decrease in the downstream region minimizing the flow separation. The wake impact pressure data showed an appreciably drag reduction with the porous surface at transonic speeds. Dissert. Abstr.

N83-13070*# Bihle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG. 2: INFLUENCE OF HORIZONTAL TAIL LOCATION FOR MODEL D

B. BARNHART Washington NASA Nov. 1982 424 p refs
(Contract NAS1-16205)
(NASA-CR-3247; NAS 1.26:3247) Avail: NTIS HC A18/MF A01 CSCL 01A

The influence of horizontal tail location on the rotational flow aerodynamics is discussed for a 1/6-scale general aviation airplane model. The model was tested using various horizontal tail positions, with both a high and a low-wing location and for each of two body lengths. Data were measured, using a rotary balance, over an angle-of-attack range of 8 to 90 deg, and for clockwise and counter-clockwise rotations covering an Omega b/2V range of 0 to 0.9. M.G.

N83-13072*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

AN ANALYSIS OF AERODYNAMIC REQUIREMENTS FOR COORDINATED BANK-TO-TURN AUTOPILOTS Final Report

A. ARROW Washington NASA Nov. 1982 304 p refs
Sponsored by NASA
(NASA-CR-3644; NAS 1.26:3644) Avail: NTIS HC A14/MF A01 CSCL 01C

Two planar missile airframes were compared having the potential for improved bank-to-turn control but having different aerodynamic properties. The comparison was made with advanced level autopilots using both linear and nonlinear 3-D aerodynamic models to obtain realistic missile body angular rates and control surface incidence. Cortical cross-coupling effects are identified and desirable aerodynamics are recommended for improved coordinated (BTT) (CBTT) performance. In addition, recommendations are made for autopilot control law analyses and design techniques for improving CBTT performance. Author

N83-13073*# Boeing Commercial Airplane Co., Seattle, Wash.
STUDY OF SUPERSONIC WINGS EMPLOYING THE ATTAINABLE LEADING-EDGE THRUST CONCEPT Final Report, Dec. 1980 - Apr. 1982

W. D. MIDDLETON Washington NASA Nov. 1982 159 p refs
(Contract NAS1-15534)
(NASA-CR-3637; NAS 1.26:3637) Avail: NTIS HC A08/MF A01 CSCL 01A

A theoretical study was made of supersonic wing geometries at Mach 1.8, using the attainable leading-edge thrust concept. The attainable thrust method offers a powerful means to improve overall aerodynamic efficiency by identifying wing leading-edge geometries that promote attached flow and by defining a local angle-of-attack range over which attached flow may be obtained. The concept applies to flat and to cambered wings, which leads to the consideration of drooped-wing leading edges for attached flow at high lift coefficients. Author

N83-13074# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

PROPULSIVE PERFORMANCE OF 2-DIMENSIONAL THIN AIRFOILS UNDERGOING LARGE-AMPLITUDE PITCH AND PLUNGE OSCILLATIONS M.S. Thesis

J. D. FAIRGRIEVE and J. D. DELAURIER Jul. 1982 130 p refs
(UTIAS-TN-226; ISSN-0082-5263) Avail: NTIS HC A07/MF A01

Three discrete-wake-vortex models were developed and applied to various pitch and plunge combinations for arbitrary motion in an inviscid fluid. The simplest model assumes that the shed vortex wake is planar, while the remaining two models allow for a two dimensional or "wavy" wake: one traced and "frozen" in space, and the other allowing the shed vortex sheet to interact with itself and the airfoil's bound vortices. Periodic, but not necessarily harmonic, motions are considered and propulsive performance measures, such as average propulsive efficiency and average thrust

coefficient, are calculated. The results show that pitch articulation, in combination with plunging motion, can increase either average propulsive efficiency or average thrust coefficient, but not necessarily both simultaneously. It was also found that a modified square-wave-type motion generally gives rise to relatively high values of average thrust. These high thrust values are obtained at the expense of excessively large relative angles of attack at certain portions of the cycle. Author

N83-13075* # Spectron Development Labs., Inc., Costa Mesa, Calif.

A STUDY OF MODEL DEFLECTION MEASUREMENT TECHNIQUES APPLICABLE WITHIN THE NATIONAL TRANSONIC FACILITY

B. P. HILDEBRAND and J. L. DOTY Feb. 1982 104 p refs (Contract NAS1-16564)

(NASA-CR-165853; NAS 1.26:166853) Avail: NTIS HC A06/MF A01 CSCL 01A

Moire contouring, scanning interferometry, and holographic contouring were examined to determine their practicality and potential to meet performance requirements for a model deflection sensor. The system envisioned is to be nonintrusive, and is to be capable of mapping or contouring the surface of a 1-meter by 1-meter model with a resolution of 50 to 100 points. The available literature was surveyed, and computations and analyses were performed to establish specific performance requirements, as well as the capabilities and limitations of such a sensor within the geometry of the NTF section test section. Of the three systems examined, holographic contouring offers the most promise. Unlike Moire, it is not hampered by limited contour spacing and extraneous fringes. Its transverse resolution can far exceed the limited point sampling resolution of scanning heterodyne interferometry. The availability of the ruby laser as a high power, pulsed, multiple wavelength source makes such a system feasible within the NTF.

A.R.H.

N83-13076* # Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

STUDY OF HIGHLY SWEEPBACK WINGS BY THE FREE VORTEX SHEET METHOD Final Report, period ending 15 Aug. 1982

S. K. CHATURVEDI and F. GHAFARI Oct. 1982 43 p refs (Contract NSG-1561)

(NASA-CR-169559; NAS 1.26:169559) Avail: NTIS HC A03/MF A01 CSCL 01A

The aerodynamic characteristics of highly sweptback wings with separations induced vortex flows have been numerically investigated using the free vortex sheet method, developed by Boeing Company, under a contract with NASA/Langley Research Center. The models studied included delta and straked wings, and wings with leading edge extensions. Also, PAN-AIR code has been used to design a fixed leading edge extension into a thick delta wing. The theoretical results predicted have been compared with the experimental data wherever available, and the code capabilities and limitations explored. New fuselage effects also have been considered in some cases. Author

N83-13078# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany). Experimentelle Aerodynamik.

DESIGN AND MANUFACTURE OF A TRANSONIC WIND TUNNEL MODEL AND THE INVESTIGATION OF MODEL COMPONENTS UNDER CRYOGENIC FLOW CONDITIONS IN THE EUROPEAN TRANSONIC WIND TUNNEL Final Report, Sep. 1981

R. LEISTNER, A. ZACHARIAS, D. SCHIMANSKI, P. ESCH (Dornier-Werke GmbH, Friedrichshafen, West Germany), R. JOOS (Dornier-Werke GmbH, Friedrichshafen, West Germany), and E. THIEL (Dornier-Werke GmbH, Friedrichshafen, West Germany) Bonn Bundesministerium fuer Forschung und Technologie Sep. 1982 113 p refs Sponsored by Bundesministerium fuer Forschung und Technologie (BMFT-FB-W-82-015; ISSN-0170-1339) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 24

A tornado model wing with high lift devices, which demonstrates that models which exhibit the critical aerodynamic characteristics for a design Reynolds number of 40 million can be built for the European wind tunnel, is presented. Stress, design life, safety factors, and mechanical and physical properties of design elements are discussed. Test data for maraging and austenitic steel elements are presented. Author (ESA)

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AIR TRANSPORTATION AND SAFETY

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

A83-13168#

CALCULATED AND EXPERIMENTAL STRESS DISTRIBUTIONS IN A RIBBON PARACHUTE CANOPY

W. L. GARRARD and K. K. MURAMOTO (Minnesota, University, Minneapolis, MN) Journal of Aircraft, vol. 19, Dec. 1982, p. 1095-1097. Research supported by Sandia National Laboratory. refs

The steady state parachute canopy stress distributions calculated by means of a modified version of the CANO computer code are compared with the distributions measured by Konicke and Garrard (1981, 1982) using Omega stress sensors. The measured and calculated distributions are close, except for a region approximately 2/3 the distance from the vent to the skirt. It is suggested that these variations near the skirt are due to differences between calculation pressure distributions and test stress measurements. O.C.

A83-14534#

ATMOSPHERIC ELECTRICITY AND AIR TRANSPORT SAFETY [L'ELECTRICITE ATMOSPHERIQUE ET LA SECURITE DU TRANSPORT AERIEN]

J. TAILLET (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Societe Francaise de Physique, Journees Physique et Industrie, Lyons, France, Sept. 13, 14, 1982.) ONERA, TP no. 1982-82, 1982. 13 p. In French. (ONERA, TP NO. 1982-82)

Atmospheric electricity hazards to avionics and structural components of aircraft featuring computerized equipment and composite materials are reviewed, together with the level of knowledge of natural electrical threats to aircraft and investigative techniques. The threats comprise static charge build-up and lightning strikes. Electrostatic charging occurs over a period of time, and is caused by airframe contact with ice or particulate aerosols, or by passage through intense electromagnetic fields near cumulonimbus clouds. The charges accumulate around antennas and electronic components, producing degraded communications and navigational capabilities. Numerous hazards are present with lightning strikes, the most serious being wing

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rupture and subsequent crash of the aircraft. Composite materials are less conductive than metal, although lighter and therefore preferred for fuel efficiency. Various experimental efforts to characterize lightning, through its artificial generation and flights through storm clouds, and its effects, in terms of damage to materials and paths through structures and electronic circuitry, are described. M.S.K.

A83-14618#

OPERATION OF A HELICOPTER ON SLOPING GROUND. I
[EKSPLOATACJA SMIGLOWCA NA TERENIE POCHYLYM. I]
J. BEREZANSKI, J. STANISLAWSKI, and K. SZUMANSKI (Instytut Lotnictwa, Warsaw, Poland) Technika Lotnicza i Astronautyczna, vol. 37, Sept. 1982, p. 8-11. In Polish.

The paper presents the principles of the analytical determination of the limits of helicopter operation (i.e., engine starting, takeoff, landing, and termination of rotor operation) on sloping ground. A simulation method and a method for conducting tests in natural conditions are described, which are found to expand the possibilities of evaluating helicopter performance. B.J.

A83-14619#

THE ICING OF AIRCRAFT GAS TURBINE ENGINES
[OBLODZENIE LOTNICZYCH SILNIKOW TURBINOWYCH]
Z. MAGNUSZEWSKI (Instytut Lotnictwa, Warsaw, Poland) Technika Lotnicza i Astronautyczna, vol. 37, Sept. 1982, p. 11-14, 22. In Polish. refs

The factors affecting the intensity of icing on components of gas turbine engines are examined. Attention is given to mechanisms of icing during flight in clouds consisting of supercooled-water drops and in clouds containing ice crystals. Icing in rapid descent from high altitudes, and in taxiing, takeoff, and climb when ambient temperatures are above the freezing point is also considered. The influence of flight speed and altitude on icing is examined, and the application of deicing systems is discussed. B.J.

A83-14623#

TENTATIVE PRINCIPLES OF THE EVALUATION OF THE AIRWORTHINESS OF AIRCRAFT OF ONE-OF-A-KIND DESIGN
[TYMCZASOWE ZASADY SPRAWDZANIA ZDATNOSCI STATKOW POWIETRZNYCH BUDOWANYCH W POJEDYNCZYCH EGZEMPLARZACH]
, Technika Lotnicza i Astronautyczna, vol. 37, Oct. 1982, p. 20-22. In Polish.

A83-14624#

OPERATION OF A HELICOPTER ON SLOPING GROUND. II
[EKSPLOATACJA SMIGLOWCA NA TERENIE POCHYLYM. II]
J. BEREZANSKI, J. STANISLAWSKI, and K. SZUMANSKI (Instytut Lotnictwa, Warsaw, Poland) Technika Lotnicza i Astronautyczna, vol. 37, Oct. 1982, p. 23-27. In Polish.

Simulation tests and tests conducted in natural conditions are described which are intended to evaluate the limits of helicopter operation on sloping ground. The possibility of using such tests to verify analytical methods for the prediction of helicopter performance is examined. B.J.

A83-15403

AN ANALYSIS OF THE FATALITY RATE DATA FROM 'JETTISON-CANOPY' AND 'THROUGH-THE-CANOPY' EJECTIONS FROM AUTOMATED AIRBORNE ESCAPE SYSTEMS

J. E. VETTER In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 8-12.

United States Navy data for pilot ejections from disabled aircraft during 1969-1979, including inadvertent ejections, are examined from a statistical viewpoint in order to compare the advantages and drawbacks of through-the-canopy (TC) and jettison-canopy (JC) ejections. Data recorded for variables such as conditions at the time of ejection, the aircraft and ejection seat models, the site or terrain over which the ejection occurred, and the injuries sustained during the ejection are included in the analysis. It is

found that TC and JC exhibit different fatality rates, and that altitude and speed risk factors at the time of ejection markedly affect the rates. The rate difference is dominated by the difference observed in the low altitude-low speed risk situation for the multiple-seat aircraft. The site where ejection occurs does not appear to have any effect on fatality rates, and rates are lower for those ejections that occur while the nose is level, for both types of ejection. C.D.

A83-15404

PRELIMINARY GENERALIZED THOUGHTS CONCERNING EJECTION FLAIL PHENOMENA

F. C. GUILL (U.S. Naval Air Systems Command, Crew Systems Div., Washington, DC) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 13, 14.

Ejection flail phenomena are discussed in terms of limb dislodgement and limb flail. Windblast is not the sole causal agent for ejection-associated limb flail, since the data indicate that the incidence rate of limb flail increases with increased ejection velocity at a rate significantly less than the square of the ejection velocity. Additional mechanisms affecting the flail incidence rate are mentioned. The first step in causing limb flail is limb dislodgement; the factors affecting it are stated, including the position of the hands on the firing control, the handle design, linear and angular accelerations imposed upon the arms, and amount of seat yaw. Factors influencing the movement of the arms subsequent to dislodgement and affecting leg dislodgement and subsequent movement are listed. The data suggest that flailing occurred in about 10 percent of ejections with injuries of varying severity in about one-half of those instances. C.D.

A83-15405

PRELIMINARY OVERVIEW ANALYSES OF U.S. NAVY AIRCREW AUTOMATED ESCAPE SYSTEMS /AAES/ IN-SERVICE USAGE DATA

C. W. STOKES (U.S. Navy, Naval Weapons Engineering Support Activity, Washington, DC), F. C. GUILL (U.S. Naval Air Systems Command, Crew Systems Div., Washington, DC), M. M. ROBERSON, L. A. LEWIS, and R. W. CONE In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 15-20.

United States Navy aviation mishaps involving ejection seat equipped aircraft occurring during 1969-1979 are analyzed. Ejection and injury types are categorized and survival and fatality rates are calculated for types of ejections attempted, inadvertent ejections, and accomplished ejections clear of aircraft. For the latter two types, the distribution of injuries by year and rates of injury are shown, and the percentage and quantities of the various causes of death are given. The role of terrain and ejection envelope for those two types are also discussed, showing the distribution of terrain and envelope and the roles of terrain and ejection envelope in survivals and fatalities. For the same types of ejections, the roles of altitude, speed, attitude, and maneuver in fatality, survival, and degree of injury are analyzed. C.D.

A83-15406

PRELIMINARY GENERALIZED THOUGHTS CONCERNING JETTISONED VS THROUGH-THE-CANOPY EJECTION ESCAPE SYSTEMS

F. C. GUILL (U.S. Naval Air Systems Command, Crew Systems Div., Washington, DC) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 21-24.

The drawbacks of through-the-canopy and jettisoned canopy aircraft ejection systems are discussed. The former results in a more than five times higher rate of vertebral fracture than the latter, which derives from the seat's decelerating as it strikes the canopy followed by rapid reacceleration as the canopy gives way. If the seat occupant rises off the seat pan during deceleration, the pan then strikes him sharply during reacceleration, often causing vertebral fracture. The seat occupant may also be injured by flying glass from the broken canopy or by contact with the jagged break

edges of the hole in the canopy during upward propulsion. Canopy jettisoning represents another failure point with the potential for reducing escape system reliability. In a survey of 35 failed ejections, 32 involved canopy jettisoning and three through-the-canopy ejection. The jettisoned canopies may also interfere with the egress or subsequent operation of the escape system after having signalled the seat to eject. C.D.

A83-15407
PRELIMINARY ANALYSES OF FLAIL, WINDBLAST AND TUMBLE PROBLEMS AND INJURIES ASSOCIATED WITH USAGE OF U.S. NAVY AIRCREW AUTOMATED ESCAPE SYSTEMS /AAES/

M. ROBERSON (U.S. Navy, Naval Weapons Engineering Support Activity, Washington, DC), F. GUILL (U.S. Naval Air Systems Command, Crew Systems Div., Washington, DC), C. STOKES, and L. LEWIS In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 25-29.

A83-15408
U.S. NAVY AIRCREW AUTOMATED ESCAPE SYSTEMS /AAES/ IN-SERVICE DATA ANALYSIS PROGRAM

F. C. GUILL (U.S. Naval Air Systems Command, Crew Systems Div., Washington, DC) and C. W. STOKES In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 30-32.

The Naval Air Systems Command's ongoing Aircrew Automated Escape System (AAES) In-Service Usage Data Analysis program is discussed in terms of its purpose, the basic problem confronting it, and its future plans. The main purposes of the program are to establish a systematic investigation of in-service AAES data, identify pervasive low-grade, nonspectacular problems, and examine effects of design and design concept changes. The basic problem is effective management of limited resources to enhance aircrew safety and performance. AAES data analyses and procurement cycles are shown, as are data inputs and flow for projecting future problem rankings for AAES, a typical AAES data chain, and data analyses usages. The role of the Naval Safety Center in the program is also indicated. C.D.

A83-15409
AN OPTION FOR ENHANCED AIRCREW SURVIVABILITY

H. GREGOIRE (U.S. Navy, Naval Air Test Center, Patuxent River, MD) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 33-37.

The capabilities of ram-air parachute canopies in comparison with present canopy designs used in emergency egress systems are discussed. An estimate of potential ram-air parachute advantages in reducing injuries, fatalities, and capture within the limitations of Southeast Asia combat ejection escape experience is documented. The known ejection locations of fixed wing Navy aircrewmembers who became POWs and who were rescued during the Southeast Asia conflict are depicted. The range extension capability of the ram-air steerable parachute is shown as a function of ejection altitude. Experiments in training requirements and recent developments in ram-air parachute reliability are described. The enhancement of noncombat as well as combat survivability is discussed from a medical perspective, particularly with regard to trauma and drowning during the parachute landing phase of an inflight egress occurrence. C.D.

A83-15416
THE 3 RING CANOPY RELEASE SYSTEM

W. R. BOOTH In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 87-90.

The structures and advantages of the three-ring canopy release system and the hand deploy pilot chute system are described. The former's function is to release the main high performance parachute in one easy motion under any load condition. The activation handle has not been accidentally released in millions of

jumps. It withstands a 5000 lb shock load and is cheap, lightweight, and easy to maintain. The handle, ripcord, ripcord housing, large harness ring, two smaller riser rings, and nylon locking loop are depicted and their function is described, as is the functioning of the whole system. The structure of the hand deploy pilot chute system is briefly stated, and its two main advantages are discussed. The system saves 200-400 feet by instantly placing the pilot chute to the side into clean, upward moving air, and it eliminates out-of-sequence deployments by insuring that the canopy will not get out of its container until the pilot chute is fully deployed. C.D.

A83-15418
SEARCH AND RESCUE LOCATOR BEACONS - THE BRITISH CONCEPT

J. A. COOK (Burndept Electronics, Ltd., Erith, Kent, England) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 101-103.

The target specifications and practical design solutions of the British version of the search and rescue locator beacon are discussed. The personal carriage requirement, operating specifications, testing and maintenance requirements, and continuity of supply aspects of the beacon are addressed. The placement of the beacon in the life preserver is described, giving an example of the beacons in use. Special stowage areas are mentioned, and the use of speech as permitted by the beacon, its waterproofing, transmission characteristics, modulation, testing, and design financing are discussed. C.D.

A83-15423
HUMAN FACTORS DILEMMAS IN THE QUEST FOR AVIATION SAFETY

J. E. ROBINSON, JR. (Hughes Aircraft Co., Systems Div., Fullerton, CA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 139-143. refs

A human factors analysis of 220 Aircraft Accident Reports issued by the National Transportation Safety Board is considered. The purpose of the over-all analysis is to describe, by examples, the human factors problems which have drawn the attention of aviation safety experts over a recent 12-year period. Ten excerpts which illustrate an equal number of human factors dilemmas in the pursuit of aviation safety have been selected. The selected excerpts are related to cabin evacuation, excessive workload leading to fatigue, difficulties arising in connection with the division of tasks, difficulties encountered when control of an aircraft is shifted from one pilot to another during an emergency, and inappropriate management policies with respect to the operational dispatching functions. Other problems considered are concerned with fog, turbulence, icing, and cumulative events. It is pointed out that the nature of the accidental events reported can contribute to the development of remedial steps in design, operational procedures, and management or regulation. G.R.

A83-15424
U.S. NAVY SEARCH AND RESCUE MODEL MANAGER

C. T. FOWINKLE (U.S. Navy, Pensacola, FL) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 144-149.

The techniques for improving search and rescue (SAR) operations and maintaining a facile flow of information employed by the SAR Model Manager of the U.S. Navy are described. The SAR Model Manager and his staff continually review existing and recommended changes to SAR procedures and equipment. Additionally, studies are performed to provide recognition incentives to encourage trained rescue swimmers to remain in the service. The SAR Model Manager coordinates the suggestions and recommendations from each service for improved operations, thus ensuring that all the services share in the improvements and cost savings derived from ideas and equipment originating in one of

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the branches, e.g., night goggles to detect IR distress signals, or changes in the Stokes litter. M.S.K.

A83-15434

A LOOK AT THE RUSSELL 'LOBE' PARACHUTE - THE FIRST ULTRASTABLE PARACHUTE DESIGN

D. GOLD (U.S. Naval Weapons Center, China Lake, CA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 200-210.

It is pointed out that parachute instability, as manifested by the swinging or oscillation of its load during descent, has been a problem since the day of the first parachute descent by a man from a balloon on October 22, 1797. The death of Sgt. Washburn, while making a training jump with a remodeled Air Service parachute, led to the invention of the 'Lobe' parachute by Russell who was investigating this fatality. On February 17, 1926, Russell applied for a patent on his new parachute concept. The unique design characteristics of Russell's parachute included a canopy which had a gore shape that was extremely formed at its skirt portion. This feature would give the parachute a pumpkin shape when inflated. Parachutists who were concerned about landing under a stable canopy favored the 'Lobe' despite a reputed high descent rate. On the other hand, parachutists who wanted to 'steer' their parachutes in connection with 'spot-landing' contests disfavored the 'lobe'. G.R.

A83-15441

THE UNITED STATES NAVY'S INJURY EXPERIENCE IN AIRCRAFT MISHAPS

V. VOGEL (U.S. Navy, Naval Air Station, Agana, GU) and M. S. BOROWSKY (U.S. Naval Safety Center, Norfolk, VA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 248-251.

The important parameters, statistically determined causes of injuries and types of injuries sustained by U.S. Navy aviators during ejection and recovery are reviewed, with a focus on head, neck, and spinal injuries. Seat design and accident analyses require information on escape conditions, the system configuration, performance, personnel equipment configuration, and the equipment performance, as well as the survival conditions and search and rescue performance. A total of 36% of the 3263 aircrew personnel involved in accidents from 1970-79 experienced head or neck injuries. The most common ailments were contusions, sprains, and strains, while fractures and dislocations were prevalent among the fatal accidents. The total loss in costs to the Navy are \$30 million per year due to skull, neck, and vertebral injuries occurring among the aviator corps. M.S.K.

N83-12055# Federal Aviation Administration, Washington, D.C. Office of Aviation Safety.

SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSES TO NATIONAL TRANSPORTATION SAFETY BOARD SAFETY RECOMMENDATIONS Quarterly Report, Jan. - Mar. 1982

J. H. MACKINNON and C. A. CARPENTER Jan. 1982 148 p (AD-A118692; FAA-ASF-300-82-2) Avail: NTIS HC A07/MF A01 CSCL 05H

This report contains NTSB (National Transportation Safety Board) recommendations and all FAA (Federal Aviation Administration) responses to Board recommendations that were delivered to the Board during the applicable quarter. In addition, the report includes NTSB requests and FAA responses concerning reconsiderations, status reports, and followup actions. GRA

N83-12056# Textron Bell Helicopter, Fort Worth, Tex. **SLACK WIRE STRIKE PROTECTION CONCEPTS Final Report, Sep. 1981 - May 1982**

Jul. 1982 72 p

(Contract DAAK51-81-C-0034; DA PROJ. 1L1-62209-AH-76) (AD-A118827; USAAVRADCOM-TR-82-D-9) Avail: NTIS HC A04/MF A01 CSCL 13I

A design study has been conducted to establish slack wire strike protection concepts. The objective of the study was to define and investigate design concepts that could prevent helicopter mishaps caused by main and tail rotor controls entanglement with a slack wire. The study helicopter was an OH-58A equipped with a taut wire strike protection system (WSPS). Author (GRA)

N83-13079 Colorado Univ., Boulder.

PILOT-IN-COMMAND: A SOCIOLOGICAL ANALYSIS OF GENERAL AVIATION ACCIDENTS Ph.D. Thesis

R. F. URBAN 1982 423 p

Avail: Univ. Microfilms Order No. DA8221131

Employing a quasi-experimental design, this investigation represents an exploratory examination of several differentiating social and demographic characteristics of a sample of calendar year 1978 Colorado-resident nonfatal accident-involved pilots and a random sample of nonaccident general aviation (i.e., non-airline) pilots. Eighty currently-active pilots were interviewed by the author during 1979-80, and information concerning the standard demographic variables in addition to several social psychological and flying-related items was obtained. The sample was generated from commercially available data files derived from U.S. Government records and consisted of forty-six accident and thirty-four nonaccident pilots who resided within a one-hundred-mile radius of Denver, east of the Rocky Mountains. Application of stepwise discriminant analysis revealed that the pilots' education, political orientation, birth order, percent of flying for business purposes, participation in nonflying aviation activities, number of years of flying experience, and an index of aviation procedural noncompliance yielded statistically significant results.

Dissert. Abstr.

N83-13080# National Transportation Safety Board, Washington, D. C.

NATIONAL TRANSPORTATION SAFETY Annual Report to Congress, 1981

30 Mar. 1982 85 p refs

Avail: NTIS HC A05/MF A01; HC also available from SOD

National transportation safety during the year 1981 is discussed.

N83-13081# National Transportation Safety Board, Washington, D. C.

AVIATION SAFETY

In its Natl. Transportation Safety p 9-24 30 Mar. 1982

Avail: NTIS HC A05/MF A01; HC also available from SOD

Aviation safety during 1981 is reviewed. The 1981 accident rate per 100,000 hours flown is charted. The effect of the air traffic controllers' strike on the safe operation of the air traffic control system is evaluated. Efforts to improve aircraft crashworthiness are described. The causes of specific accidents involving air traffic control, commuter airlines, weather detection, icing, air turbulence, corporate aircraft, crew or pilot error, helicopters, locator beacons, and others are described. J.D.

N83-13082# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.

AVIATION ACCIDENT REPORT: TRAIN AIR, INCORPORATED, GATES LEARJET 24, N44CJ, FELT, OKLAHOMA, 1 OCTOBER 1981

18 May 1982 54 p refs

(PB82-910404; NSTB-AAR-82-4) Avail: NTIS HC A04/MF A01 CSCL 01C

The probable cause of the accident was a loss of control, possibly initiated by an unexpected encounter with moderate to severe clear air turbulence, which caused the aircraft to depart

the narrow flight envelope boundaries in which it was operating and from which recovery was not effected, the flightcrew's lack of adequate training and experience in the Learjet, and the aircraft's marginal controllability characteristics near and beyond the boundaries of its flight envelope. Contributing to the accident was the flightcrew's probable extension of the spoilers in an overspeed situation, a procedure that had been prescribed in the approved aircraft flight manual until 1 year before the accident. S.L.

N83-13084# Civil Aeronautics Board, Washington, D.C. Financial Section.

AIRPORT ACTIVITY STATISTICS OF CERTIFICATED ROUTE AIR CARRIERS Annual Report for 1981

31 Dec. 1981 347 p Prepared in cooperation with FAA, Washington

(AD-A119713) Avail: NTIS HC A15/MF A01 CSCL 01B

This report furnishes airport activity of the Certificated Route Air Carriers. Included in the data contained in Table 6 are passenger enplanements, tons of enplaned freight, express, and mail. Both scheduled and non-scheduled service, and domestic and international operations are included. These data are shown by airport and carrier. Table 7 includes departures by airport, carrier and type of operation, and type of aircraft. Author (GRA)

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

A83-14116

CELESTIAL NAVIGATION IN THE COMPUTER AGE

A. B. MOODY New York, Van Nostrand Reinhold Co., 1982. 269 p. refs \$19

The role of the computer in celestial navigation is discussed. The theories on which celestial navigation is based are explained, and the theories are applied to actual navigational problems. Numerous sample equations demonstrate the solving of such problems using both a computer and more traditional techniques, so that the accuracy and efficiency of computer problem-solving can be assessed and compared with other methods. Included are applications of the computer to problems in sight reduction, plotting lines of position, determining and correcting altitude, timing and observation, and using ephemeral data. C.D.

A83-14494

A NONLINEAR SMOOTHING PROCEDURE FOR THE RECONSTRUCTION OF FLIGHT TRAJECTORIES ON THE BASIS OF RADAR DATA [EIN NICHTLINEARES GLAETTUNGSVERFAHREN ZUR REKONSTRUKTION VON FLUGBAHNEN AUS RADAR DATEN]

H.-J. MIETH (Gesellschaft zur Foerderung der astrophysikalischen Forschung, Forschungsinstitut fuer Funk und Mathematik, Wachtberg, West Germany) Mathematical Methods in the Applied Sciences, vol. 4, no. 4, 1982, p. 497-509. In German. refs

One aspect of the use of electronic data processing in applications related to airspace surveillance and air traffic control is connected with the possibility to store all the data for the reconstruction of interesting situations in the airspace at a later time. However, for such studies it would generally be necessary to have information regarding the flight trajectories. The present investigation is concerned with the possibilities for obtaining an optimal estimate of the actual trajectories on the basis of the available radar data and their statistical characteristics, taking into account also knowledge of aircraft maneuverability. A variational approach and a generalized smoothing spline method are considered. The characteristics of the discussed procedure are

illustrated with the aid of an example involving an aircraft trajectory which is typical for the airspace region near the airport. G.R.

A83-14535#

AN AUXILIARY PASSIVE MICROWAVE NAVIGATION SYSTEM

A. APPRIOU, B. VAIZAN, and F. LE CHEVALIER (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (European Microwave Conference, 12th, Helsinki, Finland, Sept. 13-17, 1982.) ONERA, TP no. 1982-83, 1982. 7 p. (ONERA, TP NO. 1982-83)

An original passive microwave system which implements an altitude determination using ground radiometric temperature measurements is described. The obtained altitude can be used either directly or for navigation updating by comparing it with prestored altitude maps. The passive ranging system principle is presented and the temperature recognition algorithm is described. The latter employs two antennas which receive signals from a source at different times, with the lag varying with the altitude of the source. Implementation features, including navigation updating, are briefly discussed. Some simulations using real ground measurements at 35 GHz and 94 GHz are shown, and two major points concerning the system's reliability are discussed in this context: the instantaneous precision when facing real measurement noises and signals, and the capability to follow different terrain shapes without falling out of step. C.D.

A83-14862#

THE DESIGN OF A PACKET SWITCHED NETWORK FOR AERONAUTICAL DATA INTERCHANGE

N. G. CHALMERS and F. W. RUSSELL (Department of Transport, Planning, Research and Development Branch, Melbourne, Australia) Journal of Electrical and Electronics Engineering, Australia, vol. 2, Sept. 1982, p. 130-138.

This paper describes development work carried out over the past three years in Transport Australia to implement new data interchange standards and facilities used for operational message traffic within the Department. The approach to hardware and software design is discussed and the trade-off's of different approaches evaluated. Facilities to be provided in the network are briefly reviewed. The requirement for the Australian network to interface a number of differing types of communication channel, with adequate provision for evolution of the network, is explained. This has led to the design of a multiprocessor packet switching exchange and network control center, with provision of smaller processor based automatic terminal controllers at remote locations. Different requirements for software operating systems in each part of the design, and the method of satisfying these requirements, is explained. Finally the training and maintenance approach to field implementation is discussed. (Author)

A83-16332#

STIMULATION VERSUS SIMULATION

B. E. DOSWELL (Marconi Avionics, Ltd., Rochester, Kent, England) In: Flight simulation - Avionic systems and aero medical aspects; Proceedings of the International Conference, London, England, April 6, 7, 1982. London, Royal Aeronautical Society, 1982. 5 p.

According to the presented definitions, stimulation is artificially driving the object device to provide the required output data, while simulation is preparation and presentation of the required data without using the object device. An avionic system is defined as a collection of avionics units with a common purpose. As an example of such a system, a description is provided of the Mission System Avionics developed for the Airborne Early Warning Nimrod. The airborne early warning (AEW) task has been to place a comprehensive radar control and reporting center into an aircraft to be operated autonomously at height. In considering how to design a mission simulator for this avionic system, the question of simulation versus stimulation was explored. The primary consideration was to present the operator with a picture which would be as close as possible to that which he would see in the air. Of similar priority was the requirement to have the system

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control functions respond in real time with correct feedback to the operators. G.R.

A83-16333# SIMULATION OF A TERRAIN FOLLOWING SYSTEM

G. FEIL and A. HESSEL (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) In: Flight simulation - Avionic systems and aero medical aspects; Proceedings of the International Conference, London, England, April 6, 7, 1982. London, Royal Aeronautical Society, 1982. 12 p. refs

One of the best approaches for the penetration of sophisticated defenses with a fighter aircraft involves flying at very low altitudes at nearly the speed of sound. A number of aircraft were recently designed with a terrain following (TF)-system. The present investigation is concerned with the requirements and performance criteria of a TF-system. The requirements for low-level flying operations are examined, taking into account an optimum balance between performance and safety. Operation of the system at day and night, and under all weather conditions is accomplished by making use of automatic control features. The TF-system described includes an TF-radar, a radar altimeter, an autopilot, a Command and Stability Augmentation System, an inertial navigator, a main computer, and displays. A description of the simulation system is provided, taking into account digital simulation, and closed loop hardware simulation. G.R.

A83-16448# A NEW TECHNIQUE FOR THE PRECISION DME OF MICROWAVE LANDING SYSTEM

F. CHIARINI, M. GORI, F. VATALARO (Industrie FACE Standard, Laboratorio Centrale, Pomezia, Italy), G. CORAZZA, and G. FALCIASECCA (Bologna, Universita, Bologna, Italy) Alta Frequenza, vol. 51, Sept.-Oct. 1982, p. 242-256. refs

Technical results from the planning of a precision distance measuring equipment to be included in a microwave landing system are reported. The proposed device functions through double pulse shaping with analog signal processing. The technique was chosen so as to minimize the equipment requirements at the transmitter and the receiver by decoupling the output waveform at the receiving filter from the transmitted signal. The RF instrumentation at the receiver is thereby optimized. A block diagram of the new DME is presented, together with operational requirements and constraints. A method of signal detection and error computation is defined, noting the necessity of allowing for both diffuse multipath and specular multipath errors. The double pulse shaping feature lowers the multipath error by assigning an error margin and noise maximum to incoming signals. M.S.K.

N83-12057# Aeronautical Research Labs., Melbourne (Australia).

HAZARDS OF COLOUR CODING IN VISUAL APPROACH SLOPE INDICATORS

B. A. J. CLARK and J. E. GORDON Dec. 1981 26 p refs (ARL-SYS-REPORT-25; AR-002-324) Avail: NTIS HC A03/MF A01

Red-White visual approach slope indicators (VASIS) and PAPI both use color differences between red and white lights as the primary means of coding the guidance signals. Australia's T-VASIS uses color coding only as a secondary separate warning of extreme undershoot. The historical development of signal coding in VASIS is described. Color coding is examined with reference to human color discrimination ability and the degradation and falsification of VASI signals by atmospheric and other influences. There are several ways (not rare) in which the perceived color differences between red and white VASI signals can become small enough for the coding to be regarded as failed. The signals may then be misinterpreted, resulting in a 'too low' signal being taken as 'too high' with consequent great danger of an undershoot accident. Color coding of VASI primary signals therefore fails unsafe and VASIS which use it, such as Red-White VASIS and PAPI, should not be used. A.R.H.

