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A Continuing Bibliography with Indexes

NASA SP-7037(166)
October 1983

National Aeronautics and Space Administration

25th Anniversary