N83-12058# Federal Aviation Administration, Atlantic City, N.J. PRELIMINARY EVALUATION OF THE BASIC EXPERIMENTAL ACTIVE BEACON COLLISION AVOIDANCE SYSTEM (BCAS) Final Report

E. QUISH and E. F. GLOWACKI Mar. 1982 97 p (DOT/FAA-RD-82-67; CT-82-100-39LR) Avail: NTIS HC A05/MF A01

This data report provides information on the testing of a basic Active Beacon Collision Avoidance System (ABCAS). The system tests were initiated in February of 1980 and were conducted in a test-evaluate-design improvement iterative process. As a result, the data in this report generally is restricted to tests which were conducted after July 13, 1980. This date is considered the point at which the design of the tracking and threat evaluation and resolution software was frozen. The flight program consisted of conducting planned encounters and operational familiarization flights in terminal areas. Two hundred and twenty-five (225) hours of instrumented flight were conducted which included 255 planned encounters and 131 operational and demonstration landings and approaches into 18 major cities. During the test period following July 13, 114 hours of instrumented flight were conducted which included 110 planned encounters and all of the operational and demonstration landings and approaches. During this period of instrumented flight, 23 unplanned encounters were experienced with random targets. Initial evaluations were performed on target acquisition range, computer utilization, track continuity, and advisory verification and appropriateness of planned and unplanned encounters. Author

N83-12059# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

FLIGHT TEST INVESTIGATION OF AREA CALIBRATED LORAN-C FOR EN ROUTE NAVIGATION IN THE GULF OF MEXICO Final Report, Jul. 1980

J. G. MORROW Washington Sep. 1982 53 p (Contract FAA PROJ. 045-390-130) (FAA-RD-82-7; FAA-CT-81-72) Avail: NTIS HC A04/MF A01

Flight tests of two Loran-C airborne navigators were conducted in the Gulf of Mexico oil/gas exploration and production area. Two systems were installed in a Federal Aviation Administration (FAA) CV-580 aircraft to examine simultaneously the performance of a LORAN-C receiver operated in an area-calibrated mode and one operated in an uncalibrated mode. Two separate test routes were flown over a period of 2 days. These routes covered the central and western test areas of the Gulf of Mexico and an overland route from Palacios, Texas, to Lafayette, Louisiana. An Inertial Navigation System (INS) was used as a position reference standard. The INS data were updated to correct for drift. The flight tests indicated that the use of area calibration greatly increased the area of compliance with Advisory Circular 90-45A en route accuracy requirements in the flight test. B.W.

N83-12060# Federal Aviation Administration, Atlantic City, N.J. COAST TERMINAL RADAR APPROACH CONTROL FACILITY (TRACON) REFURBISHMENT Final Report, Mar. - Jul. 1981

D. BOTTOMLEY and F. F. HIERBAUM, JR. Aug. 1982 32 p (Contract FAA-144-170-830) (DOT/FAA-RD-82-38; DOT/FAA-CT-82-21; AD-A120078) Avail: NTIS HC A03/MF A01

This study was conducted as a result of the Western Region's decision to change the Coast Terminal Radar Approach Control Facility (TRACON) layout from a horizontal radar island-type operation to a vertical radar perimeter-type operation. This change was brought about by a Federal Aviation Administration (FAA) decision to add terminal control advisory service to the Coast TRACON functions. In addition, the present lighting system used at the coast TRACON produced undesirable reflections and glare. Several equipment configurations were proposed by facility and Western Region office personnel as well as by the FAA Technical Center personnel. These proposals were evaluated by Coast TRACON and Western Region office personnel. The governing factors were available space, cost, and impact on facility operations. The preferred configuration, provided additional space by recessing

one row of consoles within the wall which divides the TRACON operational and maintenance areas. Experiments with various lighting techniques produced more useable ambient light while it reduced glare and reflections. B.W.

N83-12061# Systems Control Technology, Inc., West Palm Beach, Fla.

INSTRUMENT APPROACH AIDS FOR HELICOPTERS Final Report, Jan. 1981 - Jan. 1982

E. D. MCCONKEY and R. E. ACE Washington FAA Jul. 1982 94 p refs
(Contract DTFA01-80-C-10080)
(FAA-RD-82-6) Avail: NTIS HC A05/MF A01

The various instrument approach procedures that are available to the helicopter operator are identified. Emphasis is placed on the recently approved 'Helicopter Only' procedures, the criteria for which are contained in Chapter 11 of the Terminal Instrument Procedures Handbook. Currently available solutions to helicopter approach needs are examined. New and innovative solutions to helicopter approach requirements are presented. B.W.

N83-12063# Federal Aviation Administration, Atlantic City, N.J.
AIRPORT SURFACE DETECTION EQUIPMENT (ASDE)-3 IMPROVEMENTS TEST AND EVALUATION Final Report, Oct. 1980 - Oct. 1981

L. A. DVORSKY and J. F. MARSDEN Aug. 1982 26 p refs
(DOT/FAA-RD-82-23; DOT/FAA-CT-82-39; ACT-100) Avail:
NTIS HC A03/MF A01

Anomalous elongation of target returns from F-106 aircraft; an oversized waveguide installed in lieu of standard K micron waveguide; and linear vertical, linear horizontal, and right hand circular antenna feed polarizations with respect to clear weather target imaging performance were evaluated. The target elongation is generated by intermediate frequency (IF) amplifier saturation. Oversize waveguide improves system performance and should be utilized for long radiofrequency (RF) runs. Linear polarization improves clear weather target imaging and should be provided to the controller as an option. Author

N83-12064# Comsis Corp., Mountain View, Calif.
ARTS 2A DESIGN ANALYSIS Final Report, May 1981 - Jun. 1982

M. TASHKER, M. BELL, and W. CHAPEL Washington FAA Jun. 1982 99 p Prepared in cooperation with SRI International Corp., Menlo Park, Calif.
(Contract DTFA01-81-Y-10526; SB9-448(A)81-C-480)
(FAA-RD-82-54; CMSS-MV-82-01; AD-A119598) Avail: NTIS HC A05/MF A01

The design for the ARTS 2A air traffic system for terminal areas with low to medium traffic density is documented. ARTS 2 is upgraded to ARTS 2A with the replacement of the LSI 2/20 minicomputer by the LSI 2/40, which is faster and has more memory capacity, and the addition of minimum safe altitude warning, conflict alert, a tracker to support these, and a training target generator. The use of semiconductor memory in an air traffic system and the requirement for a battery backup power supply is addressed. The algorithms for the enhancements were studied to determine whether the LSI 2/40 has sufficient speed to perform them under traffic and display loads expected in 1990. It is concluded that the replacement computer has the capacity to perform the enhancement functions under maximum target and display load for the expected air traffic environment. S.L.

N83-12066# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS 1) DESIGN GUIDELINES Final Report

V. A. ORLANDO, J. D. WELCH, W. H. HARMAN, and A. R. PARADIS Washington FAA Apr. 1982 92 p refs
(Contract DOT-FA72WAI-877; F19628-80-C-0002)
(ATC-114; FAA-RD-82-12) Avail: NTIS HC A05/MF A01

The FAA airborne Traffic Alert and Collision Avoidance System known as TCAS 1 is described. Simple techniques suitable for the passive and active detection of nearby aircraft by TCAS 1

were investigated. This is followed by a review of the measurement facilities and data used to evaluate the detection techniques. Techniques for identifying passively detected returns from potentially threatening aircraft, i.e., the rejection or filtering out of non-threat aircraft, are described and evaluated. Alternatives for time-sharing the 1090 MHz channel between the TCAS 1 transponder and the passive detector are described. A candidate passive detector is defined and its performance is evaluated using flight test data. Predictions of the performance of a low-power TCAS 1 based on active detection are made via link calculations and flight test measurements. A summary of results is included. Author

N83-12067# Lincoln Lab., Mass. Inst. of Tech., Lexington.

TCAS 1 DESIGN GUIDELINES

V. A. ORLANDO, J. D. WELCH, W. H. HARMAN, and A. R. PARADIS 24 Sep. 1982 91 p refs
(Contract F19628-80-C-0002; DOT-FA72WAI-877)
(ATC-114; FAA-RD-82-12) Avail: NTIS HC A05/MF A01

The FAA airborne Traffic Alert Collision Avoidance System known as TCAS 1 is described. Simple techniques suitable for the passive and active detection of nearby aircraft by TCAS 1 were investigated. The measurement facilities and data used to evaluate the detection techniques are reviewed. Techniques for identifying passively detected returns from potentially threatening aircraft, i.e., the rejection or filtering out of non-threat aircraft, are described and evaluated. Alternatives for time-sharing the 1090 MHz channel between the TCAS 1 transponder and the passive detector are described. A candidate passive detector is defined and its performance is evaluated using flight test data. Predictions of the performance of a low-power TCAS 1 based on active detection are made via link calculations and flight test measurements. A summary of results is included. Author

N83-12068# Systems Control Technology, Inc., West Palm Beach, Fla.

APPLICATION OF THE MICROWAVE LANDING SYSTEM TO HELICOPTER OPERATIONS Final Report

E. D. MCCONKEY, J. B. MCKINLEY, and R. E. ACE Sep. 1982 125 p refs
(Contract DTFA01-80-C-10080)
(FAA-RD-82-40) Avail: NTIS HC A06/MF A01

Ways in which the microwave landing system (MLS) can be utilized to aid helicopter operations are identified. The following areas are examined: (1) helicopter instrument approach requirements by type of operation; (2) helicopter instrument approach requirements by operational area; (3) types of potential approach procedures that could be used by helicopters; (4) helicopter performance considerations during approach, landing and missed approach procedures; (5) ground and airborne MLS equipment; and (6) benefits and costs associated with the use of MLS in helicopter operations. The operational areas considered include: city centers, major hub airports, non-hub airports, remote areas, and offshore oil rig support. MLS procedures can be applied to each of these operational areas. From an economic standpoint, operations at city center heliports, major hub airports, non-hub airports, and remote areas can have benefits that exceed costs if operations counts are sufficiently large. Offshore operations will not have benefits that exceed costs due to the availability of alternative approach procedures. A.R.H.

N83-12069# H. H. Aerospace Design Co., Inc., Bedford, Mass.
A TECHNICAL ANALYSIS OF REHOSTING THE NATIONAL AEROSPACE SYSTEM SOFTWARE Final Report, Nov. 1980 - Aug. 1981

K. BRITTING, A. COCANOWER, A. GUPTA, M. HSU, and F. MARCUS Oct. 1981 162 p refs
(Contract DTFA01-80-Y-10595)
(AD-A118828; HHA-81-4; FAA-AP-82-2) Avail: NTIS HC A08/MF A01 CSCL 09B

The Federal Aviation Administration (FAA) is planning to replace within the next ten years the computers used to provide en route air traffic control services; in carrying out this replacement there

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are many different strategies the FAA could follow. The purpose of this report is to study the strategy known as rehosting the National Airspace System (NAS) software on instruction-compatible machines. The idea is that the current computers (and associated peripherals) would be replaced by modern hardware that executes the same machine-language instructions. The current NAS software would be changed only insofar as proves necessary for the software to run on the new machines; these changes to the software are expected to be minor. The rehosting strategy is evaluated in seven areas. First, how reliable is the system? Second, how well will the system perform under expected workloads? Third, how serious are the technical obstacles to adapting the software to run on the new machines? Fourth, what would the new system cost? Fifth, what problems would be encountered during the transition to the new system. Sixth, how quickly could the system be procured? Seventh, how well adapted is the system to future growth. The conclusion is that the rehost strategy is technically feasible, but there is some uncertainty about what this strategy would cost and how long the procurement process would take. Author (GRA)

N83-13086# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MODE S BEACON SYSTEM: FUNCTIONAL DESCRIPTION
V. A. ORLANDO and P. R. DROUILHET 27 Oct. 1982 100 p refs
(Contract DOT-FA72WAI-261; F19628-80-C-0002; FAA PROJ. 052-241-04)
(ATC-42-REV-B; FAA-RD-82-52) Avail: NTIS HC A05/MF A01

A functional description is provided for the Mode S Beacon System, a combined secondary surveillance radar (beacon) and ground-air-ground data link system capable of providing the aircraft surveillance and communications necessary to support ATC automation in future traffic environments. Mode S is capable of common-channel interoperation with the current ATC beacon system, and may be implemented at low user cost over an extended transition period. Mode S will provide the surveillance and communication performance required by ATC automation, the reliable communications needed to support data link services, and the capability of operating with a terminal or enroute, radar digitizer-equipped, ATC surveillance radar. Author

N83-13087# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
INSTRUMENT LANDING SYSTEM LOCALIZER VECTOR FAR FIELD MONITOR DEVELOPMENT Final Report, Oct. 1980 - Jul. 1982
O. A. BAUGHMAN and R. A. RAJNIC Washington FAA Jul. 1982 148 p refs
(Contract DTFA01-80-C-10134)
(FAA-RD-82-62) Avail: NTIS HC A07/MF A01

Design, development and results of testing of the prototype Vector Far Field Monitor (VFFM) equipment are discussed. The VFFM is a localizer monitor located in the runway approach area on the runway centerline extended between the threshold and the middle marker vicinity. It measures the in-phase and quadrature components of the scattered and reflected localizer sideband radiation on the localizer course and calculates the potential maximum course DDM disturbance using synchronous and single point detection techniques. Localizer transmitter incidental phase modulation or quadrature modulation effect on the VFFM is dealt with through a provision for a variable adjustment in the VFFM to tune out the corresponding quadrature component of the signal. Theory, equipment description, including installation and operating instructions, assembly drawings, and circuit schematics, summaries of field test data, and recommendations are included. Author

N83-13088# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERATION OF THE MODE SELECT SENSOR NETWORK COVERAGE MAP

D. REINER 24 Nov. 1982 61 p refs
(Contract DOT-FA72WAI-261; F19628-80-C-0002; FAA PROJ. 052-241-04)
(ATC-98A; FAA-RD-82-37) Avail: NTIS HC A04/MF A01

This paper describes the technique of designing the network management coverage map files necessary to coordinate a network of Mode S sensors. First, the concept of the Mode S network is defined, and the functions of Network Management are briefly described, as they relate to the coverage map. Then, the rationale for the coverage map is given together with definitions of the map structure and the information required in the file. Implementation of these definitions is illustrated in terms of a specific example: a network of four Mode S sensors in the Washington, D.C. area. As configured, each of the sensors provides service to only one of four ATC facilities (three TRACONs and one ARTCC). The resulting map generation process illustrates not only the general principles but also the significant effects of the ATC control area geometry. Finally, the procedure required for automated map generation is defined. This procedure assumes the use of an interactive computer display terminal and is applicable to any sensor network and ATC facility configuration. Author

N83-13089# National Telecommunications and Information Administration, Boulder, Colo. Institute for Telecommunication Sciences.

INSTRUMENT LANDING SYSTEM LOCALIZER RECEIVER PERFORMANCE IN THE PRESENCE OF CO-CHANNEL INTERFERENCE Final Report

E. J. HAAKINSON Jul. 1982 51 p
(Contract DT-FA01-81-Y-10534)
(AD-A118909; DOT/FAA/RD-82/43) Avail: NTIS HC A04/MF A01 CSCL 17G

Co-channel signals can cause harmful interference to navigational aid systems such as the Instrument Landing System. This report describes the performance of four localizer receivers in the presence of interference from co-channel CW (Continuous Wave), PSK (Phase Shift Keying), FSK (Frequency Shift Keying), and FM (Frequency Modulation) signals. The receiver parameters monitored during the measurements were course deviation voltage, warning flag voltage, AGC (Automatic Gain Control) voltage, and audio distortion. Measurement results are reported as the minimum signal-to-interference ratio required to keep each monitored parameter from exceeding specified bounds. Course deviation voltage is the most sensitive parameter to the co-channel interference. GRA

N83-13090# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN IMPROVED TECHNIQUE FOR ALTITUDE TRACKING OF AIRCRAFT

J. W. ANDREWS 25 Mar. 1981 62 p
(Contract F19628-80-C-0002; DOT-FA72WAI-817)
(AD-A118899; ATC-105; FAA-RD-82-14) Avail: NTIS HC A04/MF A01 CSCL 17G

When simple linear recursive tracking techniques are applied to quantized altitude reports, certain errors in estimation of altitude and altitude rate can be attributed to the response of the tracker to transitions between quantization levels. These errors can be reduced by use of an estimation technique which explicitly recognizes the quantized nature of the inputs. Smoothing of the level occupancy time (i.e., the time spent at each quantization level) can be used to control the response to redundant samples taken at the same quantization level. Further improvement is achieved by consistency tests which use particular properties of quantized data to detect changes in rate. This document presents a theoretical analysis of tracker response to quantized inputs. A tracking algorithm is synthesized using these techniques and simulation results using various altitude profiles are presented. Author (GRA)

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AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

A83-13158#

CONFLICT OF INTEREST WIND MODELING IN AIRCRAFT RESPONSE STUDY

A. B. MARKOV (Defence Research Establishment Suffield, Alberta, Canada) and L. D. REID (Toronto, University, Toronto, Canada) *Journal of Aircraft*, vol. 19, Dec. 1982, p. 1025-1031. refs

The concept of viewing the wind affecting an aircraft as being controlled by an intelligent adversary acting through a wind controller is introduced. The wind controller has objectives which are opposed to those of the aircraft controller. This conflict of interest concept is developed within the framework of linear quadratic differential game theory and applied in a number of related formulations to generate deterministic worst-case wind models for a typical STOL aircraft on the landing approach. The results indicate that the differential games technique encompasses several worst-case concepts and may be tailored to suit a variety of applications, including the generation of wind inputs that attempt to track a specified state trajectory and closed-loop wind controller models for use in aircraft training simulators. (Author)

A83-13161*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

ASSESSMENT OF INFLOW CONTROL STRUCTURE EFFECTIVENESS AND DESIGN SYSTEM DEVELOPMENT

A. A. PERACCHIO (United Technologies Corp., Pratt and Whitney Aircraft Group, East Hartford, CT) *Journal of Aircraft*, vol. 19, Dec. 1982, p. 1045-1051. refs
(Contract NAS1-15085)

(Previously cited in issue 24, p. 4124, Accession no. A81-48637)

A83-13163#

FLIGHT TEST OF THE 747-JT9D FOR AIRFRAME NOISE

O. KIPERSZTOK and G. SENGUPTA (Boeing Commercial Airplane Co., Seattle, WA) *Journal of Aircraft*, vol. 19, Dec. 1982, p. 1061-1069. refs

(Previously cited in issue 24, p. 4124, Accession no. A81-48629)

A83-13165*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

SELECTED RESULTS FROM THE QUIET SHORT-HAUL RESEARCH AIRCRAFT FLIGHT RESEARCH PROGRAM

J. A. COCHRANE, D. W. RIDDLE, V. C. STEVENS, and M. D. SHOVLIN (NASA, Ames Research Center, Moffett Field, CA) *Journal of Aircraft*, vol. 19, Dec. 1982, p. 1076-1082. refs

(Previously cited in issue 07, p. 978, Accession no. A82-19209)

A83-13167*# National Aeronautics and Space Administration, Flight Research Center, Edwards, Calif.

IN-FLIGHT DEFLECTION MEASUREMENT OF THE HIMAT AEROELASTICALLY TAILORED WING

V. M. DEANGELIS (NASA, Flight Research Center, Edwards, CA) *Journal of Aircraft*, vol. 19, Dec. 1982, p. 1088-1094.

(Previously cited in issue 03, p. 325, Accession no. A82-14381)

A83-13170#

EXISTING TIME LIMIT FOR OVERWATER OPERATIONS - ITS VALIDITY

R. SAHA (Technical Centre, Civil Aviation Dept., New Delhi, India) *Journal of Aircraft*, vol. 19, Dec. 1982, p. 1098-1100. refs

The rules requiring 60 min flying time with one engine inoperative for propeller-driven aircraft and 90 min for turbine aircraft are based

on the reliability of older piston and turbine engines. Although the reliability of turbine engines has significantly improved during the last decade, existing airworthiness code performance requirements have yet to reflect this fact. It is suggested that the present 60/90-min rule may deter the development of two-engine high capacity jet airliners such as the 757 and 767, and it is recommended that each type of aircraft be assessed on its own merits rather than in light of a common rule. O.C.

A83-14042#

PRINCIPLES OF HELICOPTER DESIGN AND CONSTRUCTION [OSNOVI PROJEKTOVANJA I KONSTRUISANJA HELIKOPTERA]

M. NENADOVIC Belgrade, SIRO Srbija, 1982. 595 p. In Serbo-Croatian. refs

Helicopter design principles are described, with attention given to ideal-rotor theory, rotor aerodynamics, and rotor mechanics. Methods for determining the aerodynamic characteristics of rotors and for analyzing helicopter performance are discussed, and attention is given to problems of stability and controllability, vibration and resonance, and structural design. B.J.

A83-14324

TOMORROW'S TOMCAT

G. M. FURLONG, JR. (U.S. Navy, Pacific Fleet, Pearl Harbor, HI) *Grumman Aerospace Horizons*, vol. 18, no. 2, 1982, p. 8-15.

After assessing the performance and interception capability improvements which the replacement of the Navy F-4 with F-14s accomplished in the early 1970s, and noting the results obtained to date with simulated F-14 actions against Soviet Backfire bombers, using the AIM-54 Phoenix missile and AGW-9 radar fire control system, attention is given to the development of intercept operations in concert with E-2C airborne warning and control aircraft. Near-term improvements in current F-14 systems focus on advanced avionics, the AIM-54C variant of the Phoenix missile, the AIM-7M version of the Sparrow missile, and the AIM-8M development of the Sidewinder missile. For the 1990s, the most significant system developments anticipated are a novel digital radar and the launch-and-leave Advanced Medium Range Air to Air Missile. O.C.

A83-14617#

ANALYTICAL CONSEQUENCES OF INCREASING THE MASS OF A GLIDER [OBLICZENIOWE KONSEKWENCJE WZROSTU MASY SZYBOWCA]

W. STAFIEJ (PZL-Bielsko, Bielsko-Biala, Poland) *Technika Lotnicza i Astronautyczna*, vol. 37, Sept. 1982, p. 5-7. In Polish.

Reasons necessitating an increase in glider mass are described. Consideration is then given to the influence of such increases on the longitudinal balance, performance, and loads of a glider. B.J.

A83-14621#

THE ULS EXPERIMENTAL ULTRALIGHT GLIDER MADE OF POLYMER COMPOSITES. I - GENESIS OF THE PROGRAM AND CONSTRUCTION OF THE GLIDER [EKSPERYMENTALNY ULTRALEKKI SZYBOWIEC ULS Z KOMPOZYTOW POLIMEROWYCH. I - GENEZA PROGRAMU I BUDOWA SZYBOWCA]

J. KEDZIERSKI, P. PLECINSKI, and R. SWITKIEWICZ (Warsawa, Politechnika, Warsaw, Poland) *Technika Lotnicza i Astronautyczna*, vol. 37, Oct. 1982, p. 5-7. In Polish.

A83-14700

THE KC-10A - USAF'S NEWEST RANGE EXTENDER

L. PEACOCK *Air International*, vol. 23, Dec. 1982, p. 265-270.

Detailed descriptions are presented of the design and functional features of the KC-10A in-flight refueling tanker and military cargo aircraft, of which a fleet of 60 is planned for the USAF's SAC operations in support of such aircraft as the C-141B, B-52, FB-111A, F-4, SR-71, F-16, A-10 and C-5A. The KC-10A is a derivative of the commercial DC-10, and incorporates both hose-and-drogue and aerial refueling boom systems for contact between the tanker and its receiver aircraft. Boom control is exercised by a U-shaped

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flying tail which features an elevator and dual rudders for precise control of movement. The KC-10A is able to carry a cargo payload of 77,112 kg over 7,033 km, or transfer 90,720 kg of fuel to receiver aircraft at a distance of 3,540 km from base. The upper cabin has a capacity of 340 cu m for palletized cargo. O.C.

A83-14952

THE A310 - EVEN BETTER THAN EXPECTED

Aircraft Engineering, vol. 54, Nov. 1982, p. 6-13.

The A310 aircraft is discussed with reference to its optimum cruise Mach number, buffet boundary, and flight tests. The fuel efficiency and operating costs are shown to be much less than those of the A300 aircraft. Attention is given to the forward facing crew cockpit which has been designed to substantially minimize crew workload. Plans for developing the A320 aircraft are outlined noting fuselage design and operating costs. Consideration is also given to the design of the Airbus TA9, TA11 and TA12 aircraft. Similarities in design between A300/A310 aircraft and TA11/TA12 aircraft are summarized. S.C.S.

A83-15308

OPEN SEAT EJECTION AT HIGH DYNAMIC PRESSURE - A RADICAL APPROACH

C. D. GRAGG (USAF, Holloman AFB, NM) SAFE Journal, vol. 12, Winter 1982, p. 14-18.

In future aircraft, it will be necessary to eject at velocities in which the dynamic pressure will create a loading of 1600 to 2000 pounds per square foot (psf) on the aircrew member. This paper proposes that the ejection be made with the aircrew member's back to the air stream. The methodology for such an ejection is described. This orientation would give a maximum tolerance for human deceleration, prevent the crew member from being exposed directly to the air stream, possibly remove the vertebral fracture potential forever, and hinge the limbs in the proper direction in case they should flail. (Author)

A83-15398

A STUDY OF THE CORROSION ACTIVITY OF THE FUSELAGE CONDENSATE OF PASSENGER AIRCRAFT [ISSLEDOVANIE KORROZIONNOI AKTIVNOSTI FIUZELIAZHNOGO KONDENSATA PASSAZHIRSKIKH SAMOLETOV]

A. M. SVINTSITSKII, N. F. VORONKIN, A. V. KARLASHOV, and R. G. GAINUTDINOV (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR) Fiziko-Khimicheskaiia Mekhanika Materialov, vol. 18, Sept.-Oct. 1982, p. 70-72. In Russian. refs

The corrosion activity of fuselage condensate, a turbid bluish liquid with a density of 0.994-1.011 g/cu cm and an acidity of 6.5-8.8, was investigated experimentally using test specimens of V95T1 alloy, and the results were compared with those for 3% NaCl solution. A statistical analysis of experimental results showed no significant difference between the two sets of data, either in terms of dispersities or of mean logarithmic values of the fatigue lives of the test specimens. It is thus possible to make use of the extensive data available on the corrosion activity of NaCl for estimating the effect of fuselage condensate on the mechanical properties of fuselage structures. V.L.

A83-15421

FIRST STAGE PROPULSION FOR THE MAXIMUM PERFORMANCE EJECTION SYSTEM

E. G. ALCHOWIAK (U.S. Navy, Naval Ordnance Station, Indian Head, MD) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 118-121.

The Navy's maximum performance ejection system (MPES) represents an integrated escape approach of which vertical seeking is one element. A recent addition to the MPES package has been the first stage propulsion system (catapult). To date, all major system demonstrations have relied on the sustainer rocket to perform the catapult function. In 1979, a project was started to obtain suitable first stage propulsion for the MPES escape package. In keeping with the goals of the program, a package has been defined which is substantially improved in a number of important

areas including improvements in redundancy, performance, and producibility. Beginning with the propellant cartridge assembly, each of the duplicate igniters contain a dual firing mechanism. In order to ensure low acquisition and life cycle costs, standardized components were used whenever possible. G.R.

A83-15425

MPES UPDATE 1981

J. J. TYBURSKI (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 150-153.

The U.S. Navy Maximum Performance Ejection System (MPES) program is presently in an Advanced Development Phase. This program has the objective to address the various problems associated with escape systems in high performance military aircraft by utilizing new and advanced state-of-the-art technologies proven feasible and developing these technologies for the enhancement of aircrew escape safety and survivability. A structured Design Decision Phase (DDP) was conducted to evaluate and select those technologies which would be used in a MPES advanced development model (ADM). Attention is given to structural subsystem tests, occupant positioning and restraint, signal transmission, tests conducted on the catapult, aspects of propulsion steering and stabilization, aspects of technology selection, and plans for validation. It is pointed out that the MPES program has recently entered the ADM design phase. G.R.

A83-15428

EASIEST EJECTION SEAT STABILITY AND CONTROL ANALYSIS CAPABILITY

L. A. JINES (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) and C. L. WEST (Boeing Military Airplane Co., Mechanical/Electrical Systems Technology Group, Seattle, WA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 161-165.

The combination of the simulation capability of the Air Force Flight Dynamics Laboratory SAFEST (Simulation and Analysis of in-Flight Escape System Techniques) program with the analysis techniques provided by the EASY (Environmental Control Analysis System) computer program of an American aerospace company has resulted in the development of an advanced analysis tool, called the EASIEST program. EASIEST (the EASY and SAFEST Integration for the Evaluation of Stability and Trajectory) has been utilized in the analysis of two advanced escape systems concepts developed by an American aerospace company under contract to the Air Force. The EASY program provides a modular approach to building and analyzing dynamic systems. Predefined modules are stored in libraries which are accessed to assemble the model specified by the user. G.R.

A83-15436

ADVANCED ESCAPE SYSTEM DESIGN FOR FUTURE COMBAT AIRCRAFT

B. A. MILLER (Martin-Baker Aircraft Co., Ltd., Higher Denham, Middx., England) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 218-220.

The MK10 ejection seat considered incorporates a very effective torso, leg and arm restraint system which provides exceptional crew protection without restricting crew movement, comfort, or visibility during combat flight conditions. Good restraint is complemented on British seats by the use of very effective and efficient protective clothing for the pilot. The MK4 helmet, Beaufort life vest, and associated flight clothing have been successfully demonstrated at speeds in excess of 625 KIAS at zero altitude. The MK12 is essentially a sophisticated MK10 and has the capability of sensing airspeed and adjusting its mode of operation accordingly. Attention is given to a 'Triple Safe Sensing' system which actually measures speed in three different and separate

ways, the low speed mode, the high speed mode, the high altitude mode, and aspects of reduced ejection initiation delay. G.R.

A83-15440

THE NEXT GENERATION - THE STENCEL S45 EJECTION SEAT DEVELOPMENT PROGRAM

M. A. A. HOBBS (Stencel Aero Engineering Corp., Asheville, NC) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 241-244.

Design and testing procedures used to develop a candidate next generation ejection seat are reviewed. The seat was built using previously qualified propulsion systems and drogue parachute. Guiding concepts in the program were low cost, performance and reliability, and a low life cycle cost. The seat is intended to keep the ejectee faced into the wind, and actually has been shown to recover from a 45 deg yaw. Launch occurs at a 90 deg angle to the relative air flow. A 29.2 ft diam parachute has met required descent rates for carriage of a 300 lb load. A signal transmission system has been tested and installed, together with electronic sequencer and thermal batteries, which provide a quick rise, short duration and, slower rise long duration units. The seat has been fired from a jet test sled at 200 kt, and further tests at 600 kt are scheduled. M.S.K.

A83-15442

DESIGN CONSIDERATIONS FOR A ELECTRICAL SIGNAL TRANSMISSION SUBSYSTEM /STS/ FOR THE MAXIMUM PERFORMANCE EJECTION SYSTEM /MPES/

K. L. ENGLANDER (U.S. Navy, Naval Ordnance Station, Indian Head, MD) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 252-256.

The design constraints, operational environment, and performance specifications for an electrical signal transmission subsystem (ESTS) for the U.S. Navy maximum performance ejection system are reviewed, particularly with regard to electromagnetically hazardous environments. The ESTS is required to translate mechanical ejection input into electrical and ballistic signals for powering vertical seeking components, all at life-saving levels of reliability. Comprising a power source, transmission lines, and ballistic output devices, the ESTS must operate over a 265 C thermal range, resist corrosive/humid atmospheres, withstand vibration, shock, and handling environments, and withstand a variety of electromagnetic hazards. Electromagnetic interference can reach the ESTS through conduction or EM field radiation. Communications and radar equipment produce the most common EM dangers for the system, while nuclear EMP from bombs cause intense, milliseconds-long conditions which can lead to damage or operational anomalies. Details of the grounding, shielding, and electrical filtering precautions implemented to realize an acceptable working system are described. M.S.K.

A83-15444

ASSESSMENT OF ADVANCED EJECTION SEAT CONCEPTS /A PROGRESS REPORT/

J. G. BRISTER, J. O. BULL, R. F. YURCZYK (Boeing Military Airplane Co., Seattle, WA), and J. M. PETERS (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 268-273. refs

(Contract F33615-79-C-3406; F33615-80-C-3404)

Progress on development of the high Q reclined ejection seat for modern combat aircraft is reported. The seat is under development to reduce windblast, minimize the forces on the crewmember, and to prevent limb flail during escape, when pressures of up to 1600 psf can be encountered. The reclined feature of the seat permits enhanced pilot performance under high acceleration, and also is more conformable to a low profile cockpit design. Wind tunnel tests were performed on configurations comprising an aftbody inflatable boom, a horizontal stabilizer, a forebody blast shield, and a forebody flow diverter for drag reduction

and crewmember safety. Computer simulations were also to analyze a six-degree-of-freedom trajectory and stability. The high Q seat was found to be effective from 0-687 kn and from 0-50,000 ft altitude. Passive windblast and head/limb restraints were judged feasible, and a deployable aftbody stabilizer provided seat stability. Finally, a variable rocket burn schedule was found to improve performance. M.S.K.

A83-16027

INDIVIDUAL BLADE CONTROL INDEPENDENT OF A SWASHPLATE

K. F. GUINN (Bell Helicopter Textron, Fort Worth, TX) American Helicopter Society, Journal, vol. 27, July 1982, p. 25-31. refs

This paper describes an evolution of helicopter main rotor control designs that deviate from conventional practice by placing the control actuators, power supplies, and computers in the rotating control system. Recent developments of this control philosophy revealed a very attractive control concept that is referred to as 'Individual Blade Control Independent of a Swashplate' (IBIS). IBIS is a two-fail operate system with four single actuators per blade. Each blade actuator is controlled by a different power supply (hydraulic and electrical) located at the rotor hub. Four computers, also located at the hub, process all the control data transmitted to and from the rotor blades. Control signals are transferred to the rotor from the airframe with redundant optical slip rings. Flight survey data from a Bell Helicopter Textron (BHT) Model 412 were used for this study to establish control loads and power requirements. Subsequent IBIS design studies revealed advantages in reliability, drag, weight, and cost. Other advantages of IBIS are in-flight blade tracking and improvements in rotor behavior that can result from higher harmonic feathering control. (Author)

A83-16029

A COMPUTATIONAL METHOD FOR PERFORMING THE MULTIBLADE COORDINATE TRANSFORMATION

D. L. KUNZ and K. L. YAGGY (U.S. Army, Research and Technology Laboratories, Moffett Field, CA) American Helicopter Society, Journal, vol. 27, July 1982, p. 80-82. refs

A method is described for the computation of the multiblade coordinate transformation, along with its mathematical basis, which can transform sets of linear equations with periodic coefficients containing both rotating and nonrotating coordinates. The method is suited to any number or combination of rotating and nonrotating components, and may be programmed as a subroutine that can be called by larger analysis in a computer implementation. O.C.

A83-16115#

FUEL-OPTIMAL AIRCRAFT TRAJECTORIES WITH FIXED ARRIVAL TIMES

J. W. BURROWS (Boeing Computer Services Co., Energy Technology Applications Div., Seattle, WA) (Guidance and Control Conference, Albuquerque, NM, August 19-21, 1981, Collection of Technical Papers, p. 28-34.) Journal of Guidance, Control, and Dynamics, vol. 6, Jan.-Feb. 1983, p. 14-19. refs

(Previously cited in issue 21, p. 3620, Accession no. A81-44081)

A83-16127#

HUMAN ENGINEERING IN AIRCRAFT AND SYSTEM DESIGN

G. ROE (British Aerospace Public, Ltd., Co., Future Projects Dept., Brough, Humberside, England) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 4-38.

Historical cockpit development in response to the expanding flight envelope and the need to improve operational effectiveness is discussed, showing the impact of this on the number and type of cockpit displays and controls. The currently proposed extensions in capability for the next generation of aircraft are considered. The difficulties these extensions will cause and possible means to resolve them, such as reclined seats, electrooptical displays, and digital data transmission are addressed. Finally, a short look into the future of cockpit display techniques and their possible impacts

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on cockpit design is taken. Exhibits are presented, including photographs of past and present cockpits and diagrams of advanced ones and their ancillary displays and functions. C.D.

A83-16372

HELICOPTER TECHNOLOGY FOR THE 1990S

R. WHITAKER Flight International, vol. 122, Dec. 11, 1982, p. 1685, 1686.

An assessment is given of the goals and development plans of the U.S. Army's Aviation Research and Development Command (Avradcom), in view of performance requirements projected for systems that will become operational in the 1990s. All Avradcom projects are managed in three stages: basic research, exploratory development, and advanced development. In composite primary airframe structures, current work includes materials, manufacturing techniques, novel design concepts, and fatigue, fracture and crashworthiness properties of composites. Progress toward vibration control systems is being made through the development of an Aeroelastically Conformable Rotor, the Higher Harmonic Control system, which varies rotor air loads to reduce vibration, and the bearingless composite hub Integrated Technology Rotor. Also underway are computerized aerodynamic studies of helicopter engine airflow O.C.

A83-16373

BLACKJACK - SOVIET B-1 OR BETTER

B. SWEETMAN and G. WARWICK Flight International, vol. 122, Dec. 11, 1982, p. 1700, 1703, 1704.

A speculative description is given of the design features and performance characteristics of the NATO-codenamed 'Blackjack' supersonic bomber, on the basis of an airport photograph in which a Blackjack is seen in proximity to two Tu-144 SSTs. The well-known features and dimensions of the Tu-144 have been used to extrapolate fuel and bomb load, cruise speed, altitude and range data which can be compared with the only Western aircraft of comparable size and technological sophistication, the B-1, as well as Blackjack's predecessor aircraft, the Backfire bomber. It is speculated that the 200,000-lb reheat thrust and relatively small, swept swing wing area of Blackjack will allow supersonic dash speeds of Mach 2.3, sustained by a fuel volume that is 60-65% greater than that of the B-1. O.C.

A83-16399

THE AQUILA - A VERSATILE, COST-EFFECTIVE MILITARY TOOL SHOWS ITS POTENTIAL

T. D. GOSSETT (U.S. Army, Research and Technology Laboratories, Moffett Field, CA) and F. A. VELLIGAN (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) Military Electronics/Countermeasures, vol. 8, Dec. 1982, p. 74-78.

The Aquila Remotely Piloted Vehicle (RPV) has been designed to enhance U.S. Army effectiveness in target acquisition, artillery fire control, laser target designation, and division or brigade reconnaissance against cold, stationary and nonemitting targets. Aquila's primary payload is a stabilized TV with autotracker and laser rangefinder/designator which offers variable fields of view and lower hemispheric coverage. RPV console operators for the Aquila include a mission commander, air vehicle operator, and mission payload operator. The Aquila ground support system is inherently adaptable to many environments and has been designed with a view to nuclear, biological and chemical environments under a global range of climatic conditions. Attention is given to the growth features and operational activities of Aquila, its three possible mission payload configurations, and the mission scenarios under consideration. O.C.

A83-16400

THE 'FLYING PEANUT' - REVOLUTIONARY DESIGN PROMISES HIGH PERFORMANCE

A. S. CLARK (Canadair, Ltd., Surveillance Systems Div., Saint-Laurent, Quebec, Canada) Military Electronics/Countermeasures, vol. 8, Dec. 1982, p. 80, 82-85.

The CL-227 'Flying Peanut' rotary wing Remotely Piloted Vehicle (RPV) is a low cost, modular system which can carry a variety of

sensors or electronics packages for such missions as reconnaissance, target acquisition and designation, radio relay, and electronic warfare. This RPV may be operated from an unprepared field site with minimum risk of detection, since both the takeoff/landing and control stations are mobile. An account is given of the CL-227's development history from 1972 to the present, along with an assessment of the systems responsible for RPV stability and control. The coaxial, contrarotating rotor RPV is in its latest development versions powered by a small gas turbine engine, and its sensor system comprises a vidicon camera with zoom lens. O.C.

N83-12070*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

APPLICATION OF ZIMMERMAN FLUTTER-MARGIN CRITERION TO A WIND TUNNEL MODEL

R. M. BENNETT Nov. 1982 30 p refs
(NASA-TM-84545; L-15508; NAS 1.15:84545) Avail: NTIS HC A03/MF A01 CSCL 01C

The Zimmerman flutter margin criterion was studied by applying it to data obtained from a wind tunnel model. The sensitivity of the flutter margin parameter was explored with a parametric trend study and by calculation of the derivatives with respect to the input frequency and damping parameters. The criterion is simple in concept and application, and it serves as a good flutter onset predictor because it gives a nearly linear variation with dynamic pressure. However, accurate values of both frequency and damping of both modes involved in flutter are required for reliable flutter onset prediction. The simplified version using only frequencies gave a highly nonconservative flutter onset in one case and should not be used in general. M.G.

N83-12071*# Sikorsky Aircraft, Stratford, Conn.

FLIGHT SERVICE EVALUATION OF COMPOSITE HELICOPTER COMPONENTS Annual Report, Mar. 1981 - Apr. 1981

M. J. RICH and D. W. LOWRY Jun. 1982 101 p refs
(Contract NAS1-16542)
(NASA-CR-165952; NAS 1.26:165952; SER-510089; AR-1)
Avail: NTIS HC A06/MF A01 CSCL 01C

This first interim report presents the technical background for including environmental effects in the design of helicopter composite structures, and test results after approximately two year field exposure of components and panels. Composite structural components were removed from Sikorsky S-76 helicopters commercially operated in the Gulf Coast region of Louisiana. Fatigue tests were conducted for a graphite/epoxy tail rotor spar and static test for a graphite/epoxy and Kevlar/epoxy stabilizer. Graphite/epoxy and Kevlar/epoxy panels are being exposed to the outdoor environment in Stratford, Connecticut and West Palm Beach, Florida. For this reporting period the two year panels were returned, moisture measurements taken, and strength tests conducted. Results are compared with initial type certificate strengths for components and with initial laboratory coupon tests for the exposed panels. Comparisons are also presented with predicted and measured moisture contents. Author

N83-12072*# Cessna Aircraft Co., Wichita, Kans. Advanced Design.

APPLICATION OF ADVANCED TECHNOLOGIES TO SMALL, SHORT-HAUL TRANSPORT AIRCRAFT (STAT) Final Report

E. F. KRAUS, O. D. MALL, R. W. AWKER, and J. W. SCHOLL
Nov. 1982 125 p refs
(Contract NAS2-10263)
(NASA-CR-152362; NAS 1.26:152362; ADR-1164) Avail: NTIS HC A06/MF A01 CSCL 01C

The benefits of selected advanced technologies for 19 and 30 passenger, short-haul aircraft were identified. Advanced technologies were investigated in four areas: aerodynamics, propulsion, structures, and ride quality. Configuration sensitivity studies were conducted to show design tradeoffs associated with passenger capacity, cabin comfort level, and design field length. Author

N83-12074# Tactical Air Command, Langley AFB, Va.
F-106 TOW SYSTEM (IOT&E)

Apr. 1982 6 p

(Contract USASADWC PROJ. 82C-185A)

(AD-A118527) Avail: NTIS HC A02/MF A01 CSCL 01C

The impending deactivation of the F-101 fleet at Tyndall AFB will require an alternate means of providing gun tow target capability at the USAFADWC. The tow capabilities of the F-106 should be investigated as a method of meeting these requirements. The RM-60 tow system was originally considered for use on the F-106. The RM-60 is a two-way tow system developed to support the target requirements of the US Army Division Air Defense System (DIVADS) program. It has been tested by the New Mexico Air National Guard (NMANG) and found to be compatible with the A-7D aircraft. In the current configuration; however, the RM-60 is not compatible with F-106 aircraft pylon. The development of a smaller, improved version of the RM-60, designated the RM-30, may solve the F-106 compatibility problems. Additionally, current assets of the A/A 37U-15 (DART) tow reels may be useful in providing an interim tow capability for F-106 aircraft. Both the RM-30 and A/A 37U-15 tow reels can carry and tow the Low Cost Tow Target (LCTT) to fulfill the gun tow target requirement at the USAFADWC.

Author (GRA)

N83-12075# Army Aviation Engineering Flight Activity, Edwards AFB, Calif. Directorate for Development and Qualification.**AIRWORTHINESS AND FLIGHT CHARACTERISTICS TEST. PART 1: YAH-64 ADVANCED ATTACK HELICOPTER Final Report, 30 May - 17 Jul. 1981**

G. L. BENDER, L. B. HIGGINS, R. SAVAGE, J. D. OTTOMEYER, B. D. PICASSO, III, and P. M. MORRIS Sep. 1981 181 p refs

(AD-A118490; USAAEFA-80-17-1) Avail: NTIS HC A09/MF A01 CSCL 01C

The Airworthiness and Flight Characteristics Test Part 1 of the prototype YAH-64 helicopter (S/N 77-23258) was conducted at three test sites; Palomar Airport, Carlsbad, California (elevation 328 ft). Bishop Airport, Bishop, California (elevation 4120 ft), and Coyote Flats, California (elevation 9980 ft). Approximately 32 productive hours were flown during 45 flights between 30 May and 17 July 1981. Several design changes affecting performance and handling qualities, were made to the YAH-64 since the last evaluation (EDT 4) the most significant of which were the changes in tail rotor rigging, the addition of a third DC electrical bus and the incorporation of a Nap-of-the-Earth/Approach mode of operation for the horizontal stabilator. Level flight performances and vibration levels have been slightly degraded since EDT 4, while handling qualities and out-of-ground-effect hover performance remain essentially the same. Numerous anomalies in the operation of the Digital Automatic Stabilization Equipment (DASE) were experienced which may render some of the handling qualities test results suspect. Two deficiencies (both DASE related) were found during this evaluation. Yaw SAS hardovers, and disengagement of the DASE with failure of the No.2 generator. Nine previously unreported shortcomings (4 DASE related) were found.

Author (GRA)

N83-12076# Northrop Corp., Hawthorne, Calif. Aircraft Div.
EVALUATION OF A DAMAGE ACCUMULATION MONITORING SYSTEM AS AN INDIVIDUAL AIRCRAFT TRACKING CONCEPT Final Report, 14 Nov. 1980 - 30 Sep. 1981

C. L. GUADAGNINO Wright-Patterson AFB, Ohio AFWAL May 1982 233 p refs

(Contract F33615-81-C-3204; AF PROJ. 2401)

(AD-A118768; NOR-82-58; AFWAL-TR-82-3023) Avail: NTIS HC A10/MF A01 CSCL 01C

The objective of this program was to study and evaluate the concept of using a damage accumulation monitoring system based on microprocessor technology for individual aircraft tracking (IAT) needed to satisfy the Force Management requirements of MIL-STD-1503A. The two major components of this study were: (1) the evaluation of selected output and input IAT parameters required to monitor the potential crack growth of each of two

major classes of aircraft (Bomber/Transport and Fighter/Attack/Trainer aircraft), and (2) the definition of the microprocessor-based IAT system in terms of capabilities and requirements. A number of existing and planned IAT programs which were considered as typical for the two major classes of aircraft were studied to determine problem areas, to evolve advanced concepts, and to evaluate the output/input parametric requirements and the functional characteristics needed to satisfy IAT system goals. Several conceptual microprocessor based IAT systems and one existing microprocessor based IAT system capable of satisfying the requisite functional requirements were developed, studied, and described. In addition, the study was extended to examine the capability of microprocessor based IAT systems to satisfy in part or wholly, the load and environment spectra survey (L/E) functions. Several system concepts were developed and described.

Author (GRA)

N83-12077# Rockwell International Corp., Los Angeles, Calif. North American Aircraft Operations.**IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS. VOLUME 1: TECHNICAL SUMMARY Final Report, 16 Jan. 1979 - 30 Nov. 1981**

J. B. CHANG, R. M. HIYAMA, and M. SZAMOSSI Wright-Patterson AFB, Ohio AFWAL Nov. 1981 217 p refs 2 Vol.

(Contract F33615-77-C-3121; AF PROJ. 2401)

(AD-A118856; NA-81-234-VOL-1; AFWAL-TR-81-3092-VOL-1)

Avail: NTIS HC A10/MF A01 CSCL 01C

This report presents the technical details of improved methods for predicting the load interaction effects on crack growth under flight spectrum loading developed in a research effort sponsored by the USAF. These include the cycle-by-cycle crack-growth prediction method used in the detail design stage, the flight-by-flight crack-growth analysis method for individual aircraft tracking usage, and preliminary design trade-off studies. Results of the experimental verification program are also presented in this document. GRA

N83-12078# Rockwell International Corp., Los Angeles, Calif. North American Aircraft Operations.**IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS. VOLUME 2: TEST DATA Final Report, 16 Jan. 1979 - 30 Nov. 1981**

J. B. CHANG and K. W. LIU Wright-Patterson AFB, Ohio AFWAL Nov. 1981 249 p refs 2 Vol.

(Contract F33615-77-C-3121; AF PROJ. 2401)

(AD-A118857; NA-81-234-VOL-2; AFWAL-TR-81-3092-VOL-2)

Avail: NTIS HC A11/MF A01 CSCL 01C

This report presents the random flight spectra crack-growth test data generated in the experimental verification program of a research effort which aimed to upgrade the crack-growth prediction technology required for implementation of the damage-tolerance control procedure throughout the life cycle of any weapon system. Fighter and transport baseline spectra used in the test program are also presented in this report. The objective of phase 3 of this program is to perform experimental testing in verifying the crack-growth methodology developed in phases 1 and 2. This volume contains tabulations and plots of test data generated during this experimental program. Data tabulations are presented for 41 random flight spectrum tests, including the fighter baseline spectrum tests, the fighter spectrum variation tests, and mission mix tests, as well as a transport baseline spectrum and its variation tests. In this volume, random flight spectrum tables used for the baseline tests and the mission mix tests are included. All test spectra used in the spectrum variation tests are not presented in this report, since they can easily be reconstructed from the baseline spectra. GRA

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N83-12079# Intermountain Forest and Range Experiment Station, Ogden, Utah.

STATIC TESTING TO EVALUATE AIRTANKER DELIVERY PERFORMANCE

A. D. BLAKELY, C. W. GEORGE, and G. M. JOHNSON Feb. 1982 22 p refs
(PB82-179946; FSGTR/INT-78) Avail: NTIS HC A02/MF A01 CSCL 01C

Airtanker performance guides to predict fire retardant ground distribution patterns from drop heights up to 500 feet when dropped from a number of different airtankers were produced using a simulation program and static test data for each specific tank and gating system. A method for collecting static test data and the analysis used in the development of the airtanker performance guide are described. This is done so the performance of any existing airtanker can be compared to the performance of any other specific airtankers that have been static tested. GRA

N83-12080# Boeing Commercial Airplane Co., Seattle, Wash. AIRCRAFT NOISE REDUCTION

R. E. RUSSELL and J. M. STRECKENBACH Oct. 1981 17 p Presented at the Intern. Symp. on Transportation Noise, Pretoria, 21-23 Oct. 1981 Prepared in cooperation with National Inst. for Transport and Road Research, Pretoria
(PB82-206095) Avail: NTIS HC A02/MF A01 CSCL 01C

A brief introduction of the Boeing commercial airliner family is followed by a discussion of the significant noise reduction accomplishments for turbine-powered aircraft from the 1950's to the 1980's, with projections of further benefits until the year 2000. Definition of the trades to be made between noise reduction and fuel economy, as well as technical problems yet unsolved, lead to a recognition that the greatest advances in aircraft noise reduction are past, and that significant research will be required in the future to lower noise floors that are presently inhibiting further progress. Emphasis is given to precautions that must be taken in the selection of meaningful fleet noise data to avoid costly and irreversible errors in airport and community planning. Author (GRA)

N83-12081# Association Aeronautique et Astronautique de France, Paris.

AERODYNAMICS ON A TRANSPORT AIRCRAFT TYPE WING-BODY MODE

V. SCHMITT Nov. 1981 28 p refs In FRENCH; ENGLISH summary Presented at the 18th Colloq. D'Aerodyn. Appliquee, Poitiers, France, 18-20 Nov. 1981
(PB82-206855; AAAF-NT-81-22; ISSN-0243-0177) Avail: NTIS HC A03/MF A01 CSCL 01C

This study carried out at ONERA is based on the DFVLR-F4 wing-body combination. The 1/38 model is formed by a 9.5 aspect ratio transonic wing and an Airbus A 310 fuselage. The purpose of this paper is to survey the work done by ONERA. After a description of the F4 wing geometrical characteristics main experimental results obtained in the S2MA wind tunnel are discussed. Both wing-fuselage interferences and viscous effects, which are important on the wing due to a high rear loading, are investigated. In order to do that, 3D calculations are performed and an attempt is made to find their limitations. Author (GRA)

N83-13061# Joint Publications Research Service, Arlington, Va. FLIGHT PERSONNEL COMMENT ON EXPERIENCE FLYING NEW YAK-42

In its USSR Rept.: Transportation, No. 98 (JPRS-82053) p 7-11 22 Oct. 1982 Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 7, Jul. 1982 p 18-19
Avail: NTIS HC A05

The flight performance of the Yak-42 aircraft is described. The new Yak-42 passenger plane has been used for almost two years on Aeroflot lines. This 120-passenger liner was developed at the design bureau of Twice Hero of Socialist Labor A. S. Yakovlev. It is designed for flights on short trunk routes and for local air routes. The new Aeroflot plane flies from Moscow to Donetsk, Zhdanov, Izhevsk, Krasnodar, Nalchik, Kherson, and a number of other cities.

In addition it serves the overseas lines from Leningrad to Helsinki, from Leningrad to Tampere, and from Kiev to Prague. B.W.

N83-13063# Joint Publications Research Service, Arlington, Va. CONSERVING AVIATION FUEL BY SHIFTING CENTER-OF-GRAVITY POSITION

S. SKRIPNICHENKO and A. FEDCHENKO In its USSR Rept.: Transportation, No. 98 (JPRS-82053) p 18-23 22 Oct. 1982 Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 8, Aug. 1982 p 26-27
Avail: NTIS HC A05

One of the reserves for conserving fuel is reducing fuel expenditure by introducing the recommendations on the influence of balancing on the aerodynamic efficiency (lift-to-drag ratio) of aircraft developed by GosNII GA together with organizations of the Ministry of Aviation Industry. It is common knowledge that in a cruising regime air dynamic efficiency determines the magnitude of fuel expenditure. This is easy to ascertain because per kilometer fuel expenditure (qkm) is inversely proportional to aerodynamic efficiency (K): $qkm = CeG/KV$ where Ce is specific fuel expenditure, G is the flying weight of the aircraft, and V is the air speed of flight. Aerodynamic efficiency itself is the ratio of the airplane's lift (Y) to the force of drag (X) or the ratio of their coefficients ($K = Cy/Cx$). At set flying altitude and speed the coefficient of lift is proportional to flying weight. But the coefficient of drag (for a given value of the lift coefficient) depends on deflection of the stabilizer and elevator. The greater these deflections, the greater the drag coefficient will be, which also means the greater fuel expenditure will be. Author

N83-13092 Sikorsky Aircraft, Stratford, Conn. STRUCTURAL DEMONSTRATION OF THE SH-60B HELICOPTER, APPENDIX 1 AND 2 Report, 7 Jul. - 27 Jul. 1981

F. MARSHALL and W. ERISON 15 Dec. 1981 1015 p refs
(Contract N00019-77-C-0202)
(SER-520235; LPL-NAV-82-2817) Avail: Issuing Activity

The SH-60B structural demonstration flight test program was successfully conducted on the Seahawk helicopter. The test program consisted of ten data flights, resulting in forty-three 'end point' maneuvers. Inclusive were twenty-nine 'up and away' maneuvers (i.e., symmetrical pullouts, pushovers, autorotative pullouts, etc.), and fourteen hard landing maneuvers. The hard landing 'end points' were achieved from a total of forty-eight hard landings, consisting of: five full autorotations, twenty-five landings on a nine degree slope, and eighteen landings on a flat surface. Five of the landings exceeded the design limit of twelve fps, with a maximum of over thirteen fps developed at touchdown, during the run-on landings. S.L.

N83-13093# Association Aeronautique et Astronautique de France, Paris.

TRIDIMENSIONAL COMPUTATION OF THE FLOW IN HELICOPTER AIR INTAKES

B. BOIZARD Nov. 1981 18 p refs In FRENCH; ENGLISH summary Presented at the 18th Colloq. d'Aerodyn. Appl., Poitiers, France, 18-20 Nov. 1981 Previously announced as A82-19740 (PB82-204512; AAAF-NT-81-01; ISSN-0243-0177) Avail: NTIS HC A02/MF A01 CSCL 01C

Efficient air intake in the helicopter was studied. A tridimensional code based on the singularity method was developed. This code was to compute the flow in the air intake of two helicopters. The first results were flow pictures taken from the water tunnel are presented. GRA

N83-13094# Messerschmitt-Boelkow-Blom G.m.b.H., Hamburg (West Germany). Transport- und Verkehrsflugzeuge.

CIVIL COMPONENT PROGRAM INTEGRATED-PROPULSION SYSTEM (IFAS) Final Report, Jul. 1981

J. SCHEERER Bonn Bundesministerium fuer Forschung und Technologie Sep. 1982 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-82-017; ISSN-0170-1339) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,50

A wind-tunnel test program on wing-body fairing and high lift systems for the European Airbus is presented. Simulation of turbine blade effects in transonic flight, modification of the tail-body configuration, structural stability, and simulation of thrust are discussed. Author (ESA)

06

AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

A83-13814

THE AVIATION AND RADIOELECTRONIC EQUIPMENT OF THE YAK-18T AIRCRAFT [AVIATIONNOE I RADIOELEKTRONNOE OBOURODOVANIE SAMOLETA IAK-18T]

R. A. DUNINA and A. N. NAUMOV Moscow, Izdatel'stvo Transport, 1982. 168 p. In Russian. refs

The piloting and navigation devices described include the KI-13K magnetic compass, the VD-10K barometric altimeter, the US-450 airspeed indicator, the VR-10M variometer, the AM-10 accelerometer, and the EUP-53M turn-and-bank indicator. The chapter on auxiliary devices and devices for monitoring the aircraft's operation gives descriptions of the ITE-1 tachometer, the 2M-80 air pressure gauge, and the VA-3 volt-ampere meter. Attention is also given to the electric circuit containing the sources of direct current and the control devices, to the GSR-3000m generator, to the 20NKBN-25 storage battery, and to the PO-250 and PT-200Ts transformers. The discussion of the aircraft's radioelectronics includes descriptions of the Landysh-5 and Baklan-5 command sets, the ARK-9 and ARK-15M automatic radio compasses, and the RV-5 radio altimeter. C.R.

A83-14530#

CORONA TYPE SENSOR FOR AIRCRAFT ELECTRICAL POTENTIAL MEASUREMENT

A. BRUNET, J. CARIU, and F. FAURE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (International Conference on Gas Discharges and Their Applications, 7th, London, England, Aug. 31-Sept. 3, 1982.) ONERA, TP no. 1982-73, 1982. 4 p.

(ONERA, TP NO. 1982-73)

A device that is intended to check the proper operation of dischargers for aircraft and to measure the potential of aircraft not usually provided with them is described. A sphere of radius one meter in an external field of 100 V/m is considered in order to show that the sensor allows this external field to be neglected. The potential is deduced from the current flowing on a sharp electrode connected to the aircraft through a high value resistor; the determination of the potential is analyzed. Proposed realizations of the sensors are shown, as are the results obtained for the effect of external pressure on output signal in the laboratory at atmospheric pressure and at 400 mb. The relationship between output signal and potential is linear and the effect of pressure is rather low. Due to their small size and light weight, these sensors are particularly easy to fit onto aircraft. C.D.

A83-15197

DEVELOP IN-FLIGHT ACOUSTIC EMISSION MONITORING OF AIRCRAFT TO DETECT FATIGUE CRACK GROWTH

P. H. HUTTON, D. K. LEMON, R. B. MELTON, and P. G. DOCTOR (Battelle Pacific Northwest Laboratories, Richland, WA) In: Review of progress in quantitative nondestructive evaluation. Volume 1 - Proceedings of the Eighth U.S. Air Force/Defense Advanced Research Projects Agency Symposium on Quantitative Nondestructive Evaluation, Boulder, CO, August 2-7, 1981. New York, Plenum Press, 1982, p. 459-462.

Signal analysis techniques are developed which automatically discriminate between acoustic emission from crack growth and acoustic noise signals such as the rubbing or fretting of fasteners, with a view to in-flight monitoring of critical aircraft structures. A data collection system was employed in this study which records waveforms from two channels simultaneously, along with an information header. Tests have been performed on 2024 and 7075 aluminum alloys. Pattern recognition analysis results as applied to signals from a 2024-T851 plate have yielded an overall accuracy of 83-90% in classifying crack growth acoustic emission and noise signals. A key consideration in pattern recognition development is ease of implementation in a real time instrument system. O.C.

A83-15429

ADVANCED P-3 FLIGHT STATION STUDIES

T. L. KIENHOLZ (Lockheed Aircraft Co., Burbank, CA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 176-179.

The P-3C is the present-generation landbased antisubmarine warfare (ASW) weapon system which has evolved from a long line of ASW vehicles. It was preceded by the PV-1, P2V, and earlier models of the P-3 Orion first introduced in 1959. Its basic configuration has been and continues to be supplemented by changes and additions to keep pace with the ever advancing state-of-the-art. Only the addition of the ASA-66 tactical display has been made to the flight station. Basically, the same instrument and flight systems have been in the aircraft for the past 22 years. Attention is given to the design of a safe, efficient flight station which is optimized for operation by a two-pilot crew during the 1990's. In order to identify problems and to arrive at timely resolutions, a program has been implemented to design and fabricate the Development Demonstration Facility. G.R.

A83-15437

DEVELOPMENT AND TESTING OF A MICROWAVE RADIOMETRIC VERTICAL SENSOR FOR APPLICATION TO A VERTICAL SEEKING AIRCREW ESCAPE SYSTEM

D. M. SORGES (U.S. Naval Weapons Center, China Lake, CA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 221-224. refs

Over the past few years, the survival rate for aircrew members ejecting from high performance aircraft has decreased alarmingly. In 1976, 37% of the ejections initiated under an altitude of 500 feet resulted in fatalities. In connection with efforts to increase the survival rate, the development of a vertical seeking seat steering system was considered. A major area of concern was the need for initialization of the autopilot by a means independent of aircraft systems. This concern results in the development of a microwave radiometry (MICRAD) attitude reference system (MARS). The vertical seeking seat steering system is being developed for incorporation in the Maximum Performance Ejection System (MPES). Attention is given to a test article description, aspects of MICRAD operation, flight tests of the MICRAD vertical seeking subsystem (VSS), and the advantages of the MICRAD vertical sensor. G.R.

**A83-15438
MICROWAVE MEASUREMENTS FOR AN ATTITUDE
REFERENCE SYSTEM DESIGN**

B. HEYDLAUFF and J. O. HOOPER (U.S. Naval Weapons Center, China Lake, CA) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 225-228.

The Naval Weapons Center, China Lake, California, is investigating the use of a Microwave Radiometric (MICRAD) Attitude Reference System (MARS) for the guidance of the thrust vector controlled Maximum Performance Escape System (MPES). Baseline design and testing of a MARS was accomplished. Concern about the effects of a variety of environmental conditions on the performance of a MARS in an operational ejection environment was the impetus for a MICRAD measurement/analysis program. Specialized radiometric equipment was designed, built, and tested for measurement of natural and man-made environmental conditions which could affect MARS design and performance. Some of the conditions measured were lightning, snow, rain, terrain variation, electromagnetic interference, petroleum fires, rocket exhausts, and conditions aboard an aircraft carrier. Measurement results have enhanced the confidence in the MARS guidance approach for MPES. (Author)

**A83-16126
ADVANCED AIRCREW DISPLAY SYMPOSIUM, 5TH, PATUXENT
RIVER, MD, SEPTEMBER 15, 16, 1981, PROCEEDINGS**
Patuxent River, MD, U.S. Naval Air Test Center, 1982. 280 p.

Various topics in aircrew display are discussed. Among the subjects addressed are: human engineering in aircraft and system design; color selection and verification testing for airborne color CRT displays; flight information requirements for monitoring an automatic landing; maneuvering flight path display; application of diffraction optics LANTIRN head-up display. Also considered are: Advanced Fighter Technology Integrator; multicolor CRT displays for military aircraft; helmet mounted display for helicopter landing on small ships; head-up display operational problems; 'light bar' attitude indicator. C.D.

**A83-16130#
THE MANEUVERING FLIGHT PATH DISPLAY - AN UPDATE**

J. F. WATLER, JR. and W. B. LOGAN (Northrop Corp., Aircraft Div., Hawthorne, CA) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 138-162. refs

The concept formulation, development to date, various operational features, and contemplated future refinements of the Maneuvering Flight Path Display (MFPD) are described. The pilot workload problem is reviewed and the basis of the MFPD concept, the need to provide a better means of presenting trajectory information to the pilot, is discussed, stating the advantages that MFPD provides. The MFPD concept of an electronically generated, flight director presentation which provides the pilot with a dynamic, graphical representation of the trajectory to be flown, is described in detail. Exhibits are presented which show the display as seen by a pilot on the path, losing the path, and off the path. The pilot interface is addressed, and contemplated improvements and extensions are discussed, with emphasis on the basic flight generation algorithms and the behavior of the velocity index. C.D.

**A83-16131#
THE APPLICATION OF DIFFRACTION OPTICS TO THE
LANTIRN HEAD-UP DISPLAY**

R. L. BERRY (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 163-175.

Advances in the application of diffraction optics to HUD technology is discussed, using the development of the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) program as an example. HUD diffraction optics are discussed and compared

with conventional optics with regard to fundamentals and applications. The HUD requirements and design for LANTIRN, which is a navigation and fire control system designed primarily to enhance weapon delivery in battlefield interdiction and close air support missions, are described. The most demanding requirement is that the field of view must be at least 25 degrees in the horizontal direction. The LANTIRN HUDs meet all of the shown specification requirements for field of view, exceeding some of them. The outside world scene transmission efficiency will be about 78 percent, the contrast ratio of the symbology against a 10,000 foot-lambert background will be 1.38:1, and the HUD will also meet a detailed set of positional accuracy requirements ranging from 1 to 7 milliradians. C.D.

**A83-16132#
ADVANCED FIGHTER TECHNOLOGY INTEGRATOR /AFTI/
F-16 DISPLAY MECHANIZATION**

M. E. COPE and K. C. WAUGH (General Dynamics Corp., Fort Worth, TX) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 176-197.

The results of the multipurpose display (MPD) evaluation for the AFTI/F-16 program are presented and discussed. An overview is given of the AFTI/F-16, including the cockpit control criteria. The two MPDs are exhibited, and the interactive MPD control operation, display techniques, and display mechanizations of each are described. The specific procedures and experimental design used for the evaluation are stated, including pilot training with scenarios of daytime VFR fighter sweep at medium to high altitude and low-latitude night attack mission. The average task times, the criteria for each scenario, and the number of times each pilot exceeded the criteria are shown. The reasons for the final selection are discussed. C.D.

**A83-16133#
AIRBORNE ELECTRONIC COLOUR DISPLAYS**

R. A. CHORLEY (Smiths Industries Aerospace and Defence Systems Co., Cheltenham, Glos., England) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 198-215. Research supported by the Department of Industry and Ministry of Defence (Procurement Executive). refs

The hardware, configuration, formats, and current trends in airborne electronic color displays are discussed. Instrument panels with partial and full electronic display systems are shown, as are block diagrams of different display system architectures. The display unit, symbol generator unit, and pilots' control panels are discussed in terms of structure and function, and the primary flight, navigation, and systems displays are described. Photographs of these displays are also shown. The influence of human factors in the use of the displays is considered, and the advantages and disadvantages of an electronic display system compared to a conventional instrument fit and of a system based on color CRTs compared with a monochrome system are assessed. C.D.

**A83-16134#
HELMET MOUNTED DISPLAY SYMBOLOGY FOR HELICOPTER
LANDING ON SMALL SHIPS**

S. T. DONLEY (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA) and T. A. DUKES (Dynasyst, Inc., Princeton, NJ) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 216-240. refs

Helmet Mounted Display symbology has been designed to aid in landing a specific helicopter, the SH-2F, on small ships, utilizing the NAVTOLAND Precision Landing Guidance System. A 'maximal' display for single-pilot operation and a 'minimal' display for two-pilot operation have been developed, both without head tracking. The 'maximal' display provides all the necessary flight information in three modes for localizer acquisition, approach, and hover. Novel symbology is introduced for aiding the pilot in localizer acquisition

under high wind conditions and for glide slope and localizer tracking during approach. The 'minimal' display symbology relies on active participation by the co-pilot via verbal communication. In this display the presentation of the positioning information is based on the Doppler Direction Velocity Indicator panel instrument format throughout approach and hover (Author)

A83-16135#**HEAD UP DISPLAY OPERATIONAL PROBLEMS**

R. L. NEWMAN (Crew Systems Consultants, Yellow Springs, OH) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 241-250. refs

Operational problems associated with HUDs are identified through a survey and discussed. Over 400 questionnaires were circulated to operational pilots flying HUD-equipped planes. The survey was restricted to common modes of flight, not covering tactical uses of the HUDs in weapons delivery. Hardware-related problems included an improper location of the design eye reference point, inadequate control of the brightness control, and inadequate wideness of view. Software problems included complaints about display dynamics, increased tendency toward disorientation while flying with HUD as the primary flight reference, and problems associated with flying the instrument landing system approach using the HUD. Procedural complaints included a lack of HUD checkout, the learning times necessary to reach steady-state performance, and a lack of procedures with which to fly the airplane by reference to the HUD. These problems are amplified on, with special emphasis given to the tendency toward disorientation. C.D.

A83-16136*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

'LIGHT BAR' ATTITUDE INDICATOR

E. K. ENEVOLDSON and V. W. HORTON (NASA, Flight Research Center, Edwards, CA) In: Advanced Aircrew Display Symposium, 5th, Patuxent River, MD, September 15, 16, 1981, Proceedings. Patuxent River, MD, U.S. Naval Air Test Center, 1982, p. 251-261.

The development and evaluation of a light bar attitude indicator to help maintain proper aircraft attitude during high altitude night flying is described. A standard four-inch ADI was modified to project an artificial horizon across the instrument panel for pitch and roll information. A light bulb was put in the center of the ADI and a thin slit cut on the horizon, resulting in a thin horizontal sheet of light projecting from the instrument. The intensity of the projected beam is such that it can only be seen in a darkened room or at night. The beam on the instrument panel of the T-37 jet trainer is shown, depicting various attitudes. The favorable comments of about 50 pilots who evaluated the instrument are summarized, including recommendations for improving the instrument. Possible uses for the instrument to ease the pilot task are listed. Two potential problems in using the device are the development of pilot complacency and an upright-inverted ambiguity in the instrument. C.D.

A83-16334#**SIMULATOR STUDIES TO DEVELOP AND IMPROVE FLIGHT ATTITUDE INFORMATION**

R. AXELSSON, S.-A. NILSSON (Lutab Prof. Sten Luthander Ingeniorsbyra AB, Bromma, Sweden), and O. HALLEN (Kungl. Tekniska Hogskolan, Stockholm, Sweden) In: Flight simulation - Avionic systems and aero medical aspects; Proceedings of the International Conference, London, England, April 6, 7, 1982. London, Royal Aeronautical Society, 1982. 10 p. Research supported by the Forsvaret Materielverk.

It has been found that the cause of aircraft accidents has been, in many cases, the pilot's inability to interpret correctly the presented flight attitude information. The Swedish Defense Material Administration has, therefore, initiated a project which is concerned with the investigation, development, and improvement of flight attitude information for military aircraft. The project background is examined. It is found that in several modern military aircraft, flight attitude information is presented both head-up and head-down.

The information presented head-up is electronically generated, while the head-down information is mechanically provided. It is intended to remove the mechanical instrument and replace it with an electronically generated display. Attention is given to details regarding the overall project aim, the simulation facilities, and research conducted to determine the most suitable approaches for the presentation of the required flight attitude information. G.R.

A83-16336#**COLOUR FLIGHT DECK DISPLAYS**

E. STRONGMAN (Royal Aircraft Establishment, Bedford, England) In: Flight simulation - Avionic systems and aero medical aspects; Proceedings of the International Conference, London, England, April 6, 7, 1982. London, Royal Aeronautical Society, 1982. 10 p. refs

Developments in CRT technology, together with cursive writing techniques, have provided the much brighter CRT displays needed for head-up display applications where the information must be viewed against a bright background. In connection with advances made in color CRT technology, the first civil aircraft with color displays for the presentation of primary flight information are about to enter service. In the United Kingdom, research into civil flight deck CRT displays was initiated in connection with simulator studies. Color displays are now flown in a BAC 1-11. A description of the UK simulator studies is presented, taking into account the Concorde simulator, and the advanced flight deck simulator. The addition of color allowed CRTs to present additional information to that available on electromechanical instruments without compromising the presentation of basic flight information. G.R.

A83-16337#**AOI DISPLAYS IN SIMULATION**

W. S. CHAMBERS (U.S. Navy, Naval Training Equipment Center, Orlando, FL) In: Flight simulation - Avionic systems and aero medical aspects; Proceedings of the International Conference, London, England, April 6, 7, 1982. London, Royal Aeronautical Society, 1982. 6 p. refs

Area of Interest (AOI) displays present visual information to the trainee in a flight simulator in such a way that detailed imagery is concentrated in only part of the total field of view. This concept can provide an efficient system as the generation and display of imagery not required for the training task is avoided. AOI displays which display a target plane for gunnery and air combat maneuvering (ACM) training have been used on a few trainers over the past 30 years. In connection with cost considerations related to the very wide angle display required for ACM, the advantages of Computer Image Generation (CIG) have not been available to ACM and other fighter and attack mission trainer tasks. However, the U.S. Navy's Visual Technology Research Simulator has now demonstrated the feasibility of applying CIG to an AOI display coupled with a background display on a spherical screen for military applications. G.R.

N83-12082# Aeronautical Research Labs., Melbourne (Australia).

COMPUTER GRAPHIC PRESENTATION OF CONVENTIONAL COCKPIT INSTRUMENTS

H. A. THELANDER and R. J. ROSSA Nov. 1981 32 p refs (ARL-SYS-NOTE-82; AR-002-320) Avail: NTIS HC A03/MF A01

Conventional aircraft cockpit instruments, presented on a computer generated color display, are discussed in the context of research flight simulation, and their general characteristics in this application are established. The hardware and software involved in a realization of a simulator cockpit instrument panel using this approach is described, and the significant problem areas and solutions achieved are highlighted. Two of the more interesting instrument are discussed to illustrate the methods. Analysis of subjective assessments and timing measurements confirms the success of the work. Author

06 AIRCRAFT INSTRUMENTATION

N83-12083# Embry-Riddle Aeronautical Univ., Daytona Beach, Fla.

EVALUATING THE USE OF ELECTRONIC FLIGHT INSTRUMENT SYSTEMS IN GENERAL AVIATION AIRCRAFT Final Report

J. B. SHELNUTT, J. M. CHILDS, W. W. PROPHET, J. P. SMITH, and B. STRAUCH 15 Nov. 1982 231 p refs Prepared in cooperation with Seville, Research Corp., Pensacola, Fla.

(Contract DOT-FA-79NA-6040)

(AD-A118604; DOT/FAA-CT-82-73; DOT/FAA-EM-82-14) Avail: NTIS HC A11/MF A01 CSCL 01D

Several avionics manufacturers announced plans to produce electronic flight instrument systems (EPIS) for general aviation aircraft. A two phased research program devoted to planning and conducting exploratory evaluations that will assess the ability of general aviation pilots to operate EFIS equipped aircraft was investigated. The results of the first phase of this project. The objectives of this phase were to determine the specific goals of the exploratory evaluations and to develop general guidance--i.e., a conceptual approach--for their conduct. The conceptual approach is described in terms of (1) the information needed from the planned evaluations; (2) the general design of the overall study; (3) requirements for the performance measurement systems that would be employed to collect data and for the analysis of that data; (4) requirements for test facilities and equipment; and (5) procedures for selecting and training evaluation subjects. The conceptual approach is discussed and described in general terms to increase its utility as general guidance for planning evaluations of pilot performance. Author

N83-13095*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

REAL-TIME DATA DISPLAY FOR AFTI/F-16 FLIGHT TESTING

P. F. HARNEY Nov. 1982 16 p refs

(NASA-TM-84899; NAS 1.15:84899) Avail: NTIS HC A02/MF A01 CSCL 01D

Advanced fighter technologies to improve air to air and air to surface weapon delivery and survivability is demonstrated. Real time monitoring of aircraft operation during flight testing is necessary not only for safety considerations but also for preliminary evaluation of flight test results. The complexity of the AFTI/F-16 aircraft requires an extensive capability to accomplish real time data goals; that capability and the resultant product are described. S.L.

N83-13096# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

FLIGHT TEST INSTRUMENTATION FOR AIRLINE DIGITAL AVIONICS

F. J. ABBINK 19 May 1981 53 p refs Presented at 4th AGARD Special Course on Flight Test Instrumentation, Delft, Netherlands, May 1981

(NLR-MP-81017-U) Avail: NTIS HC A04/MF A01

The functions and the operation of airline avionics systems, and their flight testing objectives and requirements are discussed. Data acquisition equipment developed for the evaluation and certification of a civil transport aircraft prototype is described. For the determination of flight path during automatic approaches and landings, an integrated system based on inertial positioning, radio altitude and pressure altitude during the approach, followed by photographic determination of the position during the landing, can be used on multiple CAT instrument landings system equipped runways in up to CAT II weather conditions. For the en route flight path determination, a positioning system based on the sequential measurement of the distance of the aircraft to multiple distance measuring equipment (DME) and tactical air navigation system ground stations, combined with velocity information from an inertial sensor system and altitude information from an air data system, can be used (multi-DME/inertial position reference system). Author (ESA)

N83-13097# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

THE DIGITAL DATA ACQUISITION SYSTEM FOR THE FLIGHT TESTING OF THE FOKKER F29 AIRCRAFT

R. L. VANDERVELDE 24 Feb. 1981 30 p refs Presented at 4th AGARD Special Course on Flight Test Instrumentation, Delft, May 1981

(NLR-MP-81019-U) Avail: NTIS HC A03/MF A01

An integrated measuring, recording and data processing system for the evaluation and certification tests of the Fokker F29 aircraft is described. The on board digital data acquisition system user requirements are discussed. The system can measure and record more than 1400 parameters over a wide range of sampling rates. Several data acquisition units are located remotely. The system handles ARINC-429 digital data buses. Dynamic measurement of aircraft performance and accurate trajectory determination are possible. User requirements include a mission success probability of 99%. Author (ESA)

N83-13099# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

TRANSDUCER SELECTION

F. J. VANSCHAIK and S. S. VANLEEUWEN 28 Apr. 1981 52 p refs Presented at 4th AGARD Special Course on Flight Test Instrumentation, Delft, Netherlands, May 1981

(NLR-MP-81028-U) Avail: NTIS HC A04/MF A01

The transducer selection process applied to the F29 digital data acquisition system is discussed. The procedure consists of interviews of system users, specification of the transducer part of the data acquisition system, transducer selection from manufacturer data, evaluation tests, integration into the data acquisition system and system tests. The interviews with the users lead to a parameter list for which parameter specification criteria are given. The selection of transducers that meet parameter list requirements is done by using transducer performance specification lists. Evaluation tests include acceptance tests, calibrations, environmental tests and preliminary flight tests. Transducer interaction with the total data acquisition system is tested during system integration in laboratory and flight conditions. Author (ESA)

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.

A83-13159*# Pratt and Whitney Aircraft Group, Middletown, Conn.

COMPOSITE FAN EXIT GUIDE VANES FOR HIGH BYPASS RATIO GAS TURBINE ENGINES

S. S. BLECHERMAN and T. N. STANKUNAS (United Technologies Corp., Pratt and Whitney Aircraft Group, Middletown, CT) Journal of Aircraft, vol. 19, Dec. 1982, p. 1032-1037. refs

(Contract NAS3-21037)

(Previously cited in issue 19, p. 3265, Accession no. A81-40839)

A83-13160*# Boeing Commercial Airplane Co., Seattle, Wash. **PREDICTION OF JET EXHAUST NOISE ON AIRFRAME SURFACES DURING LOW-SPEED FLIGHT**

L. M. BUTZEL (Boeing Commercial Aircraft Co., Seattle, WA) Journal of Aircraft, vol. 19, Dec. 1982, p. 1038-1044. Research supported by the Boeing Commercial Airplane Co. refs

(Contract F33657-72-C-089; F33615-77-C-3035; NAS2-9328)

(Previously cited in issue 24, p. 4127, Accession no. A81-48626)

A83-13162#

NOISE AND DETECTABILITY CHARACTERISTICS OF SMALL-SCALE REMOTELY PILOTED VEHICLE PROPELLERS

D. S. JANAKIRAM (Hughes Helicopters, Inc., Culver City, CA) and B. W. SCRUGGS (U.S. Army, Applied Technology Laboratories, Fort Eustis, VA) Journal of Aircraft, vol. 19, Dec. 1982, p. 1052-1060. refs

(Previously cited in issue 24, p. 4248, Accession no. A81-49732)

A83-13346

EXPERIMENTAL INVESTIGATION ON FILM COOLING OF A GAS TURBINE BLADE

S. KIKKAWA and K. KAMINO (JSME, Transactions, vol. 48, no. 426, 1982, p. 325-332.) Heat Transfer - Japanese Research, vol. 10, Oct.-Dec. 1981 (1982), p. 57-70. Translation. refs

Six blades of differing camber and thickness are used in measuring the pressure coefficient and film-cooling effectiveness under several angles of attack and blowing rates. The pressure coefficient on the suction side is found to increase with the blowing rate, a trend regarded as significant for an airfoil with small camber in the upstream region. On the pressure side, the pressure coefficient decreases with the blowing rate, and this is also considered important for an airfoil with a large camber. On the suction side, separation takes place just downstream from the slot for an airfoil with small camber and at about the middle point for one with a large camber. In the region downstream from the separation point, the film-cooling effectiveness falls off rapidly. On the pressure side, apparent separation is not seen, and the film-cooling effectiveness decreases gradually in the downstream direction. C.R.

A83-14115

ELECTRIC POWER SUPPLY OF AIRCRAFT [ELEKTROSNAJBZHENIE LETATEL'NYKH APPARATOV]

I. M. SINDEEV Moscow, Izdatel'stvo Transport, 1982. 272 p. In Russian. refs

Power supply systems of aircraft are reviewed with reference to their design, principles of operation, and maintenance. In particular, consideration is given to the drive systems of aircraft power generators, frequency and voltage control, static current converters, batteries, and power control, protection, and distribution systems. Methods of increasing the reliability of aircraft power supply systems are discussed. V.L.

A83-14625#

SOME COMMENTS ON A MATHEMATICAL MODEL OF THE STATIC PERFORMANCE CURVE OF A TURBOJET ENGINE [KILKA UWAG O MATEMATYCZNYM MODELU CHARAKTERYSTYKI STATYCZNEJ TURBINOWEGO ODRZUTOWEGO]

F. LENORT (Instytut Lotnictwa, Warsaw, Poland) Technika Lotnicza i Astronautyczna, vol. 37, Oct. 1982, p. 28, 29. In Polish.

The approximation of the empirical dependence of fuel consumption on engine speed and flight speed and altitude is considered with the aim of developing a mathematical model for the static performance of a turbojet engine. Two approximating functions - a simple one and a more complex, general one - are described; and the usefulness of the simpler function is demonstrated by an evaluation of approximation accuracy. The correctness of the polynomial order of the number of coefficients assumed in this function has been verified using a statistical method. B.J.

A83-14951

POWERPLANTS. I

T. FORD Aircraft Engineering, vol. 54, Nov. 1982, p. 2-5.

Attention is given to the Rolls-Royce RB211 family of turbofan engines, noting that their lower specific fuel consumption makes the powerplants more viable. Several different engines (524B2, 524C2, 524B4, 524D4) are discussed with reference to such characteristics as take-off thrust, maximum climb and cruise thrust, and engine length and inlet diameter. Advanced derivatives of the

535 engine are described in terms of the wide-chord fan, increased efficiency core and composite structural components. The RJ 500 turbofan, being developed jointly by Rolls-Royce and a consortium of Japanese aerospace companies, is considered. S.C.S.

A83-15068* Lockheed-Georgia Co., Marietta. GENERATION OF DESIRED SIGNALS FROM ACOUSTIC DRIVERS

R. RAMAKRISHNAN, M. SALIKUDDIN, and K. K. AHUJA (Lockheed-Georgia Co., Marietta, GA) Journal of Sound and Vibration, vol. 85, Nov. 8, 1982, p. 39-51. Research supported by the Lockheed-Georgia Independent Research Program refs (Contract NAS3-20797)

A procedure to control transient signal generation is developed for the study of internal noise propagation from aircraft engines. A simple algorithm incorporating transform techniques is used to produce signals of any desired waveform from acoustic drivers. The accurate driver response is then calculated, and from this the limiting frequency characteristics are determined and the undesirable frequencies where the driver response is poor are eliminated from the analysis. A synthesized signal is then produced by convolving the inverse of the response function with the desired signal. Although the shape of the synthesized signal is in general quite awkward, the driver generates the desired signal when the distorted signal is fed into the driver. The results of operating the driver in two environments, in a free field and in a duct, are presented in order to show the impedance matching effect of the driver. In addition, results using a high frequency cut-off value as a parameter is presented in order to demonstrate the extent of the applicability of the synthesis procedure. It is concluded that the desired signals can be generated through the signal synthesis procedure. N.B.

A83-15311#

ROLLS-ROYCE RB 211-535 POWER PLANT

D. J. PICKERELL (Rolls-Royce, Ltd., Derby, England) Journal of Aircraft, vol. 20, Jan. 1983, p. 15-20.

(Previously cited in issue 14, p. 2302, Accession no. A81-33886)

A83-15319#

TF41/LAMILLOY ACCELERATED MISSION TEST

D. J. ESSMAN (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH), R. E. VOGEL, J. G. TOMLINSON, and A. S. NOVICK (General Motors Corp., Detroit Diesel Allison Div., Indianapolis, IN) Journal of Aircraft, vol. 20, Jan. 1983, p. 70-75.

(Previously cited in issue 19, p. 3264, Accession no. A81-40833)

A83-15320*# Southwest Research Inst., San Antonio, Tex. PROCEDURE FOR EVALUATION OF ENGINE ISOLATORS FOR REDUCED STRUCTURE-BORNE NOISE TRANSMISSION

J. F. UNRUH (Southwest Research Institute, San Antonio, TX) Journal of Aircraft, vol. 20, Jan. 1983, p. 76-82. refs (Contract NAS1-14861)

(Previously cited in issue 24, p. 4126, Accession no. A81-48608)

A83-15850

THE DIAGNOSTICS OF DISTURBANCES IN COMPONENTS OF TURBOJET ENGINES WITH GASDYNAMICS PARAMETER MONITORING [ZUR DIAGNOSE VON KOMPONENTENSTOERUNGEN IN TURBOLUFTSTRAHLANTRIEBEN MIT GASDYNAMISCHER PARAMETERUEBERWACHUNG]

A. SPIRKL VDI-Zeitschriften Fortschritt-Berichte, Reihe 7-Stroemungstechnik, no. 67, 1982, p. 1-170. In German. refs

The present investigation is concerned with the diagnostics of 'disturbances' in the 'main components' of the engine. The 'main components' are engine components which are connected with the thermodynamic process. The concept 'disturbance' denotes an undesired deviation from the correct behavior. The main

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objective of the investigation is the determination of the thermodynamic condition of the engine. Changes regarding the mechanical condition of the engine are considered, if these changes affect the thermodynamic condition of the engine. The relations between component parameters and measurable quantities can be described with the aid of theoretical and empirical models designed to represent component behavior. The performance of such models is discussed. It is found that the models can provide incorrect results if disturbances occur which have not been considered in the design of the model. A diagnostics procedure is developed for the determination of such disturbances. G.R.

A83-16010

ANALYTICAL PROFILING OF TURBINE BLADES

A. V. DEREVIANKO and S. Z. KOPELEV (Teplotnergetika, vol. 29, no. 3, 1982, p. 63-65.) Thermal Engineering, vol. 29, Mar. 1982, p. 168-170. Translation. refs

An analytical method is presented for profiling turbine blades (including cooled blades) the outer contour of which is described by the lemniscate of Bernoulli. Apart from profiling the outer contours, the method encompasses the profiling of the inner space of a cooled blade including the finning of its surface, prediction of potential flow through a two-dimensional cascade of profiles, and graphical representation of a cascade with the aid of a plotting instrument. The method involves the use of the known relationships for selecting the geometric parameters of cascades, with prescribed number of blades, flow entry and exit angles, and blade widths. A cascade of profiles designed by the proposed method is shown. V.L.

A83-16371

SUPERSONIC HARRIER - ONE STEP CLOSER

J. MOXON Flight International, vol. 122, Dec. 4, 1982, p. 1633-1635.

Design features, planned trials, and expected performances of a Rolls-Royce plenum chamber burning (PCB) super-Pegasus jet engine are described. Initiated nearly 20 yr ago, the problem was intended to provide an engine capable of powering the modern-day Harrier to supersonic speeds. The program has resulted in solutions to problems of water ingestion and intake distortion. The full scale tests are to take place with the engine mounted in a Harrier frame and fixed on a stand. A variable area forward nozzle will be examined, as will nozzle actuation and the control system, the nozzle airframe configuration, and hot gas reinjection. Improvements are needed in tailoring the exhaust temperature profile. Combinations of droop and tail placement, nozzle convergence and hot air-tolerant dams to reduce the exhaust effects, and carrier landing techniques will be examined. M.S.K.

N83-12084# National Aerospace Lab., Tokyo (Japan). Aeroengine Div.

RESEARCH AND DEVELOPMENT OF LIFT-JET ENGINE, 1 Feb. 1982 57 p refs In JAPANESE; ENGLISH summary 2 Vol.

(NAL-TR-699) Avail: NTIS HC A04/MF A01

High thrust to weight ratio lift jet engine research for V/STOL aircraft is reviewed. Development of the lift jet engine JR100 is reported. The engine was developed to provide power to satisfy the vertical thrust requirement of V/STOL aircraft, and was designed to have a permanent air bleed fed to auxiliary jets located at the aircraft extremities. Improved models are discussed, including a JR200 series with lighter weight and higher performance. Author

N83-12085# National Aerospace Lab., Tokyo (Japan). Aeroengine Div.

RESEARCH AND DEVELOPMENT OF LIFT-JET ENGINE, 2

Feb. 1982 26 p refs 2 Vol.

(NAL-TR-700) Avail: NTIS HC A03/MF A01

The lift jet engine JR100V, scheduled to power a research plane during VTOL mode operations is reviewed. The JR100V was developed as a version of the JR100 series engines. It features higher thrust to weight ratio than that of the JR100F which was

equipped on a flying test bed. Air cooled light weight structure, accessibility control for on board maintenance, in flight starting criteria, and electronic automatic starting are described and discussed. Author

N83-12086# National Aerospace Lab., Tokyo (Japan).

AN ENGINE INSTALLATION FOR FAN JET STOL AIRCRAFT USING USB POWERED HIGH LIFT SYSTEM (I) ENGINE MATCHING TEST FOR CIRCULAR CONFLUENT EXHAUST DUCT

M. MATSUKI, T. TORISAKI, H. KONDO, S. NAKAYAMA, S. SEKINE, A. YOSHIDA, M. MORITA, T. KOSHINUMA, Y. MATSUDA, Y. FUJISAWA et al. 1982 16 p refs In JAPANESE; ENGLISH summary

(NAL-TR-703; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

Design data of an engine-nacelle for a USB powered high lift system on a STOL aircraft were obtained. In these design data, structure and strength of the engine-nacelle and conformity between an engine and its engine-nacelle are the most important problems. In order to obtain engine operational characteristics for mixing a fan and a core flow, a test was performed using a FJR 710 turbo-fan engine installed in a circular confluent exhaust duct. Test parameters of interest are the length of the mixing zone and the contraction of the mixing nozzle. As a result of this investigation, it was proved that a power-turbine output decreases with an increase of outlet pressure of the power-turbine due to the mixing, providing a design method to correct engine operational matching characteristics was found. Author

N83-12087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A REMOTE AUGMENTOR LIFT SYSTEM WITH A TURBINE BYPASS ENGINE

L. H. FISHBACH and L. C. FRANCISCUS 1982 12 p refs Presented at the 13th Cong. of the Intern. Council of Aeronautical Sci. and Aircraft Systems and Technol. Meeting, Seattle, 22-27 Aug. 1982

(NASA-TM-82932; E-1330; NAS 1.15:82932) Avail: NTIS HC A02/MF A01 CSCL 21E

Two supersonic vertical takeoff or landing (VTOL) aircraft engine types, a conventional medium bypass ratio turbofan, and a turbine bypass turbojet were studied. The aircraft assumed was a clipped delta wing with canard configuration. A VTOL deck launched intercept, DLI, mission with Mach 1.6 dash and cruise segments was used as the design mission. Several alternate missions requiring extended subsonic capabilities were analyzed. Comparisons were made between the turbofan (TF) and the turbine bypass turbojet (TBE) engines in airplane types using a Remote Augmented Lift Systems, RALS and a Lift plus Lift Cruise system (L+LC). The figure of merit was takeoff gross weight for the VTOL DLI mission. The results of the study show that the turbine bypass turbojet and the conventional turbofan are competitive engines for both type of aircraft in terms of takeoff gross weight and range. However, the turbine bypass turbojet would be a simpler engine and may result in more attractive life cycle costs and reduced maintenance. The RALS and L+LC airplane types with either TBE or TF engines have approximately the same aircraft takeoff gross weight. Author

N83-12088*# AiResearch Mfg. Co., Phoenix, Ariz.

ADVANCED GAS TURBINE (AGT) POWERTRAIN SYSTEM DEVELOPMENT PROGRAM Monthly Technical Progress Report, 1 Aug. - 31 Aug. 1980

R. A. RACKLEY 26 Sep. 1980 124 p

(Contract DEN3-167)

(NASA-CR-169475; NAS 1.26:169475; AMC-31-3480(11);

MTPR-11) Avail: NTIS HC A06/MF A01 CSCL 21E

Gas turbine automobile powertrain research is reported. The compressor, turbine, combustor, regenerator, gearbox, ceramic components/subsystems, bearings, and controls are discussed. N.W.

N83-12089*# Detroit Diesel Allison, Indianapolis, Ind.
COMPONENTS FOR DIGITALLY CONTROLLED AIRCRAFT ENGINES

J. D. MEADOR Aug. 1981 107 p refs
 (Contract NAS3-22046)

(NASA-CR-165296; NAS 1.26:165296; EDR-10696) Avail: NTIS HC A06/MF A01 CSCL 21E

Control system components suitable for use in digital electronic control systems are defined. Compressor geometry actuation concepts and fuel handling system concepts suitable for use in large high performance turbofan/turbojet engines are included. Eight conceptual system designs were formulated for the actuation of the compressor geometry. Six conceptual system designs were formulated for the engine fuel handling system. Assessment criteria and weighting factors were established and trade studies performed on their candidate systems to establish the relative merits of the various concepts. Fuel pumping and metering systems for small turboshaft engines were also studied. Seven conceptual designs were formulated, and trade studies performed. A simplified bypassing fuel metering scheme was selected and a preliminary design defined. S.L.

N83-12090*# National Aeronautics and Space Administration.
 Lewis Research Center, Cleveland, Ohio.

ADVANCED TECHNOLOGIES FOR TURBOMACHINERY SYSTEMS: AN OVERVIEW

M. J. HARTMANN Aug. 1982 78 p refs Presented at the 11th Ann. Turbomachinery Symp., Houston, Tex., 14-16 Dec. 1982

(NASA-TM-82949; E-1302; NAS 1.15:82949) Avail: NTIS HC A05/MF A01 CSCL 21E

Turbomachinery system components and associated technologies are discussed. Specific technologies reviewed include the compressor, turbine, internal flow analysis methods, combustion, fuels, materials, structures, bearings, seals, and lubrication, dynamics and controls, and instrumentation. Analytical procedures as a path to improved performance are discussed. The strong interaction between the various technologies if turbomachinery performance gains are to be realized is reflected. Author

N83-12091*# National Aeronautics and Space Administration.
 Lewis Research Center, Cleveland, Ohio.

ROTORCRAFT CONVERTIBLE ENGINES FOR THE 1980S

J. D. EISENBERG 1982 28 p refs Presented at the Rotary Wing Propulsion System Specialist Meeting, Williamsburg, Va., 16-18 Nov. 1982

(NASA-TM-83003; E-1443; NAS 1.15:83003) Avail: NTIS HC A03/MF A01 CSCL 21E

Two rotorcraft studies were executed. The goal was to identify attractive techniques for implementing convertible powerplants for the ABC, Folded Tilt Rotor, and X-wing type high speed, high-L/D rotorcraft; to determine the DOC and fuel savings benefits achieved thereby; and to define research required to bring these powerplants into existence by the 1990's. These studies are reviewed herein and the different methods of approach are pointed out as well as the key findings. Fan shaft engines using variable inlet guide vanes or torque converters, and turboprop powerplants appear attractive. Savings in DOC and fuel consumption of over 15 percent are predicted in some cases as a result of convertible engine use rather than using separate engines for the thrust and the shaft functions. Areas of required research are fan performance (including noise), integrated engine/rotorcraft control, torque converters, turbine design, airflow for rotorcraft torque control, bleed for lift flow, and transmissions and clutches. Author

N83-12092*# National Aeronautics and Space Administration.
 Lewis Research Center, Cleveland, Ohio.

QCSEE UNDER-THE-WING ENGINE-WING-FLAP AERODYNAMIC PROFILE CHARACTERISTICS

H. E. BLOOMER and N. E. SAMANICH Sep. 1982 48 p refs
 (NASA-TM-82890; E-1268; NAS 1.15:82890) Avail: NTIS HC A03/MF A01 CSCL 21E

As part of a broad-based NASA program to provide a technology base for future propulsion requirements for powered-lift aircraft, the Quiet, Clean, Short-Haul, Experimental Engine (QCSEE) program was begun by the Lewis Research Center in 1974. The initial buildup of the under-the-wing (UTW) engine was tested by the contractor at his test site. The UTW engine was delivered to Lewis in 1978 for further testing with wing and flap segments simulating an installation on a short-haul transport aircraft. The engine was also tested alone as an aid in identifying the various noise sources and their levels. As part of these tests the aerodynamic profiles at the exhaust nozzle and on the surfaces and in the wake of the wing-flap system were measured. This report documents, in plots and tabular form, the significant results from those tests. The results are presented as tabulations of aerodynamic data for all of the test points and as profiles of pressure, temperature, velocity, and normalized velocity and pressure for selected conditions. One of the main conclusions was that the measured flap surface temperatures were surprisingly low for both approach and takeoff flap settings. Author

N83-12093*# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

THE WISGSK: A COMPUTER CODE FOR THE PREDICTION OF A MULTISTAGE AXIAL COMPRESSOR PERFORMANCE WITH WATER INGESTION Final Report

T. TSUCHIYA and S. N. B. MURTHY Washington NASA
 Nov. 1982 256 p refs

(Contract NAG3-62)

(NASA-CR-3624; NAS 1.26:3624) Avail: NTIS HC A12/MF A01 CSCL 21E

A computer code is presented for the prediction of off-design axial flow compressor performance with water ingestion. Four processes were considered to account for the aero-thermo-mechanical interactions during operation with air-water droplet mixture flow: (1) blade performance change, (2) centrifuging of water droplets, (3) heat and mass transfer process between the gaseous and the liquid phases and (4) droplet size redistribution due to break-up. Stage and compressor performance are obtained by a stage stacking procedure using representative velocity diagrams at a rotor inlet and outlet mean radii. The Code has options for performance estimation with (1) mixtures of gas and (2) gas-water droplet mixtures, and therefore can take into account the humidity present in ambient conditions. A test case illustrates the method of using the Code. The Code follows closely the methodology and architecture of the NASA-STGSTK Code for the estimation of axial-flow compressor performance with air flow. Author

N83-12094*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.

ENERGY EFFICIENT ENGINE. FLIGHT PROPULSION SYSTEM PRELIMINARY ANALYSIS AND DESIGN Report, Jan. 1978 - Nov. 1979

R. P. JOHNSTON Nov. 1979 50 p refs

(Contract NAS3-20643)

(NASA-CR-159859; NAS 1.26:159859; R80AEG396) Avail: NTIS HC A03/MF A01 CSCL 21E

The characteristics of an advanced Flight Propulsion System (FPS) suitable for introduction in the late 1980's to early 1990's, were defined. It was determined that NASA goals for efficiency, environmental considerations, and economics could be met or exceeded with the possible exception of NOx emission. In evaluating the FPS, all aspects were considered including component design, performance, weight, initial cost, maintenance cost, engine-system integration (including nacelle), and aircraft integration considerations. In terms of the NASA goals, the current

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FPS installed specific fuel consumption was reduced 14.2% from that of the CF6-50C reference engine. When integrated into an advanced, subsonic, study transport, the FPS produced a fuel-burn savings of 15 to 23% and a direct operating cost reduction of 5 to 12% depending on the mission and study-aircraft characteristics relative to the reference engine. J.M.S.

N83-12096# Pennsylvania State Univ., University Park. Applied Research Lab.

EFFICIENCY IMPROVED TURBOPROP

W. S. GEARHART 10 Jun. 1982 29 p refs

(Contract N00024-79-C-6043)

(AD-A118819; ARL/PSU/TM-82-124) Avail: NTIS HC A03/MF A01 CSCL 21E

Renewed attention has been focused on the efficiency of aircraft propulsion as the cost of fuel has risen. Studies conducted by NASA (1) to obtain fuel efficient aircraft have considered relatively highly-loaded turbo-prop systems. The disc loadings of these propellers are as much as four times higher than those on present turboprop aircraft. The higher disc loadings result in greater slipstream swirl and higher energy losses. Of primary importance is the radial distribution of the energy losses across the slipstream due to the tangential and axial velocities. This study presents the results of analysis defining the various sources of energy loss resulting from a swirling slipstream downstream of a propeller. Experimental data are presented demonstrating the presence of such losses and a propeller configuration discussed which offers improved propulsive performance when relatively highly-loaded propellers are employed. Author (GRA)

N83-12163*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TURBINE ENGINE MATERIALS DURABILITY RESEARCH

S. R. LEVINE and C. A. STEARNS *In* NASA. Langley Research Center Advan. Mater. Technol. p 313-334 Nov. 1982 refs

Avail: NTIS HC A19/MF A01 CSCL 21E

High temperature environmental attack of dollar intensive turbine components reduces turbine efficiency and can limit life. The mechanisms of alloy and coating attack and the effects of interaction with the environment on mechanical behavior. This base of understanding provides the foundation for developing life prediction methods and identifying strategies for controlling attack. Subjects discussed in detail include oxidation and new developments in thermal barrier coating research. B.W.

N83-13100*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

CF6 JET ENGINE DIAGNOSTICS PROGRAM. HIGH PRESSURE TURBINE ROUNDNESS/CLEARANCE INVESTIGATION

W. D. HOWARD and W. A. FASCHING Jun. 1982 123 p refs (Contract NAS3-20631)

(NASA-CR-165581; NAS 1.26:165581; R82AEB340) Avail: NTIS HC A06/MF A01 CSCL 21E

The effects of high pressure turbine clearance changes on engine and module performance was evaluated in addition to the measurement of CF6-50C high pressure turbine Stage 1 tip clearance and stator out-of-roundness during steady-state and transient operation. The results indicated a good correlation of the analytical model of round engine clearance response with measured data. The stator out-of-roundness measurements verified that the analytical technique for predicting the distortion effects of mechanical loads is accurate, whereas the technique for calculating the effects of certain circumferential thermal gradients requires some modifications. A potential for improvement in roundness was established in the order of 0.38 mm (0.015 in.), equivalent to 0.86 percent turbine efficiency which translates to a cruise SFC improvement of 0.36 percent. The HP turbine Stage 1 tip clearance performance derivative was established as 0.44 mm (17 mils) per percent of turbine efficiency at take-off power, somewhat smaller, therefore, more sensitive than predicted from previous investigations. M.G.

N83-13101*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF BROAD PROPERTIES FUEL ON INJECTOR PERFORMANCE IN A REVERSE FLOW COMBUSTOR

S. M. RADDLEBAUGH and C. T. NORGRIN 1982 18 p refs Prepared for presentation at the 21st Aerospace Sci. Conf., Reno, Nev., 10-13 Jan. 1983; sponsored by AIAA

(NASA-TM-83013; E-1448; NAS 1.15:83013; AIAA-83-0154)

Avail: NTIS HC A02/MF A01 CSCL 21E

The effect of fuel type on the performance of various fuel injectors was investigated in a reverse flow combustor. Combustor performance and emissions are documented for simplex pressure atomizing, spill flow, and airblast fuel injectors using a broad properties fuel and compared with performance using Jet A fuel. Test conditions simulated a range of flight conditions including sea level take off, low and high altitude cruise, as well as a parametric evaluation of the effect of increased combustor loading. The baseline simplex injector produced higher emission levels with corresponding lower combustion efficiency with the broad properties fuel. There was little or not loss in performance by the two advanced concept injectors with the broad properties fuel. The airblast injector proved to be especially insensitive to fuel type. S.L.

N83-13103*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

CONCEPTUAL DESIGN, EVALUATION AND RESEARCH IDENTIFICATION FOR REMOTE AUGMENTED PROPULSIVE LIFT SYSTEMS (RALS) WITH EJECTORS FOR VTOL AIRCRAFT Final Report

W. S. WILLIS, M. KONARSKI, and M. V. SUTHERLAND May 1982 80 p refs

(Contract NAS3-22042)

(NASA-CR-167906; NAS 1.26:167906; R82AEB315) Avail: NTIS HC A05/MF A01 CSCL 21E

Ejector concepts for use with a remote augmented lift system (RALS) exhaust nozzle were studied. A number of concepts were considered and three were selected as having the greatest promise of providing the desired aircraft and exhaust gas cooling and lift enhancement. A scale model test program is recommended to explore the effects of the more important parameters on ejector performance. M.G.

N83-13104*# Solar Turbines International, San Diego, Calif.

INVESTIGATION OF A LOW NOX FULL-SCALE ANNULAR COMBUSTOR Final Report

Feb. 1982 79 p refs

(Contract NAS3-20616)

(NASA-CR-165518; NAS 1.26:165518; SR82-R-4621-36) Avail: NTIS HC A05/MF A01 CSCL 21E

An atmospheric test program was conducted to evaluate a low NOx annular combustor concept suitable for a supersonic, high-altitude aircraft application. The lean premixed combustor, known as the vortex air blast (VAB) concept, was tested as a 22.0-cm diameter model in the early development phases to arrive at basic design and performance criteria. Final demonstration testing was carried out on a full scale combustor of 0.66-m diameter. Variable geometry dilution ports were incorporated to allow operation of the combustor across the range of conditions between idle ($T_{in} = 422$ K, $T_{out} = 917$ K) and cruise ($T_{in} = 833$ K, $T_{out} = 1778$ K). Test results show that the design could meet the program NOx goal of 1.0 g NO₂/kg fuel at a one-atmospheric simulated cruise condition. Author

AIRCRAFT STABILITY AND CONTROL

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

A83-14843*# Oklahoma State Univ., Stillwater.
AN ANALYTICAL PILOT RATING METHOD FOR HIGHLY ELASTIC AIRCRAFT

R. L. SWAIM (Oklahoma State University, Stillwater, OK) and S. POOPAKA (Guidance and Control Conference, Albuquerque, NM, August 19-21, 1981, Collection of Technical Papers, p. 146-152.) Journal of Guidance, Control, and Dynamics, vol. 5, Nov.-Dec. 1982, p. 578-582. refs
 (Contract NSG-4018)

(Previously cited in issue 21, p. 3624, Accession no. A81-44093)

A83-15310#
A NEW CONCEPT FOR AIRCRAFT DYNAMIC STABILITY TESTING

M. E. BEYERS (National Research Council of Canada, Ottawa, Canada) Journal of Aircraft, vol. 20, Jan. 1983, p. 5-14. refs

(Previously cited in issue 07, p. 1012, Accession no. A81-20638)

A83-15312#
CROSS-COUPLING BETWEEN LONGITUDINAL AND LATERAL AIRCRAFT DYNAMICS IN A SPIRAL DIVE

M. VELGER and J. SHINAR (Technion - Israel Institute of Technology, Haifa, Israel) Journal of Aircraft, vol. 20, Jan. 1983, p. 21-26. refs

In this paper, the spiral dive phenomenon, encountered mainly in light, unswept wing, general aviation aircraft, is investigated. The investigation was performed by a nonlinear five-degrees-of-freedom simulation of the aircraft response to elevator deflection during a gliding turn. The simulation results indicate that this phenomenon is generated by an aerodynamic cross-coupling created owing to the dependence of the rolling moment coefficient on the angle of attack. The paper presents the mechanism of the development of the phenomenon, which is composed of three motions at almost separate time scales: a fast longitudinal motion a slowly divergent lateral motion, and a combined kinematic response of the aircraft. A criterion for 'recovery by elevator only' from spiral dive is defined and flight conditions for failure of successful recovery are determined. Results show that recovery becomes more difficult for steeper glides, larger bank angles, and lower velocities.
 (Author)

N83-12097# Aeronautical Research Labs., Melbourne (Australia).

A GENERAL PROGRAM FOR PREDICTING RIGID-AIRCRAFT GUST RESPONSE

R. A. FEIK Jan. 1982 29 p refs
 (ARL-AERO-NOTE-407; AR-002-331) Avail: NTIS HC A03/MF A01

A FORTRAN program was developed for rigid-aircraft gust response calculations. Equations of motion for the aircraft dynamics are defined in the program and may be augmented to include flight control systems. Input data are used to describe a particular aircraft configuration, aerodynamic data, and flight conditions. The program calculates the gust response spectra. The relatively simple gust model included may be modified or extended readily. The transfer functions may also be used to obtain time-domain responses to discrete gusts. Examples show the effects on gust response of variations in configuration, aerodynamics and control systems.
 Author

N83-13105# Detroit Diesel Allison, Indianapolis, Ind.
TIME-VARIANT AERODYNAMICS FOR TRANSLATIONAL MOTION OF LARGE-TURNING AIRFOILS Final Report, Oct. 1980 - Feb. 1982

R. L. JAY, M. J. GRITTON, and M. D. ROTHROCK Feb. 1982 144 p refs
 (Contract N00019-80-C-0430)
 (AD-A118884; DDA-EDR-10992) Avail: NTIS HC A07/MF A01 CSDL 21E

A cascade of five airfoil sections modelling the hub section of an advanced design turbine featuring a high inlet Mach number and 112 degrees of turning was evaluated at 4 steady-state conditions of varying exit Mach number and expansion ratio. The resulting steady-state airfoil surface pressures were compared to a state-of-the-art analytical prediction. A time-variant investigation was conducted at the 4 operating conditions of the steady-state experiment. Data from high response pressure transducers imbedded along the surfaces of the center airfoil was acquired by individually oscillating each airfoil of the cascade normal to its chord. From this data, the time-varying surface pressures as functions of interblade phase angle were quantified and compared with a current unsteady analysis.
 Author (GRA)

N83-13106# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

INSTRUMENTATION FOR GAS TURBINES

J. P. K. VLEGHERT 13 Apr. 1981 26 p refs Presented at 4th AGARD Special Course on Flight Test Instrumentation, Delft, Netherlands, May 1981
 (NLR-MP-81016-U) Avail: NTIS HC A03/MF A01

Instrumentation and test techniques for test bed and in flight trouble shooting of performance and handling aspects of gas turbine engines are discussed. Parameters essential for a performance check-up are listed, together with instrumentation systems. Problems such as the choice of sampling location, and the need for absolute integrity for probes in the gas upstream of rotating components are treated. Thrust calibration on a static test bed is considered, together with methods for obtaining in-flight thrust. High-response pressure instrumentation which can detect loss of compressor stall margin is described.
 Author (ESA)

N83-13107# Rolls-Royce Ltd., Derby (England).
RECENT ADVANCES IN THE PERFORMANCE OF HIGH BYPASS RATIO FANS

D. J. NICHOLAS and C. FREEMAN 1982 14 p refs Sponsored by UK Ministry of Defence Procurement Executive
 (PNR-90120) Avail: NTIS HC A02/MF A01

The special aerodynamic features of high bypass ratio transonic fans are described and progress in fan performance since the original RB 211-22B design is summarized. Aerodynamic performance data from model and engine size fans are compared, to show the standard of test and analysis techniques required to ensure that improvements in fan technology are realised in production engines. Theoretical and experimental techniques employed to study loss mechanisms within high Mach number blading are outlined. Linking the classical axisymmetric design approach with the quasi-3D flow observations results in more realistic theoretical modeling of the 3D flow field.
 Author (ESA)

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N83-12099*# Piasecki Aircraft Corp., Philadelphia, Pa.
HYBRID LTA VEHICLE CONTROLLABILITY AS AFFECTED BY BUOYANCY RATIO Final Report
D. N. MEYERS, P. KUBICKI, T. TARCZYNSKI, A. FAIRBANKS, and F. N. PIASECKI Oct. 1979 63 p
(Contract NAS2-101085)
(NASA-CR-152344; NAS 1.26:152344; PIAC-97-C-6) Avail:
NTIS HC A04/MF A01 CSCL 01C

The zero and low speed controllability of heavy lift airships under various wind conditions as affected by the buoyancy ratio are investigated. A series of three hybrid LTA vehicles were examined, each having a dynamic thrust system comprised of four H-34 helicopters, but with buoyant envelopes of different volumes (and hence buoyancies), and with varying percentage of helium inflation and varying useful loads (hence gross weights). Buoyancy ratio, B, was thus examined varying from approximately 0.44 to 1.39. For values of B greater than 1.0, the dynamic thrusters must supply negative thrust (i.e. downward). S.L.

N83-12100# Calspan Advanced Technology Center, Buffalo, N.Y. Flight Research Dept.
LATERAL FLYING QUALITIES OF HIGHLY AUGMENTED FIGHTER AIRCRAFT, VOLUME 2 Final Report, Mar. 1980 - May 1982
S. J. MONAGAN, R. E. SMITH, and R. E. BAILEY Wright-Patterson AFB, Ohio AFWAL Jun. 1982 282 p refs
(Contract F33615-79-C-3618)
(AD-A118071; CALSPAN-6645-F-8-VOL-2; AFWAL-TR-81-3171-VOL-2) Avail: NTIS HC A13/MF A01 CSCL 01C

Lateral-directional flying qualities data applicable to highly augmented fighter aircraft were generated. The effects of time delay and prefilter lag in the lateral flight control system were studied. The combined effects of these elements as well as the effects of nonlinear command gain and high Dutch roll damping were also evaluated. Tasks included were actual target tracking, air refueling, and precision landing as well as special Head-Up Display (HUD) tracking tasks. Results indicated that a properly designed HUD bank angle tracking task is a valid flying qualities evaluation task. Data show that lateral flying qualities are very sensitive to control system time delay and very short values of roll mode time constant typically result in poor lateral flying qualities. Excellent separation of the data into flying qualities levels is achieved. An optimum equivalent time constant value of 0.5 sec is indicated by the data; sensitivity to equivalent time delay is a minimum at this value. Pilot ratings are tabulated. Author

N83-13109 Georgia State Univ., Atlanta.
HELICOPTER VIBRATION SUPPRESSION USING SIMPLE PENDULUM ABSORBERS ON THE ROTOR BLADE Ph.D. Thesis
M. N. HAMOUDA 1982 186 p
Avail: Univ. Microfilms Order No. DA8221808

A comprehensive analytical design procedure for the installation of simple pendulums on the blades of a helicopter rotor to suppress the root reactions is presented. A frequency response analysis is conducted of typical rotor blades excited by a harmonic variation of spanwise airload distributions as well as a concentrated load at the tip. The structural modeling of the blade includes elastic degrees of freedom in flap and lead lag bending plus torsion with a hingeless hub constraint. Simple flap and lead lag pendulums are individually considered. On the basis of a rational ordering scheme the general nonlinear equations of motion for the rotor pendulum system are linearized in the perturbation elastic displacements and pendulum angle. A quasi-steady aerodynamic representation is utilized in the formation of these air loads. The solution of the system equations is based on their representation as a transfer matrix. Dissert. Abstr.

N83-13110*# Calspan Corp., Buffalo, N. Y.
AN IN-FLIGHT INVESTIGATION OF PILOT-INDUCED OSCILLATION SUPPRESSION FILTERS DURING THE FIGHTER APPROACH AND LANDING TASK
R. E. BAILEY and R. E. SMITH Mar. 1982 147 p refs
Sponsored in part by NASA
(Contract F33615-79-C-3618)
(NASA-CR-163116; NAS 1.26:163116; REPT-6645-F-9) Avail:
NTIS HC A07/MF A01 CSCL 01C

An investigation of pilot-induced oscillation suppression (PIOS) filters was performed using the USAF/Flight Dynamics Laboratory variable stability NT-33 aircraft, modified and operated by Calspan. This program examined the effects of PIOS filtering on the longitudinal flying qualities of fighter aircraft during the visual approach and landing task. Forty evaluations were flown to test the effects of different PIOS filters. Although detailed analyses were not undertaken, the results indicate that PIOS filtering can improve the flying qualities of an otherwise unacceptable aircraft configuration (Level 3 flying qualities). However, the ability of the filters to suppress pilot-induced oscillations appears to be dependent upon the aircraft configuration characteristics. Further, the data show that the filters can adversely affect landing flying qualities if improperly designed. The data provide an excellent foundation from which detail analyses can be performed. Author

N83-13111# Toronto Univ. (Ontario). Inst. of Aerospace Studies.
CONTROL LOGIC FOR LANDING-ABORT AUTOPILOT MODE
B. ETKIN and S. ZHU Feb. 1982 93 p refs Sponsored by the Natl. Sci. and Eng. Res. Council of Canada
(UTIAS-258; ISSN-0082-5255) Avail: NTIS HC A05/MF A01

An automatic control for an aborted landing is discussed with emphasis on the use of a body-mounted accelerometer, which is assumed to be both available and reliable, to provide a surrogate for an angle-of-attack signal. The control logic was developed for a typical large commercial jet transport and tested by simulation on a digital computer. The system developed met the objective: achieve a safe aborted landing and climb-out, such as might be required as a result of missing the landing window at Cat. II decision height, in the presence of severe wind shear. The performance demonstrated shows the logic to be effective and safe for initiating a go-around maneuver. Author

N83-13112*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HELICOPTER SIMULATION VALIDATION USING FLIGHT DATA
D. L. KEY, R. S. HANSEN, W. B. CLEVELAND, and W. Y. ABBOTT (Army Aviation Engineering Flight Activity) Nov. 1982 16 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif.
(NASA-TM-84291; A-9063; NAS 1.15:84291; AVRADCOM-TR-82-A-14) Avail: NTIS HC A02/MF A01 CSCL 01C

A joint NASA/Army effort to perform a systematic ground-based piloted simulation validation assessment is described. The best available mathematical model for the subject helicopter (UH-60A Black Hawk) was programmed for real-time operation. Flight data were obtained to validate the math model, and to develop models for the pilot control strategy while performing mission-type tasks. The validated math model is to be combined with motion and visual systems to perform ground based simulation. Comparisons of the control strategy obtained in flight with that obtained on the simulator are to be used as the basis for assessing the fidelity of the results obtained in the simulator. Author

N83-13113*# Honeywell Systems and Research Center, Minneapolis, Minn.

ADVANCED FLIGHT CONTROL SYSTEM STUDY Final Report
G. L. HARTMANN, J. E. WALL, JR., E. R. RANG, H. P. LEE, R. W. SCHULTE, and W. K. NG Nov. 1982 171 p refs Prepared in cooperation with Lockheed-California Co., Burbank (Contract NAS4-2876)
(NASA-CR-163117; NAS 1.26:163117; HONEYWELL-82SRC5)
Avail: NTIS HC A08/MF A01 CSCL 01C

A fly by wire flight control system architecture designed for high reliability includes spare sensor and computer elements to permit safe dispatch with failed elements, thereby reducing unscheduled maintenance. A methodology capable of demonstrating that the architecture does achieve the predicted performance characteristics consists of a hierarchy of activities ranging from analytical calculations of system reliability and formal methods of software verification to iron bird testing followed by flight evaluation. Interfacing this architecture to the Lockheed S-3A aircraft for flight test is discussed. This testbed vehicle can be expanded to support flight experiments in advanced aerodynamics, electromechanical actuators, secondary power systems, flight management, new displays, and air traffic control concepts.

A.R.H.

N83-13114*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE EFFECTS OF PILOT STRESS FACTORS ON HANDLING QUALITY ASSESSMENTS DURING US/GERMAN HELICOPTER AGILITY FLIGHT TESTS

H. J. PAUSDER (Deutsche Forschungs-und Versuchsanstalt fuer Luft-und Raumfahrt e.v., Braunschweig, West Germany) and R. M. GERDES Oct. 1982 20 p refs
(NASA-TM-84194; A-9084; NAS 1.15:84194) Avail: NTIS HC A02/MF A01 CSCL 01C

Flight tests were conducted with two helicopters to study and evaluate the effects of helicopter characteristics and pilot and task demands on performance in nap-of-the-Earth flight. Different, low-level slalom courses were set up and were flown by three pilots with different levels of flight experience. A pilot rating questionnaire was used to obtain redundant information and to gain more insight into factors that influence pilot ratings. The flight test setups and procedures are described, and the pilot ratings are summarized and interpreted in close connection with the analyzed test data. Pilot stress is discussed. The influence of demands on the pilot, of the helicopter characteristics, and of other stress factors are outlined with particular emphasis on how these factors affect handling-qualities assessment. Author

N83-13115*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

A FLIGHT TEST MANEUVER AUTOPILOT FOR A HIGHLY MANEUVERABLE AIRCRAFT

R. B. RONCOLI Nov. 1982 27 p refs Presented at the AIAA region 6 32nd Ann. Student Conf., Irvine, Calif., 28 Apr. - 1 May 1982
(NASA-TM-81372; H-1176; NAS 1.15:81372) Avail: NTIS HC A03/MF A01 CSCL 01C

A flight test maneuver autopilot (FTMAP) is currently being flown to increase the quality and quantity of the data obtained in the flight testing of the highly maneuverable aircraft technology (HiMAT) remotely piloted research vehicle (RPRV). The FTMAP resides in a ground-based digital computer and was designed to perform certain prescribed maneuvers precisely, while maintaining critical flight parameters within close tolerances. The FTMAP operates as a non-flight-critical outer loop controller and augments the vehicle primary flight control system. The inputs to the FTMAP consist of telemetry-downlinked aircraft sensor data. During FTMAP operation, the FTMAP computer replaces normal pilot inputs to the aircraft stick and throttle positions. The FTMAP maneuvers include straight-and-level flight, level accelerations and decelerations, pushover pullups, and windup turns. The pushover pullups can be executed holding throttle or Mach number fixed. The windup turns can be commanded by either normal acceleration

or angle of attack. The operational procedures, control mode configuration, and initial simulation results are discussed. R.J.F.

N83-13116# Perceptronics, Inc., Woodland Hills, Calif.
ANALYSIS AND MODELING OF INFORMATION HANDLING TASKS IN SUPERVISORY CONTROL OF ADVANCED AIRCRAFT Final Technical Report

Y. Y. CHU, K. CHEN, C. CLARK, and A. FREEDY May 1982 123 p refs
(Contract F49620-79-C-0130; AF PROJ. 2313)
(AD-A119067; PFTR-1080-82-5) Avail: NTIS HC A06/MF A01 CSCL 01C

The problems addressed in this study stem from the increasing supervisory loads imposed on the operator in airborne system operations. Future aircraft will be characterized by high information loads, several time constraints, and complex decisions regarding allocation of operator's attention, as well as display resources. The information costs and the limited processing capabilities of the human operator makes it necessary to optimize the information selected, processed, and displayed. Techniques for information selection were developed based on multi-attribute utility models and queuing formulations. These techniques take into account both subjective, individual preference factors and needs of the operator. An experiment was conducted based on a computer-aided, multi-task airborne information-handling situation with different aiding and demand levels. Model-based recommendations led toward superior performance, both in low and high stress situations. The techniques provided an analytic framework that was helpful in identifying the individual operator's information handling strategies. These techniques are expected to be useful in specifying needs and for training operators or systems to efficiently perform information handling tasks. Author (GRA)

N83-13117# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugfuehrung.

THE INFLUENCE OF THE RATIO OF CONTROL FORCE TO CONTROL PATH IN A MINIATURE CONTROL ELEMENT [EINFLUSS DES VERHAELTNISSES STEUERKRAFT ZU STEURWEG BEI EINEM MINIATURISIERTEN BEDIENELEMENT]

W. ROEGER and M. ROHLFS 29 Jan. 1980 46 p refs In GERMAN
(TUBS/FB-80-01-02) Avail: NTIS HC A03/MF A01

For a manual compensation control with two degrees of freedom, the effect of the ratio of control force to the deviation and of the different grip forms was investigated in a miniaturized aircraft control element. Effective values of the control deviation and of the output signal of the control element were measured. As regards force domain, the deviation determined the output signal, while the related control force was changed. For the adjustment domain tests, the output signal resulted from the control force and the related deviation was changed. The force domain shows no effect on the control accuracy. Improvements of the control accuracy show up with larger adjustment domains. The grip form also influences the control accuracy. Author (ESA)

N83-13118# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A CONTRIBUTION TO THE INVESTIGATION OF THE DYNAMIC BEHAVIOR OF A CONTROLLED AIRCRAFT UNDER WIND SHEAR CONDITIONS [EIN BEITRAG ZUR UNTERSUCHUNG DES DYNAMISCHEN VERHALTENS EINES GEREGLTEN FLUGZEUGS UNTER SCHERWINDEINFLUSS]

W. ALLES Jul. 1980 97 p refs In GERMAN
(TUBS/FB-80-07-01) Avail: NTIS HC A05/MF A01

The efficacy of aircraft controllers under wind shear conditions was investigated. Wind shear effects, investigated controller concepts and shear wind types are described. The results of simulation calculations and Boeing 707 flight simulations show that approach endangering by vertical wind shears can be avoided by a forward thrust controller. Flying and flight path errors can be limited by increasing the adjustment and measurement effort,

respectively. Also for automatic flight control, a wind shear indication would be desirable for the pilot. Author (ESA)

N83-13119# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugfuehrung.
PROGRAMMING OF A TRAJECTORY CONTROL CALCULATOR FOR CALCULATION, MANIPULATION AND DESCRIPTION OF 4D FLIGHT TRAJECTORIES [PROGRAMMIERUNG EINES BAHNFUEHRUNGSRECHNERS ZUR BERECHNUNG, MANIPULATION UND DARSTELLUNG VON 4-D-FLUGBAAHNEN]

P. SUNDERMEYER 1981 213 p refs In GERMAN (TUBS/FB-81-08-01) Avail: NTIS HC A10/MF A01

Programs developed for a trajectory control calculator are described. The transformations and treatment of the analytical relations required for the preparation of the programs are documented. The run of the program is illustrated by means of signal flow pictures. The digital calculation program controls, in the form of a continuous process calculation, the data acquisition from external devices and additional calculators, respectively, as well as the data transfer to external devices and calculators, respectively. Data processing and transfer between the real trajectory control calculator and the additional devices and calculators are explained by means of tables. Author (ESA)

N83-13120# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugfuehrung.
NONLINEAR OBSERVERS FOR ESTIMATION OF THE STATE VARIABLES OF AN AIRCRAFT LATERAL MOTION [NICHTLINEARE BEOBACHTER ZUR SCHAETZUNG VON ZUSTANDSGROSSEN DER LAENGSBEWEGUNG EINES FLUGZEUGES]

H. SIEDEL 1981 198 p refs In GERMAN (TUBS/FB-81-11-01) Avail: NTIS HC A09/MF A01

The estimation of the state variables of an aircraft using a nonlinear observer was investigated. The theory of linear and nonlinear observers is presented. The practical development of a nonlinear observer is explained by means of the linearized estimation error equations. The estimation of the state variables of an aircraft lateral motion is treated. The behavior in case of perturbations and the relation between observer construction and measuring goodness of the input variables are discussed. Results show that a nonlinear observer allows the estimation of elevation angle, angle of attack and trajectory angle under certain assumptions. Simulations show that nonlinear observers can be applied in a large flight domain. Author (ESA)

N83-13121# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugfuehrung.
AIRBORNE FLIGHT TRAJECTORY PLANNING AS A NEW PILOT TASK Thesis [BORDSEITIGE FLUGBAHNPLANUNG ALS NEUE PILOTENAUFGABE]

L. HAACK-VOERSMANN 3 Mar. 1982 173 p refs In GERMAN (TUBS/FB-82-04-01) Avail: NTIS HC A08/MF A01

The changes in the pilot tasks required by increasing flight control automation are discussed. Reasons for, and examples of, automation as well as resulting problems are presented. The concept of task sharing between pilot and flight system in determining the flight trajectory was proposed. The system allows the pilot to plan the trajectory in the neighborhood of an airport, using a flight trajectory calculator. A questionnaire including, besides biographical data, mainly the cognitive elements of the pilot function subject to special changes in the framework of automation, was developed and statistically evaluated. Results show that the questioned pilots developed a knowledge of the problems resulting from automation. The realizability of the system is determined. Author (ESA)

RESEARCH AND SUPPORT FACILITIES (AIR)

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

A83-13575
SKY HOOK TO HELP SHIPS LAUNCH HARRIER

D. A. BROWN Aviation Week and Space Technology, vol. 117, Dec. 6, 1982, p. 105, 107.

The Sky Hook launch and recovery system for Harrier-type vectored thrust aircraft, which will permit them to operate from small ships in heavy seas using a deck no larger than a conventional helicopter landing pad, has undergone initial flight testing. The system consists of stabilized, computer-controlled cranes with sensing and locking devices on their mechanical arms which capture and hold hovering aircraft, bring them aboard, and place them on a pallet or tray that would be preloaded with combat stores. The stabilization system of the crane would allow the pickup and locking mechanism to remain space-stabilized with ship motions as great as + or - 15 deg of roll and + or 7 deg of pitch. The ship's maximum roll rate could be as high as 5 sec per half cycle. O.C.

A83-14539#
FEASIBILITY STUDY ON STRAIN GAUGE BALANCES FOR CRYOGENIC WIND TUNNELS AT ONERA

M. DUBOIS (ONERA, Centre d'Essais de Modane, Modane, Savoie, France) (Reunion sur la Technologie Cryogenique, Amsterdam, Netherlands, Sept. 15, 1982.) ONERA, TP no. 1982-87, 1982. 20 p. refs (ONERA, TP NO. 1982-87)

Ten dynamometric test pieces and a three-component sting balance were used in a study of cryogenic wind tunnel strain gauge technology, where the test pieces were fabricated from different materials and fitted with two or three bridges composed of various kinds of strain gauges. The testing of the pieces under bending stresses reached a strain level of 1 mm/m, with cryogenic chamber temperatures in the 100-300 K range. On the basis of test results, materials were selected for the construction of the three-component balance, with balance architecture and gauge equipment designed to reduce the influence of temperature variations to a negligible level. The balance's design allows it to be fitted with controlled heating devices, and will be calibrated in both cold and heated versions prior to certification trials in the ONERA/CERT cryogenic wind tunnel. O.C.

A83-14540#
PRACTICAL PROBLEMS OF DESIGN AND MANUFACTURE OF A 2-D MODEL AND OF THE DEVICE FOR ITS COOLING AND INTRODUCTION INTO THE T2 PRESSURIZED CRYOGENIC INTERMITTENT TUNNEL

P. PACI (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Reunion sur la Technologie Cryogenique, Amsterdam, Netherlands, Sept. 15, 1982.) ONERA, TP no. 1982-88, 1982. 24 p. refs (ONERA, TP NO. 1982-88)

A description is given of the design, fabrication and operational problems which have been surmounted during the development of two-dimensional precooled models for use by the ONERA CERT T2 cryogenic wind tunnel at Toulouse, France. The model must be at the tunnel airflow temperature from the outset of a cryogenic run, in order to avoid thermal exchanges through its skin. This cooling of the model is accomplished in a separate, model precooled box which is located to the side of the test section. A quick translation device integral with the precooled box is used to insert the model into the test section, where it is locked onto the incidence-determining apparatus and the desired pressure and speed are adjusted. Attention is given to the special design

consideration given to the requirement for an 0.1-mm pressure tap diameter and the effects of thermomechanical deformations.

O.C.

A83-14541#

STING LINE FEASIBILITY FOR FORCE MEASUREMENTS IN THE EUROPEAN WIND TUNNEL

M. BAZIN (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Reunion sur la Technologie Cryogenique, Amsterdam, Netherlands, Sept. 15, 1982.) ONERA, TP no. 1982-90, 1982. 20 p.

(ONERA, TP NO. 1982-90)

Apparent contradictions among published results concerning stagnation pressure limitations in model supports for the European Transonic Wind Tunnel (ETW) have prompted the present parametric analysis to ensure that the sting line mounting of the models and accurate force measurements will be possible at high pressure levels and transonic speeds. The modelling technique employed in the analysis uses base diameter and aspect ratio as parameters and makes possible a representation of numerous sting lines with two types of balances. The pressure limitations identified are due to balance capacities, strains, static divergence risk, and model base gap. These have been calculated for the cases of the Airbus airliner and Mirage 2000 fighter aircraft, at a scale that is well adapted to the ETW test section. A dimensional analysis makes possible the use of these results for every homothetical geometry.

O.C.

A83-15309

A NEW USE FOR NWC'S WIND MACHINE - PARACHUTE TESTING

L. R. DEBOLD and D. GOLD (U.S. Naval Weapons Center, China Lake, CA) SAFE Journal, vol. 12, Winter 1982, p. 20-27.

The Naval Weapon Center's High Velocity Airflow System (HIVAS) uses two TF33-P5 turbofan jet engines to provide airflow velocities of up to 570 knots past test specimens mounted on specially designed pads, while a complete instrumentation facility records data peculiar to each test parameter. The facility has been successfully adapted for testing small parachutes under high dynamic pressure conditions, with attention to parachute candidates for a submunition store stabilization/orientation system and drogue parachutes. A description is given of the novel 'fly-away and catch' combination testing arrangement, which allows parachute testing that simulates actual flight conditions.

O.C.

A83-16331#

CHARACTERISTICS OF FLIGHT SIMULATOR VISUAL SYSTEMS

B. L. WELCH (CAE Electronics, Ltd., Montreal, Canada) In: Flight simulation - Avionic systems and aero medical aspects; Proceedings of the International Conference, London, England, April 6, 7, 1982. London, Royal Aeronautical Society, 1982. 7 p. refs

A working group was established in March 1979 to consider and report the characteristics of flight simulator visual systems. The main task of this working group was to identify and define the physical parameters which characterize and determine the fidelity of visual systems, and to recommend techniques for measuring these parameters. A description is provided of the findings of the working group. It was found that considerable progress has been made in visual simulation technology, particularly in the area of computer image generation. However, it is still necessary to make many compromises during the design of a visual system before finding a solution which is both technically sound and economically feasible. The working group concerned itself mainly with the question of which parameters should be measured and how they should be measured. The physical parameters were divided into three basic categories of spatial, energy, and temporal properties corresponding to the fundamental quantities of length, mass, and time.

G.R.

A83-16335#

SIMPLE CIG - AN APPROACH TO VISUAL SIMULATION FOR PROCEDURE TRAINING

L. A. PIETERS In: Flight simulation - Avionic systems and aero medical aspects; Proceedings of the International Conference, London, England, April 6, 7, 1982. London, Royal Aeronautical Society, 1982. 7 p. refs

The Computer Image Generation (CIG) system considered can be installed at low cost, and does not require an expensive database. The block diagram of one of the more complex units of the considered CIG system is presented. The system is almost entirely hardware based and does not use a central processor of the type commonly used in current CIG systems. The employed procedure involves the computation of the instantaneous line of sight from the pilot's eye to the intersection point with the terrain (which is assumed) to be flat, and the utilization of the coordinates of this intersection point for an interrogation of read-only memories which store the terrain and runway data. Attention is given to the visual facilities needed for training, the real-time response, the advantages of a provision of color, target tactical data for military procedural training, the aerobatic capability, the image content, and atmospheric effects.

G.R.

N83-12101# Wills (W. P.), Dallas, Tex.

CURRENT PRACTICES ON NIGHTTIME PAVEMENT CONSTRUCTION ASPHALTIC CONCRETE Final Report

W. P. WILLS Jul. 1982 103 p refs Sponsored by FAA (DOT/FAA-RD-80-121) Avail: NTIS HC A06/MF A01

The magnitude of scheduled airline operations at civil airports has made it imperative that runway repair and overlay with hot mix asphaltic concrete be accomplished at night so as not to interfere with normal airline flight schedules. Technical data and recommended construction practices such as working hours, construction lighting, automatic grade control, standby equipment, compaction, milling, stress absorbing membrane, sawing joints in overlay, construction of transition and other related items are discussed.

Author

N83-12102*# Kentron International, Inc., Hampton, Va. Hampton Technical Center.

EXTRACTION OF MODEL PERFORMANCE FROM WALL DATA IN A 2-DIMENSIONAL TRANSONIC FLEXIBLE WALLED TEST SECTION Final Report

M. J. GOODYER Sep. 1982 22 p refs (Contract NAS1-16000; NSG-7172)

(NASA-CR-165994; NAS 1.26:165994; TO3-TZ20) Avail: NTIS HC A02/MF A01 CSCL 14B

Data obtained from the boundary of a test section provides information on the model contained within it. A method for extracting some of this data in two dimensional testing is described. Examples of model data are included on lift, pitching moment and wake displacement thickness. A FORTRAN listing is also described, having a form suitable for incorporation into the software package used in the running of such a test section.

Author

N83-12103# Naval Training Equipment Center, Orlando, Fla. Advanced Simulation Concepts Lab.

A VISUAL TECHNOLOGY RESEARCH SIMULATOR FOR VERTICAL TAKE OFF AND LANDING (VTOL) Interim Report

J. W. HERNDON 15 Mar. 1982 26 p refs

(AD-A115626; NAVTRAEQUIPCEN-IH-337) Avail: NTIS HC A03/MF A01 CSCL 051

The Visual Technology Research Simulator (VIRS) Vertical Take Off and Landing (VTOL) visual system, including hardware and capabilities, is described.

Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

N83-12104# ARO, Inc., Arnold Air Force Station, Tenn.
THE 1981 CALIBRATION OF THE AEDC-PWT AERODYNAMIC WIND TUNNEL (4T) AT MACH NUMBERS FROM 0.1 TO 1.3 Final Report, 18-24 Mar. 1981
W. LUCHUK, C. F. ANDERSON, and M. L. HOMAN AEDC
Aug. 1982 87 p refs
(AD-A118704; AEDC-TR-82-10) Avail: NTIS HC A05/MF A01
CSCL 14B

The Propulsion Wind Tunnel facility Aerodynamic Wind Tunnel (4T) has been recalibrated. Measurements of the tunnel centerline Mach number distributions and tunnel calibration parameter have been obtained over a Mach number range from 0.1 to 1.3. The bulk of the Mach number measurements was made at a total pressure of 1,200 psfa, with other measurements taken at pressures ranging from 600 to 3,100 at selected Mach numbers. Data were obtained for tunnel wall porosities of 4, 5, and 6 percent over the entire Mach number range and for wall porosities ranging from 1 to 7 percent at selected transonic Mach numbers. Results of previously obtained flow angularity measurements in the test section made over a Mach number range of 0.4 to 1.3 are presented. Effects of honeycomb geometry and asymmetric wall porosity on the mean flow angles and on the standard deviations in flow angles are also presented. Author (GRA)

N83-12105# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
FEASIBILITY OF COMPUTING RESIDUAL DISPLACEMENTS IN RUNWAYS AND CRATER REPAIRS Final Report
L. C. RUDE Apr. 1982 57 p refs
(Contract AF-AFOSR-0102-81; AF PROJ. 2307)
(AD-A118610; AFOSR-82-0669TR) Avail: NTIS HC A04/MF
A01 CSCL 13B

The purpose of this study was to determine the feasibility of computing residual displacements in runways and crater repairs under repeated aircraft loadings. This report presents a methodology for computing residual displacements that is economical and easy to use. It also contains a literature review and a presentation of a second procedure to compute residual displacements. Sample calculations were done to illustrate the first procedure and the results compared favorably with previously published test data. The limitations of the second procedure were also discussed. Author (GRA)

N83-12106# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
RESEARCH ISSUES IN THE DETERMINATION OF SIMULATOR FIDELITY: PROCEEDINGS OF THE ARI SPONSORED WORKSHOP
R. T. HAYS, ed. Nov. 1981 168 p refs Workshop held
23-24 Jul. 1981
(Contract DA PROJ. 2Q1-62717-A-790)
(AD-A118253; ARI-TR-547) Avail: NTIS HC A08/MF A01
CSCL 051

This report is the proceedings from an ARI sponsored workshop on 'Research Issues in Simulator Fidelity.' Papers are included which: (1) state the goals and organization of the workshop, (2) present topics which were addressed during the workshop, (3) summarize the efforts of the working/discussion groups, and (4) summarize the results of the workshop as a whole. Workshop topics included definitional issues, communications issues, research support issues and research methodology issues. Author (GRA)

N83-13122*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
DEVELOPMENT OF CLOSED LOOP ROLL CONTROL FOR MAGNETIC BALANCE SYSTEMS Final Report, Feb. 1978 - Feb. 1982
E. E. COVERT, C. W. HALDEMAN, G. RAMOHALLI, and P. WAY
Hampton, Va. NASA. Langley Research Center Oct. 1982
86 p refs
(Contract NSG-1502)
(NASA-CR-166017; NAS 1.26:166017) Avail: NTIS HC A05/MF
A01 CSCL 14B

This research was undertaken with the goal of demonstrating closed loop control of the roll degree of freedom on the NASA prototype magnetic suspension and balance system at the MIT Aeronautics Laboratory, thus, showing feasibility for a roll control system for any large magnetic balance system which might be built in the future. During the research under this grant, study was directed toward the several areas of torque generation, position sensing, model construction and control system design. These effects were then integrated to produce successful closed loop operation of the analogue roll control system. This experience indicated the desirability of microprocessor control for the angular degrees of freedom. Author

N83-13123# National Aerospace Lab., Tokyo (Japan). Second Aerodynamics Div.
CONSTRUCTION AND PERFORMANCE OF NAL TWO-DIMENSIONAL TRANSONIC WIND TUNNEL
Feb. 1982 52 p refs
(NAL-TR-647T; ISSN-0389-4010) Avail: NTIS HC A04/MF A01

The construction and the results of initial calibration are described for a tunnel built to meet the requirements of high Reynolds number testing of wing sections at transonic regime. This blowdown tunnel has a test section of 0.3m x 1.0m. The required capability of the tunnel is for Mach numbers ranging from 0.2 to 1.2 and for a Reynolds number up to 40 x 100 to the 6th power at Mach number 0.8 with sufficient running time. The design objectives are outlined and the completed facilities, i.e., the wind tunnel, the instrumentation and operation system, the silencer and auxiliary equipment of the air compressor and the air reservoir, are described. The performance of the tunnel is discussed based on experimental results. High Reynolds number effects on the airfoil characteristics are clarified experimentally. Author

N83-13124*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A UNIQUE FLIGHT TEST FACILITY: DESCRIPTION AND RESULTS
R. R. MEYER, JR. Nov. 1982 19 p refs Presented at 13th
Congr. of the Intern. Council of the Aeron. Sci. (ICAS)/AIAA Aircraft
Systems and Technol. Conf., Seattle, 22-27 Aug. 1982
(NASA-TM-84900; NAS 1.15:84900; ICAS-PAPER-82-5.3.3)
Avail: NTIS HC A02/MF A01 CSCL 14B

The Dryden Flight Research Facility has developed a unique research facility for conducting aerodynamic and fluid mechanics experiments in flight. A low aspect ratio fin, referred to as the flight test fixture (FTF), is mounted on the underside of the fuselage of an F-104G aircraft. The F-104G/FTF facility is described, and the capabilities are discussed. The capabilities include (1) a large Mach number envelope (0.4 to 2.0), including the region through Mach 1.0; (2) the potential ability to test articles larger than those that can be tested in wind tunnels; (3) the large chord Reynolds number envelope (greater than 40 million); and (4) the ability to define small increments in friction drag between two test surfaces. Data are presented from experiments that demonstrate some of the capabilities of the FTF, including the shuttle thermal protection system airload tests, instrument development, and base drag studies. Proposed skin friction experiments and instrument evaluation studies are also discussed. Author

N83-13125# Aeronautical Research Labs., Melbourne (Australia).

A PROJECTED LARGE LOW-SPEED WIND TUNNEL TO MEET AUSTRALIAN REQUIREMENTS. AERODYNAMICS NOTE

D. A. LEMAIRE, N. MATHESON, and D. H. THOMPSON Mar. 1982 24 p refs (AD-A118913; ARL/AERO NOTE-410) Avail: NTIS HC A02/MF A01 CSCL 20D

The requirement for a major new Australian low speed wind tunnel is examined in this report and the form such a facility should take is proposed. The existing low speed wind tunnel has been in service for 40 years during which time it has made many valuable contributions to the needs of the military services and the Australian aircraft industry, as well as to many diverse civil needs. All of the locally developed aircraft, targets and drones, guided missiles and free-fall weapons have been extensively tested in this tunnel and numerous investigation have been carried out on non-aeronautical subjects including funnel plumes, flow separations on ships' hulls, flows over airstrips and around buildings, road vehicles and wind generators. During the early sixties the tunnel performance was increased when a new power plant and fan of twice the original capacity were provided. In the seventies a digital data acquisition, recording and control system was installed to increase tunnel productivity and efficiency. However, despite these improvements, the continuing demand for tests of expanding range and diversity has produced a growing need for a larger wind tunnel with improved flow quality. A salient factor has been the increased emphasis in recent years on support for Australian military air operations. GRA

N83-13128# British Aerospace Aircraft Group, Preston (England). Research Test Facility.

MULTI POINT EXCITATION GROUND RESONANCE TEST FACILITY AT BRITISH AEROSPACE WARTON

A. CROFT and T. E. SIMMONS Mar. 1982 16 p (BAE-TN-5411) Avail: Issuing Activity

A mobile facility used for fighter aircraft ground tests is described. It has two 1500N maximum excitation channels, and eight 200N maximum channels, manually or semiautomatically controlled. Data logging is controlled by a PDP 8e minicomputer. Resonant frequency, mode phase shape distribution, structural damping, mode linearity, and generalized mass can be measured. A fast Fourier transformation program is also available.

Author (ESA)

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CHEMISTRY AND MATERIALS

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

A83-13200

ANALYSIS OF BONDED REPAIRS TO DAMAGED FIBRE COMPOSITE STRUCTURES

R. JONES, R. J. CALLINAN, and K. C. AGGARWAL (Defence Science and Technology Organisation, Aeronautical Research Laboratories, Melbourne, Australia) Engineering Fracture Mechanics, vol. 17, no. 1, 1983, p. 37-46. refs

An analytical method for modeling repairs to thin metal structures is extended to the case where the structure is constructed of a fiber composite material. A finite element method is defined for describing the behavior of flaws in thin fiber composite sheets repaired with a bonded overlay. Attention is given to the adhesive used to form the bond, and allowances are made for shear deformation in the skin, adhesive, and patch. Both the skin and patch are assumed to be orthotropic laminates. Examples are provided for the repair of a cracked graphite/epoxy laminate, using either titanium sheets, boron/epoxy, or graphite/epoxy

laminates. The results indicate that unidirectional laminates are most suitable for the repair of cracks in composite laminates, while titanium or quasi-isotropic boron repair can be used with holes in a unidirectional laminate. M.S.K.

A83-13512#

ION IMPLANTING BEARING SURFACES FOR CORROSION RESISTANCE

R. VALORI, D. POPGOSHEV (U.S. Naval Air Propulsion Center, Trenton, NJ), and G. K. HUBLER (U.S. Navy, Naval Research Laboratory, Washington, DC) American Society of Mechanical Engineers and American Society of Lubrication Engineers, Lubrication Conference, Washington, DC, Oct. 5-7, 1982, ASME 8 p. refs (ASME PAPER 82-LUB-23) MEMBERS, \$2.00; NONMEMBERS, \$4.00

A program is currently underway to use ion implantation to improve the tribological and corrosion characteristics of load bearing surfaces in both rolling element bearings and gears used in aircraft propulsion systems. This paper describes that aspect of the program concerned with the use of ion implantation for surface alloying of bearing components in order to alleviate the problem of corrosion in costly M50 steel mainshaft aircraft engine bearings. Results to date indicate that implantation of selected ion species can significantly improve resistance to both generalized and localized (pitting) corrosion without adversely affecting bearing performance or fatigue endurance life. (Author)

A83-15394

THE EFFECT OF LIQUID MEDIA ON THE STRENGTH OF AN ALUMINUM-MATRIX COMPOSITE [VLIANIE ZHIDKIKH SRED NA PROCHNOST' KOMPOZITA S ALIUMINIEVOI MATRITSEI]

M. I. IATSENKO and A. G. VASILENKO (Akademiia Nauk Ukrainskoi SSR, Institut Mekhaniki, Kiev, Ukrainian SSR) Fiziko-Khimicheskaia Mekhanika Materialov, vol. 18, Sept.-Oct. 1982, p. 35-38. In Russian. refs

Specimens of an aluminum/boron composite containing 25-35% of boron fibers by volume were held for 4000 hr in aviation fuel TS-1 and 3% aqueous solution of NaCl and then tested in tension at a crosshead speed of 100 mm/min. It is found that exposure to TS-1 fuel has practically no effect on the composite strength, whereas in 3% NaCl, the strength decreases by 5-12% when the angle between the tensile force and the fibers is 0-15 deg, and up to 20% when this angle is greater than 15 deg. The exposure to 3% NaCl causes strong tubercular and exfoliation corrosion practically over the entire specimen surface, the corrosion products penetrating about 2 microns deep into the matrix. V.L.

A83-15433

DESIGN AND DEVELOPMENT OF CARTRIDGE ACTUATED DEVICE /CAD/ PRIMER

B. F. BEARD (U.S. Navy, Naval Ordnance Station, Indian Head, MD) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 192-195.

A Cartridge Actuated Device (CAD) percussion primer has been designed to replace the small arms ammunition percussion primers currently in use in CADs. The CAD percussion primer was designed for high reliability and to alleviate the problems peculiar to aircrew escape systems. The problems include susceptibility to vibration damage, sensitivity to hardware variability, susceptibility to sensitivity degradation from off-center firing pin strikes, and the lack of an environmental seal. The unique flat anvil design of the CAD percussion primer incorporates full support to the composition alleviating vibration damage, simplified components/assembly, large tolerance to off-center firing pin strikes, and an environmental seal alleviating degradation from contaminants. The design effort included a comprehensive composition study to develop a sensitive composition which is stable at 200 F for long periods of time. The CAD percussion primer is currently under development at the Naval Ordnance Station, Indian Head, Maryland (Author)

A83-15874

COLD-SETTING ADHESIVES FOR REPAIR PURPOSES USING VARIOUS SURFACE PREPARATION METHODS

K. W. ALLEN (City University, London, England), K. B. ARMSTRONG (British Airways, Hounslow, Middx., England), and S. Y. T. CHAN International Journal of Adhesion and Adhesives, vol. 2, Oct. 1982, p. 239-247. refs

The effect of six surface preparation methods on the performance of five adhesives was studied. Comparisons were made using the lap shear test and the Boeing wedge test. It was concluded that only chromic acid etching and anodizing and phosphoric acid anodizing are suitable for permanent primary structure repairs. However, grit blasting and some paste etches may be acceptable for temporary primary structure repairs and for routine secondary structure repairs. Some case histories of actual repairs are included. (Author)

A83-16145

THE EFFECT OF THE JET FUEL TEMPERATURE ON WEAR RATES DURING THE FRICTION OF SLIDING AND ROLLING [VLIANIE TEMPERATURY REAKTIVNYKH TOPLIV NA SKOROST' IZNASHIVANIIA PRI TRENII KACHENIIA S PROSKAL'Z'YVANIEM]

A. F. GORENKOV and E. I. DOMKIN Khimiia i Tekhnologiiia Topliv i Masel, no. 11, 1982, p. 28-30. In Russian.

The effect of the temperature of jet fuels on wear rates during the friction of sliding and rolling has been studied on a laboratory machine for several different fuels (TS-1, T-7, T-8V, and T-6) with and without an antioxidant (lonol, 0.003%). It is found that the wear rate increases with the fuel temperature up to a certain temperature and then decreases. For lonol-free fuels, the maximum wear rates are observed in the range 80-100 C; for fuels containing lonol, the range is 100-110 C. V.L.

N83-12147*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ADVANCED MATERIALS TECHNOLOGY

C. P. BLANKENSHIP, comp. and L. A. TEICHMAN, comp. Nov. 1982 438 p refs Proc. held at Hampton, Va., 16-17 Nov. 1982 Sponsored in cooperation with AIAA (NASA-CP-2251; L-15537; NAS 1.55:2251) Avail: NTIS HC A19/MF A01 CSCL 11G

Composites, polymer science, metallic materials (aluminum, titanium, and superalloys), materials processing technology, materials durability in the aerospace environment, ceramics, fatigue and fracture mechanics, tribology, and nondestructive evaluation (NDE) are discussed. Research and development activities are introduced to the nonaerospace industry. In order to provide a convenient means to help transfer aerospace technology to the commercial mainstream in a systematic manner.

N83-12148*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

OPPORTUNITIES FOR COMPOSITES IN COMMERCIAL TRANSPORT STRUCTURES

H. L. BOHON In its Advan. Mater. Technol. p 1-28 Nov. 1982 refs

Avail: NTIS HC A19/MF A01 CSCL 11D

Manufacturers are developing composite versions of structural components on existing aircraft. Development involves testing of various material options before selecting one and then extensive testing to develop an adequate data base of material strength and stiffness properties. Design options are narrowed through analysis and a varied spectrum of development tests on small and large subcomponents. In parallel with this, a suitable production process including economical ply preparation and cure at high temperature and pressure is evolved, tools are designed and fabricated, and full scale components are then manufactured for ground qualification tests, flight tests, and airline service. The various tests include many that are required by the FAA for flight certification, which must precede airline service. Inspection and repair methods to insure adequate maintenance in service are also developed. S.L.

N83-12150*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

POLYMER MATERIALS RESEARCH AT NASA AMES RESEARCH CENTER

J. A. PARKER, A. H. HEIMBUCH, and W. J. GILWEE In NASA. Langley Research Center Advan. Mater. Technol. p 49-64 Nov. 1982 refs

Avail: NTIS HC A19/MF A01 CSCL 11I

Polymers that provide significant improvements in both efficiency and safety for civilian transport aircraft and military combat aircraft were developed. High strength to weight structures such as carbon fiber composites with long term durability are requirements common to both classes of aircraft. Aircraft safety improvements in fire resistance and crashworthiness of primary and secondary structures are long term objectives for transport aircraft. Void filler ballistic foams, intumescent coatings, and radiation-resistant transparent plastics contribute to vulnerability reduction in combat military aircraft. Low and high velocity impact tolerance, fire resistance, thermal stability, and long term durability of polymers and components are emphasized. S.L.

N83-12151*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

POLYMER MATRIX COMPOSITES RESEARCH AT NASA LEWIS RESEARCH CENTER

T. T. SERAFINI In NASA. Langley Research Center Advan. Mater. Technol. p 65-90 Nov. 1982 refs

Avail: NTIS HC A19/MF A01 CSCL 11I

The in situ polymerization of monomer reactants (PMR) approach was demonstrated to be a powerful approach for solving many of the processing difficulties associated with the use of high temperature resistant polymers as matrix resins in high performance composites. The PMR-15 polyimide provides the best overall balance of processing characteristics and elevated temperature properties. The excellent properties and commercial availability of composite materials based on PMR-15 led to their acceptance as viable engineering materials. The PMR-15 composites are used to produce a variety of high quality structural components. S.L.

N83-12153*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PROCESSING COMPOSITE MATERIALS

R. M. BAUCOM In its Advan. Mater. Technol. p 115-140 Nov. 1982

Avail: NTIS HC A19/MF A01 CSCL 11D

The fabrication of several composite structural articles including DC-10 upper aft rudders, L-1011 vertical fins and composite biomedical appliances are discussed. Innovative composite processing methods are included. S.L.

N83-12156*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ADVANCED POWDER METALLURGY ALUMINUM ALLOYS AND COMPOSITES

W. B. LISAGOR and B. A. STEIN In its Advan. Mater. Technol. p 183-200 Nov. 1982 refs

Avail: NTIS HC A19/MF A01 CSCL 11F

The differences between powder and ingot metallurgy processing of aluminum alloys are outlined. The potential payoff in the use of advanced powder metallurgy (PM) aluminum alloys in future transport aircraft is indicated. The national program to bring this technology to commercial fruition and the NASA Langley Research Center role in this program are briefly outlined. Some initial results of research in 2000-series PM alloys and composites that highlight the property improvements possible are given. R.J.F.

N83-12161*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESEARCH ON ULTRA-HIGH-TEMPERATURE MATERIALS, MONOLITHIC CERAMICS, CERAMIC MATRIX COMPOSITES AND CARBON/CARBON COMPOSITES

T. J. MILLER and H. H. GRIMES *In* NASA. Langley Research Center Advan. Mater. Technol. p 275-292 Nov. 1982 refs

Avail: NTIS HC A19/MF A01 CSCL 11D

Research on three classes of materials that show potential for allowing significant increases in operating temperatures in gas turbine engines is discussed. Monolithic ceramics, ceramic matrix composites, and carbon-carbon composites are discussed. Sintering, hot pressing, and densification are discussed. R.J.F.

N83-12164*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DURABILITY OF AIRCRAFT COMPOSITE MATERIALS

H. B. DEXTERN *In its* Advan. Mater. Technol. p 335-356 Nov. 1982 refs

Avail: NTIS HC A19/MF A01 CSCL 11D

Confidence in the long term durability of advanced composites is developed through a series of flight service programs. Service experience is obtained by installing secondary and primary composite components on commercial and military transport aircraft and helicopters. Included are spoilers, rudders, elevators, ailerons, fairings and wing boxes on transport aircraft and doors, fairings, tail rotors, vertical fins, and horizontal stabilizers on helicopters. Materials included in the evaluation are boron/epoxy, Kevlar/epoxy, graphite/epoxy and boron/aluminum. Inspection, maintenance, and repair results for the components in service are reported. The effects of long term exposure to laboratory, flight, and outdoor environmental conditions are reported for various composite materials. Included are effects of moisture absorption, ultraviolet radiation, and aircraft fuels and fluids. B.W.

N83-12237*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

APPLICATION OF THERMOCHEMICAL MODELING TO AIRCRAFT INTERIOR POLYMERIC MATERIALS Final Report, 30 May 1980 - 30 May 1981

W. DOKKO and K. RAMOHALLI Atlantic City, N.J. FAA Jun. 1982 74 p refs Sponsored by NASA

(Contract DOT-FA80NA)

(NASA-CR-169384; JPL-5030-543; NAS 1.26:169384;

FAA-CT-82-83) Avail: NTIS HC A04/MF A01

This report summarizes the results from a twelve-month study of the feasibility of applying certain basic concepts in thermochemical modeling to aircraft cabin fire safety. The concepts developed earlier on a NASA-sponsored program were applied to six specific tasks dealing with the thermochemical performance of interior carpets and seat cushions. The specific objective was to predict the burning rate as a function of the material property values, geometry and heat flux; more important, it was the aim to predict and provide rationale for certain special features that have been experimentally observed by the FAA. It was also the specific objective to introduce new concepts that have not been the subject of pursuit at other centers. That is, the novel concepts developed at JPL were highlighted. Three fundamental hypotheses were introduced: the condensed phase degradation of the polymeric material is the overall rate-limiting step; the extent of degradation at the vaporization step (at the surface) is not arbitrary but has to be specified by a scientific criterion such as the vapor pressure equilibrium criterion; and the diffusion/mixing of the pyrolysis products with the oxidizer (air) is the rate-limiting step in the vapor phase combustion. B.W.

N83-12246*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ANTIMISTING KEROSENE ATOMIZATION AND FLAMMABILITY

R. FLEETER, R. A. PETERSEN, R. D. TOAZ, A. JAKUB, and V. SAROHIA Jul. 1982 182 p refs

(Contract FA-03-80-A-00215)

(NASA-CR-169385; NAS 1.26:169385; JPL-PUB-82-40;

DOT/FAA-CT-82-19; AD-A120671) Avail: NTIS HC A09/MF A01

Various parameters found to affect the flammability of antimisting kerosene (Jet A + polymer additive) are investigated. Digital image processing was integrated into a technique for measurement of fuel spray characteristics. This technique was developed to avoid many of the error sources inherent to other spray assessment techniques and was applied to the study of engine fuel nozzle atomization performance with Jet A and antimisting fuel. Aircraft accident fuel spill and ignition dynamics were modeled in a steady state simulator allowing flammability to be measured as a function of airspeed, fuel flow rate, fuel jet Reynolds number and polymer concentration. The digital imaging technique was employed to measure spray characteristics in this simulation and these results were related to flammability test results. Scaling relationships were investigated through correlation of experimental results with characteristic dimensions spanning more than two orders of magnitude. S.L.

N83-12248*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FRICIONAL CHARACTERISTICS AND HEAT TRANSFER OF ANTIMISTING FUELS IN TUBES Final Report, Aug. 1980 - Sep. 1981

J. WAT and V. SAROHIA Aug. 1982 70 p refs

(Contract NAS7-100; DTFA03-80-A-00215)

(NASA-CR-169388; JPL-PUBL-82-53; NAS 1.26:169388;

FAA-CT-82-20) Avail: NTIS HC A04/MF A01

The modification in flow and heat transfer behavior caused by the presence of the antimisting polymer additive FM-9 in jet fuel was determined. The antimisting kerosene (AMK) skin friction versus Reynolds number, or Nusselt number versus Reynolds number behavior, can be divided into three regions: (1) Newtonian laminar region, (2) shear-thickening transition region, and (3) drag reduction turbulent region. At low flow rates, AMK has Newtonian behavior, i.e. constant viscosity. At a certain critical wall shear rate which depends on the fuel temperature and additive concentration, shear thickening occurs and causes a large increase in skin friction and heat transfer rates. In the third region, the skin friction and heat transfer rates drop rapidly and fall below the predicted Newtonian flow skin friction and heat transfer values; e.g., for 0.3 percent FM-9 AMK at a temperature of 20 C, these values coincide with Newtonian values at solvent Reynolds number, equal to 2.2×10 to the 4th power and $1.0 \times$ to the 4th power. Beyond these points, there is a reduction in skin friction and heat transfer rates. Author

N83-12252# Battelle Columbus Labs., Ohio.

ANALYTICAL TECHNIQUES FOR AROMATIC COMPONENTS IN AIRCRAFT FUELS Final Technical Report, 15 Jun. 1978 - 30 Sep. 1981

J. S. WARNER, T. H. DANISON, and J. S. MCNULTY Wright-Patterson AFB, Ohio AFWAL May 1982 155 p refs

(Contract F33615-78-C-2019; AF PROJ. 3048)

(AD-A118838; AFWAL-TR-82-2015) Avail: NTIS HC A08/MF

A01 CSCL 21D

An ultraviolet detector was shown to be highly satisfactory for the selective determination of aromatic components in jet fuels. The detector was operated at 208 nm and used with a fused silica capillary column gas chromatographic system. The detector gave a linear response in the range of interest and could detect individual benzenes and naphthalenes in jet fuels at levels down to 0.01% and 0.002% respectively. Nitrogen-containing compounds were determined by the use of an alkali flame detector, high

11 CHEMISTRY AND MATERIALS

pressure liquid chromatography, and mass spectrometry.

Author (GRA)

N83-13174*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF LIGHTWEIGHT, FIRE RETARDANT, LOW SMOKE, THERMALLY STABLE, HIGH STRENGTH FLOOR PANELING: PASSENGER FLOOR PANELS Final Report

F. J. GORGES 1982 46 p refs

(Contract NAS9-16400)

(NASA-CR-167770; NAS 1.26:167770; D6-51689) Avail: NTIS
HC A03/MF A01 CSCL 11D

A fire retardant, low smoke-emitting, thermally stable, light weight sandwich paneling, suitable for high traffic flooring on a passenger aircraft, was evaluated. The material is of sandwich panel construction, with graphite face sheets (a phenolic-vinyl resin) and honeycomb core. The lower side of the paneling is coated with a Fluorel elastomer L-4805, which provides an additional fire barrier, as well as reduced noise transmission. S.L.

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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.

A83-13133*# Ohio State Univ., Columbus.

A SIMILARITY ANALYSIS OF THE DROPLET TRAJECTORY EQUATION

M. B. BRAGG (Ohio State University, Columbus, OH) AIAA Journal, vol. 20, Dec. 1982, p. 1681-1686. refs
(Contract NAG3-28)

A procedure is established to reduce the number of similarity parameters in the trajectory equation for particles in a moving fluid. This is accomplished by the use of an approximate sphere drag law to derive a new trajectory scaling parameter. The modified inertia parameter proposed by Langmuir specifically for the aircraft icing problem is analyzed and for the first time a closed-form solution is obtained. Both experimental and analytical results are presented to verify this new trajectory scaling parameter.

(Author)

A83-13234
WEAR AND FRICTION OF HIGH-TEMPERATURE SELF-LUBRICATING COMPOSITES

P. SUTOR (Midwest Research Institute, Wright-Patterson AFB, OH) American Society of Mechanical Engineers and American Society of Lubrication Engineers, Lubrication Conference, Washington, DC, Oct. 5-7, 1982, ASLE 7 p. refs
(Contract F33615-80-C-5190)

(ASLE PREPRINT 82-LC-2B-2) MEMBERS, \$2.00;
NONMEMBERS, \$2.00

Recent efforts to design and fabricate self-lubricating composites capable of 316 C (600 F) service in gas turbine engine bearings have resulted in several promising new materials. Wear and friction bench tests of two advanced composites, containing cured WSe₂/Ga/In lubricant bound in a polyimide resin and reinforced with a 3D weave of carbon fibers, were conducted and compared to results for a MoS₂-containing baseline composite. The advanced formulations demonstrated a 2 to 10-fold improvement in wear and 2- to 6-fold improvement in friction over the MoS₂ baseline. An empirical wear rate equation proved useful for material comparison and visualization of wear rate variation with load and velocity variables. (Author)

A83-13239

THE LOAD-LIFE RELATIONSHIP FOR M50 STEEL BEARINGS WITH SILICON NITRIDE CERAMIC BALLS

F. R. MORRISON, J. I. MCCOOL, T. M. YONUSHONIS (SKF Industries, Inc., King of Prussia, PA), and P. WEINBERG (U.S. Navy, Naval Air Command, Washington, DC) American Society of Mechanical Engineers and American Society of Lubrication Engineers, Lubrication Conference, Washington, DC, Oct. 5-7, 1982, ASLE 7 p. refs

(ASLE PREPRINT 82-LC-3C-4) MEMBERS, \$2.00;
NONMEMBERS, \$4.00

The rolling contact bearings which are used to support gas turbine engine shafts present a problem because of inherently high operating temperatures and speeds. Innovative approaches will be needed to assure that the bearing does not become the component limiting the improvement of turbine engine efficiency. One approach considered involves the use of ceramic bearing materials, such as hot-pressed silicon nitride. Significant performance improvements can be achieved in current systems by using hybrid bearing assemblies comprised of steel rings and ceramic rolling elements. A description is provided of the results and analysis of the initial low-speed endurance tests conducted at four loads on hybrid angular contact ball bearings having silicon nitride balls and rings made of vacuum induction-melted, vacuum arc-remelted (VIMVAR) M50 steel. G.R.

A83-13490#

FAIL-SAFE OPTIMAL DESIGN OF COMPLEX STRUCTURES WITH SUBSTRUCTURES

D. T. NGYUEN and J. S. ARORA (Iowa, University, Iowa City, IA) ASME, Transactions, Journal of Mechanical Design, vol. 104, Oct. 1982, p. 861-868. Army-supported research. refs

In this paper, the problem of fail-safe design of complex structural systems is considered. A substructural formulation for this class of design problems is presented. Constraints are imposed on stresses, deflections, natural frequency, and member sizes. It is shown that a structure can be designed to withstand the projected future damage. It is also shown that the substructural formulation offers computational advantage for both structural analysis and design sensitivity analysis parts of an optimal design algorithm. Fail-safe designs of open truss and closed helicopter tailbooms are obtained using a program developed based on the substructural formulation. (Author)

A83-13521*# Texas A&M Univ., College Station.
FINITE-LENGTH SOLUTIONS FOR ROTODYNAMIC COEFFICIENTS OF TURBULENT ANNULAR SEALS

D. W. CHILDS (Texas A & M University, College Station, TX) American Society of Mechanical Engineers and American Society of Lubrication Engineers, Lubrication Conference, Washington, DC, Oct. 5-7, 1982, ASME 8 p. refs
(Contract NAS8-33716; NAG3-181)

(ASME PAPER 82-LUB-42) MEMBERS, \$2.00; NONMEMBERS, \$4.00

A finite-length solution procedure is developed for perturbation equations which are based on Hirs' (1973) turbulent lubrication model. The equations apply to small motions about a centered position and include the influence of swirl and changes in Reynolds number due to perturbations in clearances. Numerical results are presented for a range of L/D ratios, with and without swirl. For zero swirl, changes in the L/D ratios show results which are similar to those obtained by Black and Jenssen (1970), but when L/D = 1, differences of about 15 percent appear. The results including swirl give physically insupportable results at small L/D ratios, such as a negative cross-coupled stiffness coefficient at L/D = 0.2. This result demonstrates that the complete Hirs turbulence model is not suitable for short seals with significant swirling flow. C.D.

A83-13907

PREDICTION CAPABILITY AND IMPROVEMENTS OF THE NUMERICAL NOTCH ANALYSIS FOR FATIGUE LOADED AIRCRAFT AND AUTOMOTIVE COMPONENTS

H. NOWACK (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Werkstoff-Forschung, Cologne, West Germany), D. HANSCHMANN, G. LUETJERING (Hamburg, Technische Universitaet, Hamburg, West Germany), G. JACOBY (Schenck AG, Darmstadt, West Germany), and J. FOTH In: Low-cycle fatigue and life prediction. Philadelphia, PA, American Society for Testing and Materials, 1982, p. 269-295. Research supported by the Deutsche Forschungsgemeinschaft. refs

Improved fatigue life prediction methods are needed in connection with the objective to obtain light-weight constructions of greater efficiency. In the 'companion specimen method' described by Crews and Hardrath (1966), local stresses and strains are determined by an approach involving the use of a notched and an unnotched specimen. The most practical derivative of the companion specimen method is the numerical notch analysis. In the present investigation the prediction capability of the conventional notch analysis for the crack initiation stage is considered. A damage calculation scheme which considers load sequence effects on the damage accumulation is proposed. It is found in the investigation, that the main causes of the unsatisfactory results of the conventional notch analyses (large scatter bands in the predictions) are inadequate consideration of the sequence effects and the disregard of the different initiation behavior of small cracks at notches and at unnotched specimens. G.R.

A83-14485#

THE MULTILEVEL SUBSTRUCTURE AND THE LOCAL ANALYSIS OF STRUCTURE

J.-B. CHEN and Y.-Z. CAI Acta Mechanica Solida Sinica, Aug. 1982, p. 325-338. In Chinese, with abstract in English. refs

An analytical method for a multilevel substructure is presented, together with a local analysis technique of structures. Emphasis is placed on the local symmetry of structure, on protruding structure, and the local identity structure. Descriptions are provided of the local structure modification and the mesh refinement, and basic formulas for analyzing a local symmetry are derived. The local analysis technique is noted to reduce the required computing time, in addition to facilitating flexibility in modeling an ideal structure. M.S.K.

A83-14528#

APPLICATIONS OF FLOW VISUALIZATION TECHNIQUES IN AERODYNAMICS

C. M. VERET (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (International Congress on High Speed Photography and Photonics, 15th, San Diego, CA, Aug. 21-27, 1982.) ONERA, TP no. 1982-68, 1982. 7 p. (ONERA, TP NO. 1982-68)

Optical techniques for flow visualization are valuable in that they are nonintrusive and offer a global view of a given flowfield which aids in the interpretation of local measurements with hot wires, pitot tubes, etc. New applications of laser light-based optical techniques are presently explored, including holographic interferometry, used in the millisecc-microsecc domain to analyze supersonic boundary layer turbulence, and the illumination of smoke - seeded subsonic flows by a laser beam that has been enlarged in one dimension by a cylindrical lens to form a light sheet. This latter technique is applied to the study of vortices in the microsecc-nanosecc domain. O.C.

A83-14533#

ROTATION AND CURVATURE EFFECTS ON REYNOLDS STRESSES IN BOUNDARY-LAYERS

J. COUSTEIX and B. AUPOIX (ONERA, Centre d'Etudes et de Recherches de Toulouse, Toulouse, France) (Symposium International sur la Modelisation Fine des Ecoulements, Paris, France, Sept. 7-10, 1982.) ONERA, TP no. 1982-81, 1982. 11 p. refs

(ONERA, TP NO. 1982-81)

Rotation effects on Reynolds stresses in boundary layers are studied by using Reynolds stress equations modelled in a rotating reference system. The resulting equations are applied to particular cases in which the rotation vector is either parallel or perpendicular to the plane of mean shear. Using a few simplifying hypotheses, Reynolds stresses are expressed by means of algebraic formulas from which rotation effects can be demonstrated. It is found that the rotation and curvature effects contribute significantly even for small values of rotation parameters. Thus, the classic hypothesis which consists of keeping terms in du/dy in Reynolds stress equations is a too restrictive hypothesis; any extra rate of strain needs to be kept in Reynolds stress equations even if it is small compared with du/dy . An analogy is also demonstrated between the effects of longitudinal wall curvature in the case of a stationary body and the effects of rotation of a two-dimensional boundary layer. C.D.

A83-14576

EXPERIMENTS ON THE ROLE OF AMPLITUDE AND PHASE MODULATIONS DURING TRANSITION TO TURBULENCE

R. W. MIKSAD, F. L. JONES, E. J. POWERS, Y. C. KIM, and L. KHADRA (Texas, University, Austin, TX) Journal of Fluid Mechanics, vol. 123, Oct. 1982, p. 1-29. refs

(Contract F49620-77-C-0101; NSF MEA-78-00719)

Transition measurements were made in the two-dimensional laminar wake of a thin airfoil (maximum thickness 3 mm, length 20 cm) in a 20 x 20 x 120 cm test section of a low-turbulence wind tunnel in order to establish the role of amplitude and phase modulations in the spectral-broadening and energy-redistribution process. The measurements show that the fluctuating velocity field produced by multiply interacting instabilities in the wake can be described in terms of a dominant instability mode whose amplitude and phase are simultaneously modulated by low-frequency fluctuations. The results also indicate that amplitude and phase modulations are produced by nonlinear interactions involving a low-frequency difference mode and suggest that this is one of the basic features that a dynamical model should account for. V.L.

A83-14620#

APPLICATION OF FATIGUE-STRENGTH ANALYSIS TO THE EVALUATION OF THE CONSEQUENCES OF LOCAL DAMAGE AND THE EFFECTS OF WING-SHELL REPAIRS. III - AN EXAMPLE OF THE APPLICATION OF FATIGUE-STRENGTH ANALYSIS USING A SPECIFIC FATIGUE WEAR [ZASTOSOWANIE ANALIZY TRWALOSCI ZMECZENIOWEJ DO OCENY SKUTKOW USZKODZEN LOKALNYCH I EFEKTOW NAPRAW POWLOK SKRZYDLA. III - PRZYKLAD STOSOWANIA ANALIZY TRWALOSCI ZMECZENIOWEJ Z WYKORZYSTANIEM JEDNOSTKOWEGO ZUZYCIA ZMECZENIOWEGO]

S. DANILECKI (Warszawa, Politechnika, Warsaw, Poland) Technika Lotnicza i Astronautyczna, vol. 37, Sept. 1982, p. 23-26. In Polish. refs

A83-14726

PROBLEMS OF THE STATICS AND DYNAMICS OF MODERN ENGINEERING STRUCTURES - CURRENT STATUS AND PROSPECTS [O PROBLEMAKH STATIKI I DINAMIKI SOVREMENNYKH INZHENERNYKH KONSTRUKTSII - SOSTOIANIE VOPROSA, NOVYE PROBLEMY I PERSPEKTIVY]

I. F. OBRAZTSOV Problemy Prochnosti, Nov. 1982, p. 3-11. In Russian. refs

Problems related to the statics and dynamics of complex thin-walled structures, such as those used in aircraft, space vehicles, power generation systems, and pipelines, are reviewed.

The discussion covers computer-aided analysis of the static and dynamic strength of modern aircraft structures, nonlinear vibrations of cylindrical shells with imperfections, vibrations of flexible shells with liquid flows, and the dynamics and strength of the structures of nuclear power plants. Particular attention is given to the development of mathematical models for mechanical systems on the basis of experimental results. V.L.

A83-15160
AN ENHANCEMENT FOR THE ULTRASONIC TEST BED TO INSPECT ENGINE DISK BOLT HOLES

R. C. ADDISON (Rockwell International Science Center, Thousand Oaks, CA) In: Review of progress in quantitative nondestructive evaluation. Volume 1 - Proceedings of the Eighth U.S. Air Force/Defense Advanced Research Projects Agency Symposium on Quantitative Nondestructive Evaluation, Boulder, CO, August 2-7, 1981. New York, Plenum Press, 1982, p. 97-105. refs (Contract MDA903-80-C-0641)

The quantitative flaw definition program described has demonstrated novel techniques for the sizing of flaws. These techniques have been extended from the idealized geometries, transducer bandwidths, and SNRs used in an earlier research program to situations involving parameters which are more representative of real parts. A hybrid technique consisting of optical and ultrasonic inspection is proposed in pursuit of a 'retirement for cause' strategy in aircraft gas turbine engine disks. The initial, optical approach uses magnifications up to 50X, providing the detection sensitivity needed for small cracks. The microscope output will then be coupled to an image analyzer which automatically scans each frame for crack-like features and retains their number, length and location. These features are then inspected ultrasonically, providing detailed quantitative data.

O.C.

A83-15191
MULTISEGMENT EDDY CURRENT PROBE

W. SHEPPARD, D. MIH, and K. TAM (Northrop Corp., Hawthorne, CA) In: Review of progress in quantitative nondestructive evaluation. Volume 1 - Proceedings of the Eighth U.S. Air Force/Defense Advanced Research Projects Agency Symposium on Quantitative Nondestructive Evaluation, Boulder, CO, August 2-7, 1981. New York, Plenum Press, 1982, p. 395-398.

Extensive use of aircraft beyond specification lifetimes has increased the probability of fatigue cracking of critical aircraft structures. A factor of particular concern is related to the development of cracks radiating from fastener holes. Problems arise regarding the employment of an appropriate inspection method. Inspection techniques are needed which do not require the removal of the fastener. A disadvantage of the ultrasonic method is related to the absence of a second layer inspection capability. Low frequency eddy current techniques employing a single element probe penetrate the second layer, but suffer from other drawbacks. The present investigation is concerned with the development of a suitable inspection method for the considered problem. The developed method is based on the employment of low frequency eddy currents. A multisegment approach is employed to overcome the drawbacks of an eddy-current method using a single element probe. G.R.

A83-15192
NDE OF FASTENER HOLE CRACKS BY THE ELECTRIC CURRENT PERTURBATION METHOD

C. M. TELLER and G. L. BURKHARDT (Southwest Research Institute, San Antonio, TX) In: Review of progress in quantitative nondestructive evaluation. Volume 1 - Proceedings of the Eighth U.S. Air Force/Defense Advanced Research Projects Agency Symposium on Quantitative Nondestructive Evaluation, Boulder, CO, August 2-7, 1981. New York, Plenum Press, 1982, p. 399-403; Discussion, p. 403. USAF-supported research.

Progress in the application of the electric current perturbation (ECP) method to NDE of fastener hole fatigue cracks is reviewed. Results are presented of recently completed experiments on simple laboratory specimens as well as a C-5A wing splice joint specimen

with simulated fatigue cracks (saw slots) in the second layer. These results confirm that the ECP method is capable of detecting slots in the size range of 2.54 mm radial length or larger through outer layer thicknesses up to 6.35 mm with titanium or steel fasteners installed. Preliminary results of rapid inspection using linear scanning are also presented. (Author)

A83-15198
ESTABLISHING SIGNAL PROCESSING AND PATTERN RECOGNITION TECHNIQUES FOR INFIGHT DISCRIMINATION BETWEEN CRACK-GROWTH ACOUSTIC EMISSION AND OTHER ACOUSTIC WAVEFORMS

P. HORVATH and F. J. COOK (Adaptronics, Inc., McLean, VA) In: Review of progress in quantitative nondestructive evaluation. Volume 1 - Proceedings of the Eighth U.S. Air Force/Defense Advanced Research Projects Agency Symposium on Quantitative Nondestructive Evaluation, Boulder, CO, August 2-7, 1981. New York, Plenum Press, 1982, p. 463-473. DARPA-supported research. refs

The purpose of this ongoing program is to develop signal processing and pattern recognition algorithms to discriminate crack-growth acoustic emissions from other innocuous, extraneous acoustic sources. To date, more than a dozen laboratory experiments have been performed to record thousands of crack-growth and noise waveforms on aircraft structural aluminum plates of different geometries and alloy compositions. The problem was separated into four stages, each solved in an automatic mode: detection of signal in background noise, windowing of various parts of the signal, feature extraction, and classification. The algorithms were designed keeping the limitations and requirements of real-time implementation in mind. An approach to pattern recognition and modeling known as the Adaptive Learning Network methodology was used to select the most important features from the candidate feature list and to derive nonlinear classification functions. The preliminary results indicate that optimum combinations of temporal and spectral features result in significantly improved acoustic emission signal identification. (Author)

A83-15211
CHARACTERIZATION OF NDE RELIABILITY

A. P. BERENS and P. W. HOVEY (Dayton, University, Dayton, OH) In: Review of progress in quantitative nondestructive evaluation. Volume 1 - Proceedings of the Eighth U.S. Air Force/Defense Advanced Research Projects Agency Symposium on Quantitative Nondestructive Evaluation, Boulder, CO, August 2-7, 1981. New York, Plenum Press, 1982, p. 579-585; Discussion, p. 586. refs (Contract F33615-80-C-5140)

While NDE reliability is usually quantified in terms of the probability of crack detection (POD) as a function of crack length, crack qualities other than length influence the effectiveness of an NDE system to the point that different cracks of the same length will have different chances of giving a positive crack indication. By postulating a distribution of probabilities for the population of all conceptual cracks of each crack length, the POD can be shown to be the mean of the distribution of probabilities and may therefore be modeled by regression analysis. Data from a recent U.S. Air Force study on NDE reliability are used to establish a POD model and estimate parameters which are easily analyzed by means of two different procedures. O.C.

A83-15321*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

DESIGN FOR GLOBAL DAMAGE TOLERANCE AND ASSOCIATED MASS PENALTIES

R. T. HAFTKA (Virginia Polytechnic Institute and State University, Blacksburg, VA), J. H. STARNES, JR., and S. NAIR (Illinois Institute of Technology, Chicago, IL) Journal of Aircraft, vol. 20, Jan. 1983, p. 83-88. refs

(Contract NAG1-5)

A structural design with global damage tolerance is defined as a design that can tolerate the destruction of one or more major structural components. The mass penalty associated with improving

the global damage tolerance of optimized structures is evaluated herein for structures typically used in aircraft wing construction. It is shown that this mass penalty is strongly related to the degree of redundancy of the structure, being most severe for structures of low redundancy. For highly redundant wing-box structures made of composite materials, it is shown that significant improvement in global damage tolerance may be achieved without any mass penalty. (Author)

**A83-15415
COMPUTERIZED DESIGN OF CAD**

B. E. PAUL and T. A. PHAM (Scot, Inc., Downers Grove, IL) In: SAFE Association, Annual Symposium, 19th, Las Vegas, NV, December 6-10, 1981, Proceedings. Van Nuys, CA, SAFE Association, 1982, p. 79-83.

A computerized ballistic design technique for CAD/PAD is described by which a set of ballistic design parameters are determined, all of which satisfy a particular performance requirement. In addition, the program yields the remaining performance predictions, so that only a very few computer runs of the design program can quickly bring the ballistic design within the specification limits prescribed. An example is presented for a small propulsion device, such as a remover or actuator, for which the input specifications define a maximum allowable thrust and minimum end-of-stroke velocity. The resulting output automatically satisfies the input requirements, and will always yield an acceptable ballistic design. C.D.

**A83-15545#
A PROGRAM SYSTEM FOR DYNAMIC ANALYSIS OF AERONAUTICAL STRUCTURES /HAJIF-II/
D. GUAN** Acta Aeronautica et Astronautica Sinica, vol. 3, Sept. 1982, p. 25-33. In Chinese, with abstract in English. refs

Performance features of the HAJIF-II program system for calculating the modal characteristics of aircraft structures, in addition to flutter and gust response analysis, are described. Up to 99 substructures with 7000 degrees of freedom each are included in the program set, which also has a capability to handle 300 panels for studying unsteady aerodynamic forces and 50 modes for analyzing flutter and gust response. A total of 31 computational flows are available for tailored use, and a structure can be either discretized or simulated as a single spar. An algorithm is included for real eigenvalue problems, and two synthesis methods are available. The HAJIF-II system contains 26,000 FORTRAN IV statements and uses functional modules to facilitate modification and extension. Additionally, the system incorporates an advanced file management scheme. M.S.K.

**A83-15546#
SYSTEM IDENTIFICATION AND AIRCRAFT FLUTTER
L. ZHANG** (Nanjing Aeronautical Institute, Nanjing, People's Republic of China) Acta Aeronautica et Astronautica Sinica, vol. 3, Sept. 1982, p. 33-41. In Chinese, with abstract in English. refs

The use of system identification for aircraft flutter analysis is reviewed and three new methods of system identification are introduced. All modal parameters are shown to be obtainable from the transfer function method, based on a complex modal analysis, and an optimization technique. The methods are shown effective with raw experimental data from artificial random or transient excitation, and from response data from natural random excitation, using what are called the Impulse Function Method and the Autoregressive Moving Average Method, both time domain methods. M.S.K.

**A83-16028
HELICOPTER VIBRATION REDUCTION BY LOCAL STRUCTURAL MODIFICATION**

B. P. WANG, L. KITIS, W. D. PILKEY (Virginia, University, Charlottesville, VA), and A. B. PALAZZOLO (Southwest Research Institute, San Antonio, TX) American Helicopter Society, Journal, vol. 27, July 1982, p. 43-47. Army-supported research. refs

The problem of vibration reduction in helicopter design is addressed by the results obtained by an efficient numerical method for vibrating structure frequency response calculation as a function of structural properties. A sensitivity analysis is then conducted to determine which structural element changes are most useful in vibration reduction. This course constitutes an alternative to the Vincent circle and strain energy approaches to sensitivity, and is used to obtain numerical results illustrative of the method's usefulness for the specific case of an elastic line helicopter model. O.C.

**A83-16122#
EFFECTIVE ELECTROMAGNETIC SHIELDING IN MULTILAYER PRINTED CIRCUIT BOARDS**

K. G. WILES and J. L. MOE (General Dynamics Corp., Fort Worth, TX) (Digital Avionics Systems Conference, 4th, St. Louis, MO, November 17-19, 1981, Collection of Technical Papers, p. 593-596.) Journal of Guidance, Control, and Dynamics, vol. 6, Ja2.-Feb. 1983, p. 61, 62.

(Previously cited in issue 03, p. 365, Accession no. A82-13528)

**A83-16198
ENGINEERING SAFETY ANALYSIS VIA DESTRUCTIVE NUMERICAL EXPERIMENTS**

E. HAUG (Engineering System International, Rungis, France) Rozprawy Inzynierskie, vol. 29, no. 1, 1981, p. 39-49.

The paper presents an overview of numerical methods used for the analysis of crash, impact, penetration/perforation, and explosion problems relevant to safety considerations in automotive, naval, aerospace, nuclear, and civil engineering industries. Current numerical methods are discussed, emphasizing the success of mixed approaches where initial physical testing and numerical analysis for program validation are equally important, particularly in cases involving as yet unexplored and complex phenomena. Typical examples of problems solved in the mentioned categories are presented. V.L.

A83-12167*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TRIBOLOGY
D. H. BUCKLEY In NASA. Langley Research Center Advan. Mater. Technol. p 391-410 Nov. 1982 refs
Avail: NTIS HC A19/MF A01 CSCL 20K

The adhesion, friction, and wear properties of materials are reviewed and some of the factors influencing these properties are discussed. The forms of lubrication and types of lubricants will also be discussed. B.W.

A83-12266# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

APPLICATION OF STRAIN GAUGES AND THERMOCOUPLES TO ROTATING AND STATIONARY HARDWARE
R. DEROSE In Von Karman Inst. for Fluid Dyn. Meas. Tech. in Turbomachines 16 p 1981 refs
Avail: NTIS HC A23/MF A01

The application of strain gages in a reliable manner to rotating turbomachinery airfoils is discussed. The method described is designed for use on integral rotors at temperatures below approximately 225 C. Low temperature applications of polyimide strain gages below 260 C are discussed. E.A.K.

N83-12267# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

SIGNAL TRANSMISSION VIA SLIPRINGS AND TELEMETRY
R. DEROSE *In* Von Karman Inst. for Fluid Dyn. Meas. Tech. in Fluid Dyn. 46 p 1981
Avail: NTIS HC A23/MF A01

Problems in turbomachinery instrumentation and the recovery of data from high speed rotors are examined. Either telemetry or slip rings are used to obtain data. The only viable method of recovering core rotating data is with the use of a telemetry system, since a slip ring which requires access to the end of the high speed spool shaft is unavailable. This situation will usually exist in multispool machines. Fan rotating data, on the other hand, are obtained by a slip ring or a telemetry system. System measurement capacity is considered. The best current high speed slip ring can handle 100, two wire signals, either strain or temperature, in any mix. The latest telemetry system has a limit of 40 channels of dynamic strain. Thermocouple transmitters can multiplex up to six temperature measurements per channel. E.A.K.

N83-12270# Cranfield Inst. of Tech., Bedfordshire (England). School of Mechanical Engineering.

INITIAL FINDINGS DURING STUDIES OF THE FLOW WITHIN A HIGH SPEED IMPELLER USING A TRANSIT ANEMOMETER
M. E. GILL, C. FORSTER, and R. L. ELDER *In* Von Karman Inst. for Fluid Dyn. Meas. Tech. in Turbomachines 15 p 1981 refs Presented at the 4th Intern. Conf. on Photon Correlation Tech. in Fluid Mech., Stanford, Calif., Aug. 1980
Avail: NTIS HC A23/MF A01

Problems involved in conducting flow measurements at blade frequencies of up to 24 KHz and within very small passages are addressed. Some results are shown of measurements taken just outside a centrifugal compressor impeller using an oblique forward scatter Doppler system. The development of a two spot capability which was established to provide measurements within rotating blade passages where a forward view is not possible is also discussed. M.G.

N83-12271# Glasgow Univ. (Scotland). Dept. of Aeronautics and Fluid Mechanics.

MEASUREMENT TECHNIQUES FOR HEAT TRANSFER IN THE TURBINE USING SHORT DURATION WIND TUNNEL TECHNIQUES

B. E. RICHARDS *In* Von Karman Inst. for Fluid Dyn. Meas. Tech. in Turbomachines 41 p 1981 refs
Avail: NTIS HC A23/MF A01

Heat transfer measurement techniques used in conjunction with short duration (under 1 sec.) wind tunnel methods are discussed. Particular emphasis is given to the isentropic light piston concept and its use in cascade tunnels. The use of one such cascade tunnel in the measurement of film cooling effectiveness in gas turbines is described. M.G.

N83-12272# National Aerospace Lab., Amsterdam (Netherlands).

LASER DOPPLER MEASUREMENTS IN TRANSPARENT PUMP IMPELLERS

H. KANNEMANS *In* Von Karman Inst. for Fluid Dyn. Meas. Tech. in Turbomachines 50 p 1981 refs
Avail: NTIS HC A23/MF A01

Two different shrouded fully transparent pump impellers with thin backswept blades were built and the velocity distribution in the rotating flow channel was measured using a laser Doppler velocimeter. One impeller was two dimensional and radial; the other one was of the mixed-flow type. Two components of the velocity were measured at different radial cross sections and for different flow rates. The results show that the flow is highly influenced by viscous effects. In the radial impeller experimental data and potential flow theory calculations agree at medium and high flow rate. M.G.

N83-12273# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Groupe de Recherches.

MEASUREMENT TECHNIQUES IN TURBOMACHINES, ULTRATHIN TRANSDUCERS APPLIED TO MEASUREMENTS IN TURBOMACHINES

J. PAULON, M. PORTAT, J. C. GODEFROY, and E. SZECHENYI *In* Von Karman Inst. for Fluid Dyn. Meas. Tech. in Turbomachines 27 p 1981 refs
Avail: NTIS HC A23/MF A01

A set of thin film transducers of three types intended respectively for the measurement of pressures, temperatures, and heat fluxes are described. In parallel with the results obtained with these transducers, some information on the use of more conventional thin transducers during studies of aeroelasticity and of the operation of a compressor in transient regime is presented. M.G.

N83-12274# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. of Turbomachinery.

HOT WIRE THERMAL TUFT DEVELOPMENT FOR MEASUREMENT OF FLOW REVERSAL NEAR A COMPRESSOR BLADE

B. GYLES and P. M. LIGRANI *In* its Meas. Tech. in Turbomachines 47 p 1981 refs
Avail: NTIS HC A23/MF A01

A hot wire thermal tuft probe which is suitable for mounting on a rotor blade of an axial flow compressor was developed. The probe was subjected to a number of qualification tests to determine its behavior under various flow conditions. The probe was then installed in a low speed axial flow compressor and measurements were taken while the machine was operating in rotating stall in order gain an understanding of stall-associated events. M.G.

N83-12275# Rolls-Royce Ltd., Derby (England). Electronics and Instrumentation Group.

BLADE PRESSURE MEASUREMENTS

J. W. H. CHIVERS *In* Von Karman Inst. for Fluid Dyn. Meas. Tech. in Turbomachines 21 p 1981
Avail: NTIS HC A23/MF A01

Three measurement techniques which enable rotating pressures to be measured during the normal operation of a gas turbine or a component test rig are described. The first technique was developed specifically to provide steady and transient blade surface pressure data to aid both fan flutter research and general fan performance development. This technique involves the insertion of miniature high frequency response pressure transducers into the fan blades of a large civil gas turbine. The other two techniques were developed to measure steady rotating pressures inside and on the surface of engine or rig turbine blades and also rotating pressures in cooling feed systems. These two low frequency response systems are known as the 'pressure pineapple' (a name which resulted from the shape of the original prototype) and the rotating scanivalve. M.G.

N83-12279# Middlesex Research Center, Inc., Washington, D.C.

EFFECTS OF METRIC CHANGE ON SAFETY IN THE WORKPLACE FOR SELECTED OCCUPATIONS Final Report

J. M. LEFANDE and J. L. POKORNEY 21 Apr. 1982 139 p (Contract AA-80-SAC-X8605)
(AD-A118595) Avail: NTIS HC A07/MF A01 CSCL 13L

The study assesses the potential safety issues of metric conversion in the workplace. A purposive sample of 35 occupations based on injury and illnesses indexes were assessed. After an analysis of workforce population, hazard analysis and measurement sensitivity of the occupations, jobs were analyzed to identify potential safety hazards by industrial hygienists, safety engineers and academia. The study's major findings were as follows: No metric hazard experience was identified. An increased exposure might occur when particular jobs and their job tasks are going the transition from customary measurement to metric measurement. Well planned metric change programs reduce hazard potential. Metric safety issues are unresolved in the aviation industry.

Author (GRA)

N83-12298# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

RECOMMENDATIONS FOR AUTOMATED MONITORING OF RADIO EQUIPMENT ASSOCIATED WITH FLIGHT SERVICE STATIONS Final Report, Feb. - Oct. 1981

A. J. REHMANN Aug. 1982 65 p refs

(Contract FAA PROJ. 144-170-900)

(FAA-CT-82-31) Avail: NTIS HC A04/MF A01

The radio equipment associated with flight service stations and back-up emergency communications radio equipment was examined. Radio parameters critical to remote maintenance monitoring were identified as necessary for remote certification, remote maintenance, or remote control. The parameters are grouped according to function. The functional characteristics of test functional modules (TFM) are defined according to the parameter grouping. Finally, limited recommendations for the electrical characteristics and operating specifications of each TFM are given. S.L.

N83-12299# Ohio Univ., Athens. Avionics Engineering Center.
THE EFFECTS OF PRECIPITATION STATIC AND LIGHTNING ON THE AIRBORNE RECEPTION OF LORAN-C. VOLUME 1: ANALYSIS Final Report, 11 Dec. 1980 - 30 Apr. 1982

J. D. NICKUM Apr. 1982 138 p refs

(Contract FA01-81-C-10007)

(DOT/FAA-RD-82-45-1; OU/AEC-EER-54-2; AD-A119743) Avail:

NTIS HC A07/MF A01

Results of a ground p-static survey of an aircraft to determine p-static noise reduction are given. The effects of the airborne reception of Loran-C in actual thunderstorm conditions are described. Additionally, data from flight tests conducted using an airframe biased discharger producing p-static airframe charging in flight are presented. P-static noise reduction using quality static wick dischargers to improve Loran-C reception in flight is demonstrated. Author

N83-12300# Electromagnetic Compatibility Analysis Center, Annapolis, Md.

EMC ANALYSIS OF A PROTOTYPE CIVIL USE GPS RECEIVER ON FOUR AIRCRAFT CONFIGURATIONS

R. L. MULLEN (IIT Research Inst., Annapolis, Md.) Washington

FAA Jul. 1982 71 p refs Sponsored in part by FAA

(Contract F10628-80-C-0042)

(ECAC-CR-82-048; FAA-RD-82-63) Avail: NTIS HC A04/MF

A01

The cosite electromagnetic compatibility aspects were evaluated for the simultaneous operation of a prototype civil-use GPS receiver and other avionic systems on board four specific aircraft configurations. Author

N83-12318# McDonnell-Douglas Research Labs., St. Louis, Mo.
ALGORITHM FOR SURFACE OF TRANSLATION ATTACHED RADIATORS (A-STAR). VOLUME 1: FORMULATION OF THE ANALYSIS Final Technical Report, 17 Mar. 1980 - 16 Oct. 1981

L. N. MEDGYESIMITSCHANG and J. M. PUTNAM May 1982

88 p refs

(Contract F30602-80-C-0106)

(AD-A118459; RAD-TR-82-113-VOL-1) Avail: NTIS HC

A05/MF A01 CSCL 12A

A general analytical formulation, based on the method of moments (MM) is described for solving electromagnetic problems associated with off-surface (wire) and aperture radiators on finite-length cylinders of arbitrary cross section, denoted in this report as bodies of translation (BOT). This class of bodies can be used to model structures with noncircular cross sections such as wings, fins and aircraft fuselages. GRA

N83-12348# National Aerospace Lab., Tokyo (Japan).

NUMERICAL SIMULATION OF INVISCID COMPRESSIBLE FLOW THROUGH TWO-DIMENSIONAL CASCADE BY FINITE AREA METHOD

M. FUKUDA, H. NISHIMURA, and A. TAMURA 1982 17 p

refs In JAPANESE; ENGLISH summary

(NAL-TR-709; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

The steady inviscid compressible flow through the two dimensional cascade is computed by the method of time-dependent finite area with hexagonal integral domain. Three different equation systems are considered which are physically equivalent under two assumptions: (1) steady state, (2) subsonic, or (3) existing weak shock flow field. The basic system is composed of the continuity equation, the Euler equation, and the energy equation. Their differences during numerical behavior approaching the steady state are examined through computations. To prevent the pressure or the density from becoming negative, the spatial averaging for smoothing was used, which appears to have some artificial viscosity and damping factor for time-dependent computations. In the steady state computed airfoil pressure distributions show good agreement with experimental measurements and there were few differences among the three equation systems. Author

N83-12380# University of Southern California, Los Angeles.
THE TRANSITON AND DYNAMICS OF BOUNDED AND FREE SHEAR LAYERS Dept. of Aerospace Engineering.

J. LAUFER, R. KAPLAN, and C. M. HO Mar. 1982 27 p refs

(Contract F49620-78-C-0060; AF PROJ. 2307)

(AD-A118665; AFOSR-82-0652TR) Avail: NTIS HC A03/MF

A01 CSCL 20D

Research activities in transitional and turbulent boundary layers and free shear flows are described. Experimental efforts which focused on an understanding of turbulent 'spots' in a developing laminar boundary layer flow, the development of conditional sampling technique for high response anemometry data, studies of spanwise streaks in the near wall region of a turbulent boundary layer and the dynamics of free and impinging jet flows are described. Analytical studies of the nonlinear stability of plane stagnation flows are also discussed. GRA

N83-12393*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A NONINTRUSIVE LASER INTERFEROMETER METHOD FOR MEASUREMENT OF SKIN FRICTION

D. J. MONSON Oct. 1982 36 p refs

(NASA-TM-84300; A-9077; NAS 1.15:84300) Avail: NTIS HC

A03/MF A01 CSCL 14B

A method is described for monitoring the changing thickness of a thin oil film subject to an aerodynamic shear stress using two focused laser beams. The measurement is then simply analyzed in terms of the surface skin friction of the flow. The analysis includes the effects of arbitrarily large pressure and skin friction gradients, gravity, and time varying oil temperature. It may also be applied to three dimensional flows with unknown direction. Applications are presented for a variety of flows including two dimensional flows, three dimensional swirling flows, separated flow, supersonic high Reynolds number flows, and delta wing vortical flows. Author

N83-12395*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FLOW VISUALIZATION IN A CRYOGENIC WIND TUNNEL USING HOLOGRAPHY

A. W. BURNER and W. K. GOAD Nov. 1982 22 p refs

(NASA-TM-84556; L-15510; NAS 1.15:84556) Avail: NTIS HC

A02/MF A01 CSCL 14E

Results of holographic flow visualization from tests made in the Langley 0.3 meter transonic cryogenic tunnel are presented. The tunnel was operated over a temperature range from 100 to 300 K and a pressure range from 1.1 to 4 atm. Interferometry at the facility may be of limited use at the low temperature high pressure conditions because of the jumbled nature of the reference fringes. The shadowgraph technique appears to be the best means

of visualizing shocks at these high density conditions. The spot size at the focus of the reconstructed beams was measured and used as an indicator of density fluctuations in the flow field. These density fluctuations appear to be caused by temperature fluctuations of the test gas which are relatively independent of tunnel conditions. Author

N83-12410# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
ADAPTATION OF LASER VELOCIMETERS TO VARIOUS APPLICATIONS

A. BOUTLER /in Von Karman Inst. for Fluid Dynamics Laser Velocimetry 34 p 1981 refs
Avail: NTIS HC A21/MF A01

The requirements for a laser velocimeter working in wind tunnels are discussed as well as the elements making up an operational laser velocimeter. Some set ups which are currently operated in aerodynamic flows are described. R.J.F.

N83-12433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FERROGRAPHIC AND SPECTROMETER OIL ANALYSIS FROM A FAILED GAS TURBINE ENGINE
W. R. JONES, JR. 1982 15 p refs Presented at the Intern. Conf. on Advan. in Ferrography, Swansea, UK, 22-24 Sep. 1982 (NASA-TM-82956; E-1267; NAS 1.15:82956) Avail: NTIS HC A02/MF A01 CSCL 14D

An experimental gas turbine engine was destroyed as a result of the combustion of its titanium components. It was concluded that a severe surge may have caused interference between rotating and stationary compressor that either directly or indirectly ignited the titanium components. Several engine oil samples (before and after the failure) were analyzed with a Ferrograph, a plasma, an atomic absorption, and an emission spectrometer to see if this information would aid in the engine failure diagnosis. The analyses indicated that a lubrication system failure was not a causative factor in the engine failure. Neither an abnormal wear mechanism nor a high level of wear debris was detected in the engine oil sample taken just prior to the test in which the failure occurred. However, low concentrations (0.2 to 0.5 ppm) of titanium were evident in this sample and samples taken earlier. After the failure, higher titanium concentrations (2 ppm) were detected in oil samples taken from different engine locations. Ferrographic analysis indicated that most of the titanium was contained in spherical metallic debris after the failure. The oil analyses eliminated a lubrication system bearing or shaft seal failure as the cause of the engine failure. Author

N83-12460*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE DISPLACEMENTS AND STABILITY ANALYSIS OF NONLINEAR PROPELLER STRUCTURES
R. A. AIELLO and C. C. CHAMIS /in Georgia Univ. 10th NASTRAN User's Colloq. p 112-132 Nov. 1982
Avail: NTIS HC A12/MF A01 CSCL 20K

The use of linear rigid formats in COSMIC NASTRAN without DMAP procedures for the analysis of nonlinear propeller structures is described. Approaches for updating geometry and applying follower forces for incremental loading are demonstrated. The COSMIC NASTRAN rigid formats and other independent finite element programs are compared. The comparisons include results from the four approaches for updating the geometry using RIGID FORMAT 1, RIGID FORMATS 4 and 13, MARC and MSC/NASTRAN. It is shown that user friendly updating approaches can be used to predict the large displacements and instability of these nonlinear structures. The approaches are easily implemented by the user and predict conservative results. E.A.K.

N83-12464*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

A NEW CAPABILITY FOR ELASTIC AIRCRAFT AIRLOADS VIA NASTRAN

H. C. BRIGGS and L. E. CHRISINGER /in Georgia Univ. 10th NASTRAN User's Colloq. p 165-186 Nov. 1982
Avail: NTIS HC A12/MF A01 CSCL 20K

A new direct matrix abstract program for NASTRAN written to calculate internal stresses and airloads for a flexible wing is described. The difficulties encountered in interfacing the doublet lattice solution to the aerodynamic problem to the finite element solution to the structural problem are discussed. A brief numerical example is included. Author

N83-13292# Hydronautics, Inc., Laurel, Md.
SELF RESONATING PULSED WATER JETS FOR AIRCRAFT COATING REMOVAL: FEASIBILITY STUDY

G. L. CHAHINE, V. E. JOHNSON, JR., and G. S. FREDERICK
Jun. 1982 90 p refs
(Contract N00014-82-C-0143)
(AD-A119114; TR-8268-1) Avail: NTIS HC A05/MF A01 CSCL 13H

The objective of this project was to investigate the feasibility of disrupting a high pressure water jet into a discrete train of well organized slugs through passive acoustic self-excitation of the jet, and as a result to enhance the ability of the jet to remove aircraft coatings and to prepare surfaces for recoating. This innovative technique takes advantages of the water hammer pressures produced by the slugs' impact (which are much higher than the stagnation pressures generated by a continuous jet), without the drawbacks of having a mechanical rotating interrupter. In addition this technique provides larger working standoff distances, wider areas of impact and thus greater control of the energy imparted to a target than a cavitating jet. It is therefore capable of overcoming the drawbacks of existing water jet methods in preparing aircraft surfaces for repainting and of providing a primary supplement if not a practical replacement for chemical removal methods. GRA

N83-13294# National Engineering Lab., East Kilbride (Scotland). Metals Technology Dept.

CASTING CRITICAL COMPONENTS

R. MCCALLUM Jun. 1982 18 p Sponsored by British Investment Casting Trade Association (BICTA)
(NEL-681) Avail: NTIS HC A02/MF A01

Investment casting is an essential processing route for critical rotating and static aero gas turbine components and for a wide spectrum of high integrity parts. These must perform reliably under arduous operating conditions involving high stresses and, frequently, extremely hostile environments. The advanced technology, in-process controls, rigorous specifications, and stringent testing and inspection procedures required for high integrity investment castings are considered along with some examples of the technological 'spin-off' into diverse industry sectors. Author (ESA)

N83-13320# Transportation Research Board, Washington, D.C.
AIRPORT LANDSIDE OPERATIONS AND AIR SERVICE

P. B. MANDLE, E. M. WHITLOCK, F. LAMAGNA, R. A. MUNDY, and P. J. OBERHAUSEN 1982 44 p refs
(PB82-235946; TRB/TRR-840; ISBN-0-309-03317-9; ISSN-0361-1981; LC-82-12456) Avail: NTIS HC A03/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D.C. 20418 CSCL 13B

The following areas are discussed: airport curbside planning and design; analysis of New Orleans airport ground transportation system; time series analysis of intercity air travel volume; economic justification of air service to small communities; and general aviation and the airport and airway system (an analysis of cost allocation and recovery). GRA

N83-13324 Ohio State Univ., Columbus.

RELATIONSHIP BETWEEN THE ADAPTIVE PERFORMANCE OF ANTENNA ARRAYS AND THEIR UNDERLYING ELECTROMAGNETIC CHARACTERISTICS Ph.D. Thesis

I. J. GUPTA 1982 162 p refs

Avail: Univ. Microfilms Order No. DA822091

A direct relationship between the conventional array characteristics of an antenna array and its performance in an adaptive mode is established. Expressions to obtain the output signal-to-interference-plus-noise ratio (SINR) of an adaptive array in terms of its unperturbed pattern (the radiation pattern of the array responding to a desired signal in the absence of any interfering signal) and the locations of the desired signal and jammers are provided. These expressions permit the evaluation of the performance of an adaptive array without an exhaustive search of all possible signal-jammer scenarios and parametric values. An algorithm to select element location of one dimensional arrays is presented. The algorithm leads to thinned arrays which provide the required performance level in a two dimensional field of view. The one dimensional approach is extended to provide planar arrays for aircraft and satellite adaptive antenna systems.

Dissert. Abstr.

N83-13338# Grumman Aerospace Corp., Bethpage, N.Y. System Engineering Dept.

PILOT ABILITY TO UNDERSTAND SYNTHETIC VOICE AND RADIO VOICE WHEN RECEIVED SIMULTANEOUSLY

E. MANAKER Jun. 1982 55 p refs

(AD-A119137; ACT-R-82-01) Avail: NTIS HC A04/MF A01

CSCL 05J

The goals of a prior study were to determine if synthetic voice messages would reduce the F-14 aircraft pilot's workload, increase his effectiveness during the mission, and to establish the hardware impact on the aircraft. Recommendations for additional studies to use voice in the F-14 and other future naval aircraft were made as well as for investigations into related areas such as crew perception and discrimination of a computer generated voice. The goals of a prior study were to determine if synthetic voice messages would reduce the F-14 aircraft pilot's workload, increase his effectiveness during the mission, and to establish the hardware impact on the aircraft. Recommendations for additional studies to use voice in the F-14 and other future naval aircraft were made as well as for investigations into related areas such as crew perception and discrimination of a computer generated voice. Some pertinent questions arising from the F-14 study concerned: the distinctiveness and intelligibility of a computer generated synthetic voice in the aircraft hearing situation; whether or not the pilot can separate radio-transmitted human voice messages of interest from simultaneously generated synthetic voice messages; and the optimum method of presenting such messages through the headset. An exploratory study was designed to investigate these questions. The intent was to examine differing methodologies in presenting the stimuli used, and to ascertain trends in the subjects performance data.

GRA

N83-13344# Honeywell Systems and Research Center, Minneapolis, Minn.

APPLICATION OF ADVANCED SPEECH TECHNOLOGY IN MANNED PENETRATION BOMBERS Final Draft Report, Aug. 1980 - Sep. 1981

R. NORTH and W. LEA Wright-Patterson AFB, Ohio AFWAL Mar. 1982 171 p refs

(Contract F33615-80-C-3606; AF PROJ. 2403)

(AD-A119274; REPT-81SRC57; AFWAL-TR-82-3004) Avail:

NTIS HC A08/MF A01 CSCL 17B

This report documents research on the potential use of speech technology in a manned penetration bomber aircraft (B-52/G and H). The objectives of the project were to analyze the pilot/copilot crewstation tasks over a three-hour-and forty-minute mission and determine the tasks that would benefit the most from conversion to speech recognition/generation, determine the technological feasibility of each of the identified tasks, and prioritize these tasks based on these criteria. Secondary objectives of the program were

to enunciate research strategies in the application of speech technologies in airborne environments, and develop guidelines for briefing user commands on the potential of using speech technologies in the cockpit. The results of this study indicated that for the B-52 crewmember, speech recognition would be most beneficial for retrieving chart and procedural data that is contained in the flight manuals. Technological feasibility of these tasks indicated that the checklist and procedural retrieval tasks would be highly feasible for a speech recognition system. GRA

N83-13413# British Aerospace Aircraft Group, Preston (England). Aerodynamics Dept.

THE STRENGTHS AND WEAKNESSES OF COMPUTATIONAL FLUID MECHANICS (CFM) IN AERODYNAMIC DESIGN AND ANALYSIS. PART 1: BACKGROUND AND PHILOSOPHY

B. HUNT, W. R. MARCHBANK, and B. L. HEWITT 1981 83 p refs

Avail: Issuing Activity

The capabilities of modern theoretical methods for predicting some of the more important types of aerodynamic flow are summarized and the likelihood of their development and acceptance as routine, mainstream tools of the aircraft aerodynamicist are discussed. The impact of the new generation of computers and the associated numerical algorithms on the ability to solve large systems of differential equations, significantly reducing the need for expensive, time-consuming wind-tunnel tests and transforming aircraft design from a black art to an exact science is examined. The concept of validation of computational fluid mechanics methods is developed, involving the assessment of the accuracy with which the numerical method solves the boundary value problem posed. The methods discussed include linearized potential flow methods, nonlinear potential flow methods, the transonic small perturbation theory and exact inviscid flow methods.

Author (ESA)

N83-13417# Aeronautical Research Inst. of Sweden, Stockholm.

MEASURING THE FLOW PROPERTIES OF SLOTTED TEST-SECTION WALLS

S. B. BERNDT (Royal Inst. of Technology, Stockholm) 1982 18 p refs In ENGLISH; SWEDISH and FRENCH summaries

(PB82-239849; FFA-135) Avail: NTIS HC A02/MF A01 CSCL 14B

By measuring pressure distributions at two levels near a slotted wall it is possible to deduce simultaneous values of normal and longitudinal velocities. Such measurements require, for their proper interpretation, a basic understanding of the flow in the neighborhood of the wall. The problems involved are analyzed. GRA

N83-13419*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

IMAGE DEGRADATION IN LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL

W. L. SNOW, A. W. BURNER, and W. K. GOAD Nov. 1982 24 p refs

(NASA-TM-84550; L-15512; NAS 1.15:84550) Avail: NTIS HC A02/MF A01 CSCL 14B

The optical quality of gas in a cryogenic wind tunnel was determined by observing Sayce targets through different pathlengths of the medium. The data were used to determine the square wave response of the test gas. At conditions corresponding to 15 times ambient density, considerable decrease in response to higher spatial frequencies was noted even in the absence of flow. Under flow conditions, vibrations further degraded the response. The results are interpreted in terms of possible photogrammetric approaches to measure model deformation in large cryogenic facilities such as the National Transonic Facility.

Author

N83-13455 Rensselaer Polytechnic Inst., Troy, N. Y.
LUBRICANTS IN BEARINGS AND ABSORBED MATERIALS ON AIRCRAFT FUEL LINES BY INFRARED EMISSION FOURIER MICROSCPECTROPHOTOMETRY Ph.D. Thesis

L. E. KELLER 1982 236 p

Avail: Univ. Microfilms Order No. DA8223323

Solid and liquid thin films were analyzed by infrared emission Fourier microspectrophotometry. Studies of lubricant behavior in a simulated ball bearing showed the alignment of the fluid molecules in the Hertzian area. Polyphenyl ether contaminated with 1% 1, 1,1,2-trichloroethane required far lower shear rates for the same degree of alignment than without contaminant. The experiment was run with 440 C stainless steel balls and 440 C balls coated with TiN, a chemically inert material. In both cases, the alignment was strongly influenced by the presence of the contaminant. The results showed: (1) the dependence of alignment of fluid molecules on flow and not on adsorption at metallic surfaces; (2) phase separation between lubricant and additive under high pressure which results in two-phase flow; and (3) reduction in traction of torque-transmitting (traction) fluids. With the same instrument solid deposits on aircraft fuel lines were studied. Despite the strong background radiation and the presence of a multitude of compounds, the spectral contrast was sufficient to establish a relationship between fuel and deposit composition.

Dissert. Abstr.

N83-13476 Oregon State Univ., Corvallis.
AN AEROELASTIC ANALYSIS OF THE DARRIEUS WIND TURBINE Ph.D. Thesis

E. E. MEYER 1982 161 p

Avail: Univ. Microfilms Order No. DA8224111

The stability of small oscillations of the troposkein-shaped blade used on Darrieus wind turbines is investigated. The blade is assumed to be attached to a perfectly rigid rotor shaft and spinning in still air. Linear equations of motion are derived which include the effects of in-plane, out-of-plane, and torsional stiffness, mass and aerodynamic center offsets, and the aerodynamic wake. Results presented include the free-vibration characteristics of the rotating blade, stability of the blade rotating in air, and the effects of mass density, mass center offset, and stiffness parameters on the flutter rotation rates. All results are presented in dimensionless form, hence apply to a family of blades.

Dissert. Abstr.

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GEOSCIENCES

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

N83-13673# Acurex Corp., Morrisville, N.C.
PILOT-SCALE ASSESSEMENT OF CONVENTIONAL PARTICULATE CONTROL TECHNOLOGY FOR PRESSURIZED FLUIDIZED-BED COMBUSTION EMISSIONS Final Report, Mar. 1979 - Jun. 1980

W. O. LIPSCOMB, III, S. R. MALANNI, C. L. STANLEY, and S. P. SCHLIESSER Apr. 1982 132 p refs

(Contract EPA-68-02-2646)

(PB82-230921; EPA-600/7-82-028) Avail: NTIS HC A07/MF

A01 CSCL 13B

Results of an evaluation of electrostatic precipitator (ESP) and fabric filter particulate control technology for the EPA/Exxon pressurized fluidized bed combustion (PFBC) Miniplant in Linden, NJ are given. EPA's mobile ESP and fabric filter pilot facilities were slip streamed downstream of the Miniplant's tertiary cyclone to simulate the flue gas stream exiting a PFBC combined cycle gas turbine. Results presented include control device operating characteristics and performance based on mass and fractional collection efficiencies.

Author (GRA)

N83-13706*# Lassen Research, Manton, Calif.
NASA AIRBORNE DOPPLER LIDAR PROGRAM: DATA CHARACTERISTICS OF 1981 Final Technical Report

R. W. LEE Apr. 1982 122 p

(Contract NAS8-34768)

(NASA-CR-170667; NAS 1.26:170667; FTR-1) Avail: NTIS HC A06/MF A01 CSCL 04B

The first flights of the NASA/Marshall airborne CO₂ Doppler lidar wind measuring system were made during the summer of 1981. Successful measurements of two-dimensional flow fields were made to ranges of 15 km from the aircraft track. The characteristics of the data obtained are examined. A study of various artifacts introduced into the data set by incomplete compensation for aircraft dynamics is summarized. Most of these artifacts can be corrected by post processing, which reduces velocity errors in the reconstructed flow field to remarkably low levels.

Author

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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.

A83-16146**ROBUST MODEL FOLLOWING SYSTEMS**

T. OKADA, M. KIHARA, and T. TAKEI (Defense Academy, Yokosuka, Japan) International Journal of Control, vol. 36, Dec. 1982, p. 905-923. refs

A robust model-following (RMF) system is proposed which yields such properties as asymptotic stability, disturbance rejection and model-following with reduced sensitivity to plant parameter variation. For a given plant, a double RMF system is employed in which one of the constituent models is used for response while the other provides robustness, as well as sensitivity reduction. It is shown that RMF systems can generally be designed for plants whose input and output are commensurate, and that upon the satisfaction of system form and parameter variation conditions, plant outputs having greater dimensions than inputs can be made robust. The RMF system is illustrated by the design of a helicopter flight control system.

O.C.

N83-12867# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE AMPS COMPUTER SYSTEM: DESIGN AND OPERATION
 J. L. GERTZ and A. D. KAMINSKY Sep. 1982 118 p refs
 (Contract DOT-FA7WAI-242; F19628-80-C-0002)
 (ATC-110; FAA-RD-81-103) Avail: NTIS HC A06/MF A01

The Lincoln Laboratory Air Traffic Control Radar Beacon System (ATCRBS) Monopulse Processing System (AMPS) is a mobile, stand-alone, ATCRBS surveillance sensor for processing and disseminating target reports from transponder-equipped aircraft. AMPS is essentially the ATCRBS portion of the Mode Select Beacon System (Mode S), a system designed to be an evolutionary replacement for the present third generation ATCRBS. AMPS utilizes several new features introduced by the Mode S sensor concept. In particular, the use of monopulse angle estimation permits more accurate aircraft azimuth estimation with fewer replies per scan, and improved decoding (identification) performance when garble is present. The details and philosophy of the AMPS computer system implementation and operation are described. Specific and detailed descriptions of the interrelations between AMPS's several subsystems and subtasks are provided as well as a guide on how to run them.

Author

N83-12895# Comarco, Inc., Anaheim, Calif.
COMPUTER AIDED MISSION PLANNING SYSTEM (CAMPS)
Final Technical Report, 1 Jul. 1979 - 1 Oct. 1981
 D. BAILEY, D. FRYE, and W. WOODBURY Griffiss AFB, N.Y.
 RADC Jun. 1982 50 p
 (Contract F30602-79-C-0230; AF PROJ. 2315)
 (AD-A118567; RADC-TR-82-148) Avail: NTIS HC A03/MF A01
 CSCL 09B

Algorithms and computer programs were developed to automate a wing/squadron level capability for flight planning and penetration analysis for the F-4E and F-111F; and weapons planning for the F-4E with a limited set of weapons and release conditions.

Author (GRA)

N83-12919# Office of Technology Assessment, Washington, D.C.
IMPACT OF ADVANCED AIR TRANSPORT TECHNOLOGY. PART 2: THE AIR CARGO SYSTEM, BACKGROUND PAPER
 Jan. 1982 55 p refs
 (PB82-186818; OTA-BR-T-10-PT-2) Avail: NTIS HC A04/MF A01
 CSCL 01C

The economic, environmental, and societal impacts of advances in the technology of transport aircraft on the air cargo system is assessed. The role and importance of aircraft technology in the total air cargo system is put in perspective. The principal factors that could influence the future evolution of air cargo transport are discussed.

GRA

N83-12920# Office of Technology Assessment, Washington, D.C.
IMPACT OF ADVANCED TRANSPORT TECHNOLOGY. PART 3: AIR SERVICE TO SMALL COMMUNITIES
 Feb. 1982 49 p refs
 (PB82-186800; OTA-T-170-PT-3) Avail: NTIS HC A03/MF A01
 CSCL 01C

An assessment of the impact of advances in air transport technology on commuter airlines operation is presented. Air service to small and medium-size communities is presently undergoing a rapid and sometimes disruptive transition from a regulated environment to a deregulated, competitive market. Past Government regulation has affected not only the level of service to small communities, but also the aircraft that were (or were not) developed for this market by U.S. manufacturers. The future growth of computer airlines will ultimately depend on their ability to provide convenient and competitive service in short-haul markets.

GRA (Author)

N83-12959*# Myers (Raymond H.), Blacksburg, Va.
A STUDY OF THE FEASIBILITY OF STATISTICAL ANALYSIS OF AIRPORT PERFORMANCE SIMULATION Final Report
 R. H. MYERS Washington NASA Nov. 1982 36 p refs
 Sponsored by NASA
 (NASA-CR-3633; NAS 1.26:3633) Avail: NTIS HC A03/MF A01
 CSCL 12A

The feasibility of conducting a statistical analysis of simulation experiments to study airport capacity is investigated. First, the form of the distribution of airport capacity is studied. Since the distribution is non-Gaussian, it is important to determine the effect of this distribution on standard analysis of variance techniques and power calculations. Next, power computations are made in order to determine how economic simulation experiments would be if they are designed to detect capacity changes from condition to condition. Many of the conclusions drawn are results of Monte-Carlo techniques.

Author

N83-13824# Technische Universitaet, Brunswick (West Germany). Inst. fuer Flugfuehrung.
DESIGN AND CONSTRUCTION OF A FLEXIBLE AUTONOMOUS ELECTRONIC DISPLAY DEVICE Ph.D. Thesis - Tech. Univ. Carolo-Wilhelmina [ENTWURF UND AUFBAU EINES FLEXIBEN AUTONOMEN ELEKTRONISCHEN ANZEIGEGERAETES]
 R. FRIELING 1980 166 p refs In GERMAN
 (TUBS/FB-80-12-02) Avail: NTIS HC A08/MF A01

The design criteria for development and construction of a compact, autonomous display device for research in the domain of flight control are presented. A display device was required with which synthetic graphic pictures can be shown and dynamic processes can be recorded. Such a device is not commercially available. It consists of a microprocessor and an image element generator which is essentially composed of increment calculating circuits in a modular way. The detailed mathematical description of the generation of conical sections as image elements and their linear transformation enables a universal utilization in practice. Performance and efficiency of the system are demonstrated by means of two examples.

Author (ESA)

N83-13835*# Michigan Univ., Ann Arbor. Interferometry Lab.
COMPUTER TOMOGRAPHY OF FLOWS EXTERNAL TO TEST MODELS Final Technical Report, 1 Jun. 1981 - 31 Aug. 1982
 I. PRIKRYL and C. M. VEST Oct. 1982 337 p refs
 (Contract NAG2-118)
 (NASA-CR-169521; NAS 1.26:169521; INTFL-8202) Avail: NTIS HC A15/MF A01
 CSCL 09B

Computer tomographic techniques for reconstruction of three-dimensional aerodynamic density fields, from interferograms recorded from several different viewing directions were studied. Emphasis is on the case in which an opaque object such as a test model in a wind tunnel obscures significant regions of the interferograms (projection data). A method called the Iterative Convolution Method (ICM), existing methods in which the field is represented by a series expansions, and analysis of real experimental data in the form of aerodynamic interferograms are discussed.

Author

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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.

A83-13136*# Lockheed Missiles and Space Co., Palo Alto, Calif.
NOISE AND FLOW STRUCTURE OF A TONE-EXCITED JET
 K. K. AHUJA, J. LEPICOVSKY, and R. H. BURRIN
 (Lockheed-Georgia Co., Marietta, GA) AIAA Journal, vol. 20, Dec. 1982, p. 1700-1706. Research supported by the Lockheed-Georgia Co. refs
 (Contract NAS3-21987)
 (Previously cited in issue 24, p. 4245, Accession no. A81-48640)

A83-13375#
A NOTE ON THE GENERAL SCALING OF HELICOPTER BLADE-VORTEX INTERACTION NOISE
 F. H. SCHMITZ, D. A. BOXWELL (U.S. Army, Aeromechanics Laboratory, Moffett Field, CA), C. DAHAN, and S. LEWY (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) ONERA, TP no. 1982-32, 1982. 14 p. refs
 (ONERA, TP NO. 1982-32)

A model-rotor acoustic experiment in a three meter open section anechoic wind tunnel (CEPRA-19) is described. The important scaling parameters are reviewed and some on-line acoustic data are presented for conditions known to produce blade-vortex

interaction noise on a single rotor helicopter. Time averages of the model-scale acoustic pulses are compared with similar full-scale data taken in-flight under the same non-dimensionalized conditions. Good general agreement between model and full-scale pulse shapes and amplitudes of blade-vortex interaction noise is shown for one advance ratio over a range of inflow conditions for the rotor. Directivity sweeps for a condition known to generate blade-vortex interactions are presented. Some model rotor testing limitations of the CEPRA-19 facility in its present configuration are indicated. (Author)

A83-13590

AEROACOUSTICAL CHARACTERISTICS OF A MECHANICAL NOISE SUPPRESSOR IN A NOZZLE CONFIGURATION WITH A CENTRAL TAILCONE

L. I. SORKIN and M. N. TOLSTOSHEEV Soviet Physics - Acoustics, vol. 28, May-June 1982, p. 236-239. Translation. refs

Results are presented from model studies on a mechanical noise suppressor in the form of turbulence generators incorporated into a nozzle configuration with a central tailcone. Inasmuch as the ratio between the additional thrust losses created by the active noise suppressor and the noise level reduction is an important characteristic of jet noise suppressors, both the aerodynamic and the acoustical characteristics of the noise suppressors are investigated. The experiments on the acoustical characteristics of mechanical noise suppressors in a nozzle configuration with a central tailcone are carried out on an open acoustic test stand. C.R.

A83-15289#

SOUNDING PROPAGATION IN MULTISTAGE AXIAL FLOW TURBOMACHINES

K. E. HEINIG (Motoren- und Turbinen-Union Muenchen GmbH, Munich, West Germany) AIAA Journal, vol. 21, Jan. 1983, p. 98-105. Research sponsored by the Bundesministerium der Verteidigung. refs

(Previously cited in issue 24, p. 4246, Accession no. A81-48652)

A83-15298#

LENGTH AND TIME SCALES RELEVANT TO SOUND GENERATION IN EXCITED JETS

W. G. RICHARZ (Toronto, University, Toronto, Canada) AIAA Journal, vol. 21, Jan. 1983, p. 148, 149. refs

Length and time scale measurements of excited jets are applied to an analytical model for jet noise generation to infer an effective source strength distribution to obtain the overall sound pressure level. Analytical formulations are presented for the far-field mean square sound pressure, which is governed by the time and length scales and can be measured with two-point time and space correlations. Alteration of the time and length scales, in addition to the turbulence level, will change the acoustic intensity. Correlation measurements performed on a 10 cm circular jet operated at an exit velocity of 45 m/sec ($Re = 300,000$), with the jet excited at the nozzle lip by speakers radiating into the annular cavity, are reported. Trials were run for an undisturbed jet, at Strouhal numbers of 1.1 and 4.4. Effective turbulence control was determined to be impossible when an acoustic excitation is used in a pinching mode around the jet. The investigation of other methods of changing the turbulence level, the time, and length scales is recommended. M.S.K.

A83-15314#

PROPELLER NOISE AT MODEL- AND FULL-SCALE

W. J. G. TREBBLE, J. WILLIAMS (Royal Aircraft Establishment, Aerodynamics Dept., Farnborough, Hants., England), and R. P. DONNELLY (Dowty-Rotol, Ltd., Cheltenham, Glos., England) Journal of Aircraft, vol. 20, Jan. 1983, p. 34-41.

(Previously cited in issue 24, p. 4128, Accession no. A81-48634)

A83-15316#

NOVEL AIRBORNE TECHNIQUE FOR AIRCRAFT NOISE MEASUREMENTS ABOVE THE FLIGHT PATH

T. A. HOLBECHE and A. F. HAZELL (Royal Aircraft Establishment, Aerodynamics Dept., Farnborough, Hants., England) Journal of Aircraft, vol. 20, Jan. 1983, p. 50-57. refs

(Previously cited in issue 24, p. 4246, Accession no. A81-48647)

A83-15317*#

National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

WIND TUNNEL MEASUREMENTS OF BLADE/VANE RATIO AND SPACING EFFECTS ON FAN NOISE

R. P. WOODWARD and F. W. GLASER (NASA, Lewis Research Center, Cleveland, OH) Journal of Aircraft, vol. 20, Jan. 1983, p. 58-65. refs

(Previously cited in issue 24, p. 4128, Accession no. A81-48628)

A83-12966*#

National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CORRELATION OF CORE NOISE OBTAINED BY THREE SIGNAL COHERENCE TECHNIQUES

U. VONGLAHN and E. KREJSA 1982 22 p refs Presented at the 104th Meeting of the Acoustical Soc. of Am., Orlando, Fla., 9-12 Nov. 1982

(NASA-TM-83012; E-1447; NAS 1.15:83012) Avail: NTIS HC A02/MF A01 CSCL 20A

The prediction of frequency content and noise levels of turbofan engine core noise is reexamined as a result of recent test data and a new diagnostic technique. The diagnostic technique, utilizing a three-signal coherence method, is used to obtain core noise spectra for several engines. Similarities and differences of the spectra are discussed. Finally, the three-signal coherence data are correlated, leading to an improved core noise prediction procedure. B.W.

A83-12968*#

Lockheed-Georgia Co., Marietta.

TOUR-EXCITED JET: THEORY AND EXPERIMENTS Final Report

K. K. AHUJA, J. LEPICOVSKY, C. K. W. TAM (Florida State Univ., Tallahassee), P. J. MORRIS (Pennsylvania State Univ.), and R. H. BURRIN Washington NASA Nov. 1982 244 p refs (Contract NAS3-21987)

(NASA-CR-3538; NAS 1.26:3538; LG82ER0031) Avail: NTIS HC A11/MF A01 CSCL 20A

A detailed study to understand the phenomenon of broadband jet-noise amplification produced by upstream discrete-tone sound excitation has been carried out. This has been achieved by simultaneous acquisition of the acoustic, mean velocity, turbulence intensities, and instability-wave pressure data. A 5.08 cm diameter jet has been tested for this purpose under static and also flight-simulation conditions. An open-jet wind tunnel has been used to simulate the flight effects. Limited data on heated jets have also been obtained. To improve the physical understanding of the flow modifications brought about by the upstream discrete-tone excitation, ensemble-averaged schlieren photographs of the jets have also been taken. Parallel to the experimental study, a mathematical model of the processes that lead to broadband-noise amplification by upstream tones has been developed. Excitation of large-scale turbulence by upstream tones is first calculated. A model to predict the changes in small-scale turbulence is then developed. By numerically integrating the resultant set of equations, the enhanced small-scale turbulence distribution in a jet under various excitation conditions is obtained. The resulting changes in small-scale turbulence have been attributed to broadband amplification of jet noise. Excellent agreement has been found between the theory and the experiments. It has also shown that the relative velocity effects are the same for the excited and the unexcited jets. Author

N83-12972# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab.

A NOTE ON THE GENERAL SCALING OF HELICOPTER BLADE-VORTEX INTERACTION NOISE

F. H. SCHMITZ, D. A. BOXWELL, S. LEWY (ONERA), and C. DAHAN (ONERA) May 1982 14 p refs Presented at the Ann. Forum of the Am. Helicopter Soc., Anaheim, Calif., May 1982

(AD-A118761) Avail: NTIS HC A02/MF A01 CSCL 20A

A model-rotor acoustic experiment in a three meter open section anechoic wind tunnel (CEPRA-19) is described. The important scaling parameters are reviewed and some on-line acoustic data are presented for conditions known to produce blade-vortex interaction noise on a single rotor helicopter. Time averages of the model-scale acoustic pulses are compared with similar full-scale data taken in-flight under the same non-dimensionalized conditions. Good general agreement between model and full-scale pulse shapes and amplitudes of blade-vortex interaction noise is shown for one advance ratio over a range of inflow conditions for the rotor. Directivity sweeps for a condition known to generate blade-vortex interactions are presented. Some model rotor testing limitations of the CEPRA-19 facility in its present configuration are indicated.

Author (GRA)

N83-12973# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamics and Bioengineering Div.

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 172: HUSH-NOISE SUPPRESSOR (AERO SYSTEMS ENGINEERING, INCORPORATED) FAR-FIELD NOISE

R. A. LEE, T. H. RAU, and C. JONES Jul. 1982 823 p refs (Contract AF PROJ. 7231)

(AD-A118773; AMRL-TR-75-50-VOL-172) Avail: NTIS HC A99/MF A01 CSCL 20A

The hush-house noise suppressor was made by Aero Systems Engineering of Texas, Inc. for acoustical suppression of various AF fighter/trainer aircraft during ground runup operations. This report provides measured and extrapolated data defining the bioacoustic environments produced by several aircraft/engines operating in the hush-house suppressor for various engine power configurations. Far-field data measured at 20 locations are normalized to standard meteorological conditions and extrapolated from 75-8000 meters to derive sets of equal-value contours for seven acoustic measures as function 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(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. Data are presented for the following aircraft/engines operating in the hush-house noise suppressor: F-4, F-15, F-16, F-105, F-106, F-111F and T-38 aircraft and the TF41-A-1, J79-GE-15, F100-PW-100, J75-P19, J-75-P-17 and TF30-P-100 engines.

Author (GRA)

N83-12974# Army Construction Engineering Research Lab., Champaign, Ill. Environmental Div.

OPERATIONAL NOISE DATA FOR UH-60A AND CH-47C ARMY HELICOPTER Final Report

P. D. SCHOMER, A. AVERBUCH, and R. RASPET Jun. 1982 46 p refs

(Contract DA PROJ. 4A7-62720-A-896)

(AD-A118796; CERL-TR-N-131) Avail: NTIS HC A03/MF A01 CSCL 20A

The objectives of this study were to develop sound exposure level (SEL) versus distance curves for the UH-60A and CH-47C Army helicopters, to investigate the variation of SEL with aircraft speed, and to confirm the validity of the measurement procedures by comparing data obtained for UH-1H helicopters at Forts Campbell and Rucker. Sound levels produced by the helicopters were measured for heavily and lightly loaded aircraft which were hovering and traveling at various speeds and distances. The data

show that a heavily loaded UH-60A is about 2 dB louder than a lightly loaded one. Landing noise with the UH-60A and CH-47 is substantially greater than for level flyover. The variation of SEL with speed is rather modest, except for aircraft at very low or very high speeds. The results for the UH-1H at Forts Campbell and Rucker did not compare as favorably as expected. Various factors, including maintenance procedures and the surface of the test area, may have contributed to the discrepancies.

Author (GRA)

N83-12975# Civil Aeronautics Board, Washington, D.C.
AREA EQUIVALENT METHOD: A QUICK PROCEDURE FOR DETERMINING NOISE IMPACT AT CIVILIAN AIRPORTS

Feb. 1982 92 p refs

(PB82-195892) Avail: NTIS HC A05/MF A01 CSCL 13B

A background of the Area Equivalent Method concept is given along with specific instructions in its use. The method is used as an analysis tool in determining noise impact at commercial airports.

GRA

N83-12976# Association Aeronautique et Astronautique de France, Paris.

NOISE SOURCE MECHANISMS IN UNSTEADY FLOW

J. E. F. WILLIAMS Nov. 1980 28 p refs Presented at the

7th Colloq. d'Acoustique Aeron., Lyon, 4-5 Nov. 1980

(PB82-203837; AAAF-NT-80-49; ISSN-0243-0177) Avail: NTIS

HC A03/MF A01 CSCL 20A

Some noise units are described and their relevance to various audible sounds and to pseudosound is discussed. A definition is then made of both sound and sound sources, the two being defined as non-overlapping in space. Surface sources are incorporated within that definition by a formal mathematical step. Linear noise sources are described and some examples given with an indication of their strength and practical importance. In an unbounded perfect gas such linear sources arise only because of unsteady heating or by the acceleration of inhomogeneous fluid or by unsteady boundary conditions. Compact sources are described and the noise due to unsteady heating and the acceleration of hot flames is illustrated. Efficient compact monopoles are discussed as are the linear dipole sources that act on inhomogeneous matter in unsteady motion.

GRA

N83-13936*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

PREDICTION OF SOUND RADIATION FROM DIFFERENT PRACTICAL JET ENGINE INLETS Final Technical Report, 2 Jun. 1980 - 31 Jul. 1982

W. L. MEYER and B. T. ZINN 31 Jul. 1982 365 p refs

(Contract NAG3-67)

(NASA-CR-169533; NAS 1.26:169533) Avail: NTIS HC A16/MF A01 CSCL 20A

Computer codes which were based upon a special integral representation of the external solutions of the Helmholtz equation were upgraded so that they would yield accurate results for the acoustic radiation patterns in the field surrounding an axisymmetric body for nondimensional wave numbers, based on duct radius, of up to twenty. The accuracy of these computer programs was checked by the use of the point source method for the generation of exact solutions and then by comparison with the results of other experimental and theoretical studies. These computer codes were used in a parametric study of the dependence of the radiated sound field on input modal distribution, wave number, and inlet lip shape. The results of this study show that: (1) as the wave number (i.e., cut off ratio) is increased for a given input modal distribution that the acoustic radiation peak moves towards the inlet centerline and becomes more compact (i.e., narrows); (2) as the input mode number is increased for a given cut off ratio the acoustic radiation peak moves away from the inlet centerline and becomes more compact.

S.L.

N83-13937*# Wyle Labs., Inc., Arlington, Va.
SHOULD HELICOPTER NOISE BE MEASURED DIFFERENTLY FROM OTHER AIRCRAFT NOISE? A REVIEW OF THE PSYCHOACOUSTIC LITERATURE Final Report

J. A. MOLINO Washington NASA Nov. 1982 90 p refs
 (Contract NAS1-16276)
 (NASA-CR-3609; NAS 1.26:3609; WR-82-19) Avail: NTIS HC A05/MF A01 CSCL 20A

A review of 34 studies indicates that several factors or variables might be important in providing a psychoacoustic foundation for measurements of the noise from helicopters. These factors are phase relations, tail rotor noise, repetition rate, crest level, and generic differences between conventional aircraft and helicopters. Particular attention was given to the impulsive noise known as blade slap. Analysis of the evidence for and against each factor reveals that, for the present state of scientific knowledge, none of these factors should be regarded as the basis for a significant noise measurement correction due to impulsive blade slap. The current method of measuring effective perceived noise level for conventional aircraft appears to be adequate for measuring helicopter noise as well. Author

N83-13939*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RECENT RESULTS ABOUT FAN NOISE: ITS GENERATION, RADIATION AND SUPPRESSION

C. E. FEILER 1982 37 p refs Presented at the 19th Ann. Meeting of the Soc. of Eng. Sci., Rolla, Mo., 27-29 Oct. 1982 - (NASA-TM-83002; E-1438; NAS 1.15:83002) Avail: NTIS HC A03/MF A01 CSCL 20A

Fan noise including its generation, radiation characteristics, and suppression by acoustic treatment is studied. In fan noise generation, results from engine and fan experiments, using inflow control measures to suppress noise sources related to inflow distortion and turbulence, are described. The suppression of sources related to inflow allows the experiments to focus on the fan or engine internal sources. Some of the experiments incorporated pressure sensors on the fan blades to sample the flow disturbances encountered by the blades. From these data some inferences can be drawn about the origins of the disturbances. Also, hot wire measurements of a fan rotor wake field are presented and related to the fan's noise signature. The radiation and the suppression of fan noise are dependent on the acoustic modes generated by the fan. Fan noise suppression and radiation is described by relating these phenomena to the mode cutoff ratio parameter. In addition to its utility in acoustic treatment design and performance prediction, cutoff ratio was useful in developing a simple description of the radiation pattern for broadband fan noise. Some of the findings using the cutoff ratio parameter are presented. S.L.

N83-13940# Deutsche Lufthansa Aktiengesellschaft, Cologne (West Germany).

AIRCRAFT NOISE PROBLEMS [DIE PROBLEMATIK DES FLUGLAERMS]

Jan. 1981 98 p In GERMAN
 Avail: NTIS HC A05/MF A01

The problems related to aircraft noise were studied. Physical origin (sound), human reaction (noise), quantization of noise and sound sources of aircraft noise are discussed. Noise abatement at the source, technical, fleet-political and air traffic measures are explained. The measurements and future developments are also discussed. The position of Lufthansa as regards aircraft noise problems is depicted. Author (ESA)

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.

N83-13024*# National Academy of Sciences - National Research Council, Washington, D. C. Committee on NASA Scientific and Technological Program Reviews.

AERONAUTICS RESEARCH AND TECHNOLOGY. A REVIEW OF PROPOSED REDUCTIONS IN THE FY 1983 NASA PROGRAM

National Academy Press Jul. 1982 79 p refs Sponsored by NASA
 (NASA-CR-169386; NAS 1.26:169386) Avail: NTIS HC A05/MF A01 CSCL 05J

Reductions in the Fiscal Year 1983 program from the original proposal to the levels of the appropriation request submitted to Congress are reviewed. The request asked for an assessment of the national criticality of the excluded programs and, for each one, the risk (probability of success) associated with achieving the objectives sought and the degree to which it might be assumed by the private sector. Based on this request, a charge comprising an assessment of those aeronautics projects excluded from the FY 1983 budget request to Congress, the likelihood that industry would undertake them, the impact of their not being done, and the more general question of the need for government to bridge the gap between the aeronautics research and technology base and early application was developed. The charge further specifies that the assessment is to encompass considerations of safety, national defense, efficient transport, and the national economy. S.L.

N83-13027# Forecasting International Ltd., Arlington, Va.
EVALUATION OF TECHNOLOGY ASSESSMENTS AND DEVELOPMENT OF EVALUATION PROTOCOLS, PROJECT REPORT

M. J. CETRON, E. F. BISHOP, and J. J. HENDRY Feb. 1982
 240 p refs
 (Contract NSF PRA-80-22613)
 (PB82-197393; NSF/PRA-82005) Avail: NTIS HC A11/MF A01 CSCL 05A

The elements of the six technology assessments considered are compared in order to determine consistent patterns of analysis and to identify "generic items" which could be included in checklists of elements to be considered in TA evaluations. These analyses also draw out many subsidiary issues and ideas which may be of interest to both the TA evaluator and the general reader. The recommended format and methodology for structuring a TA summary or 'synopsis' is described in a way that presents the important assumptions, information, and policy recommendations in a concise and easily retrievable format. Detailed directions for application of the evaluation protocol developed are provided, including recommended checklists and other tools. GRA

N83-13028# Forecasting International Ltd., Arlington, Va.
EVALUATION OF TECHNOLOGY ASSESSMENTS AND DEVELOPMENT OF EVALUATION PROTOCOLS Executive Summary

M. J. CETRON, E. F. BISHOP, and J. J. HENDRY Feb. 1982
 53 p
 (Contract NSF PRA-80-22613)
 (PB82-197385; NSF/PRA-82007) Avail: NTIS HC A04/MF A01 CSCL 05A

A group of technology assessments (TA's) were studied to determine whether there were any consistent patterns in the analysis, policy option identification, or other elements which could provide useful guidance in the efficient management of TA's. Some

of the topics outlined in this summary are: the project methodology and experience; analysis and comparison of the elements of the TA's considered; TA goals established and achieved; policy and technology options; problematic issues; the unique nature of the problem-oriented TA; terms of reference of risk; the technology assessment synopsis format; and the evaluation protocol. The major conclusion of the research was that there are features among previously performed TA's which can be rearranged into consistent patterns of analysis which cut across differing technologies. Distilling the elements of the TA permits design of a number of patterns of analysis, depending upon intended use. Two examples are the synopsis format and policy format. The synopsis format is the more refined and successful of the analyses. GRA

N83-14022*# Operations Research, Inc., Silver Spring, Md.
GOVERNMENT FINANCIAL SUPPORT FOR CIVIL AIRCRAFT RESEARCH, TECHNOLOGY AND DEVELOPMENT IN FOUR EUROPEAN COUNTRIES AND THE UNITED STATES Final Report

B. CHANDLER, R. GOLASZEWSKI, C. PATTEN, B. RUDMAN, and R. SCOTT 1 Apr. 1980 93 p refs Prepared in cooperation with Gellman Research Associates, Inc.

(Contract NASW-2961)

(NASA-CR-169537; NAS 1.26:169537) Avail: NTIS HC A05/MF A01 CSCL 05D

Data on the levels of government financial support for civil aircraft airframe and engine (CAAE) research and technology (R&T) in the United States and Europe (United Kingdom, West Germany, France and The Netherlands) and means of comparing these levels are provided. Data are presented for the years 1974-1977. European R&T expenditure data were obtained through visits to each of the four European countries, to the Washington office of the European Communities, and by a search of applicable literature. CAAE R&T expenditure data for the United States were obtained from NASA and Federal Aviation Administration (FAA). Author

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GENERAL

A83-16375#

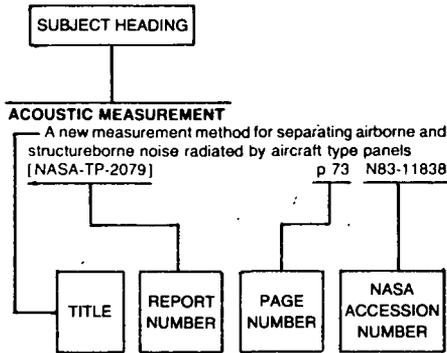
AEROSPACE HIGHLIGHTS 1982

Astronautics and Aeronautics, vol. 20, Dec. 1982, p. 18-22, 24, 26 (87 ff.).

An assessment is given of the most significant achievements in aircraft design for the year 1982, with attention to the indications of Western military aircraft superiority in the Israeli intervention in Lebanon and in the Falklands War; in both cases, the AIM-9L Sidewinder missile performed exceptionally, along with the F-16 and F-15 fighters of the Israeli Air Force and the Harrier VTOL fighters of the British Navy, respectively. Also noted are developments in civilian and military helicopter design and development, continuing interest in, and experimentation with, such alternative aviation fuels as liquefied natural gas, NASA flight tests on aircraft surface improvements for boundary flow laminatization, the relative merits of the 757, 767 and A-310 new-generation airliners, and advanced derivatives of the F-5 and F-16 fighters.

O.C.

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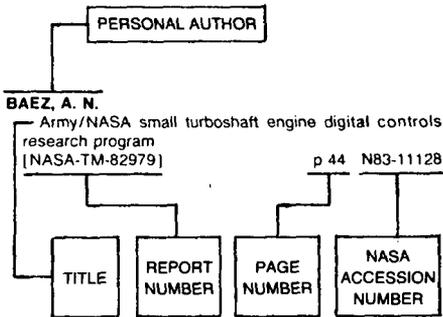
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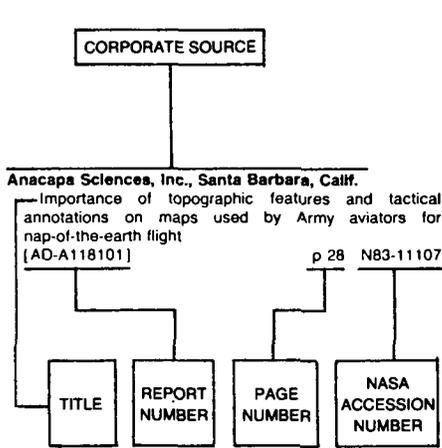
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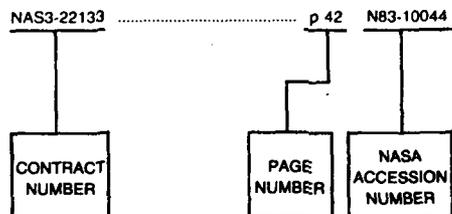
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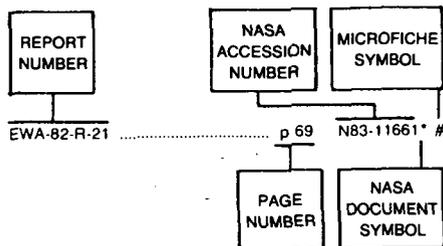
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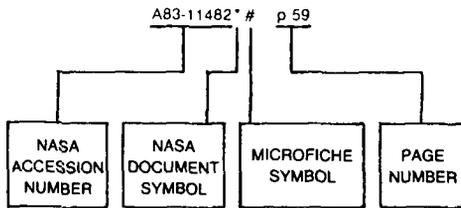
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AD-A118665	p 117	N83-12380 #	ARL-SYS-NOTE-82	p 97	N83-12082 #	FAA-CT-82-31	p 117	N83-12298 #
AD-A118692	p 84	N83-12055 #	ARL-SYS-REPORT-25	p 86	N83-12057 #	FAA-CT-82-83	p 111	N83-12237* #
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AD-A118756	p 80	N83-12053 #	ARL/PSU/TM-82-124	p 102	N83-12096 #	FAA-RD-82-12	p 87	N83-12066 #
AD-A118761	p 123	N83-12972 #	ARO-16061.2-EG	p 80	N83-12051 #	FAA-RD-82-12	p 87	N83-12067 #
AD-A118768	p 93	N83-12076 #	ASLE PREPRINT 82-LC-2B-2	p 112	A83-13234 #	FAA-RD-82-14	p 88	N83-13090 #
AD-A118773	p 123	N83-12973 #	ASLE PREPRINT 82-LC-3C-4	p 112	A83-13239 #	FAA-RD-82-37	p 88	N83-13088 #
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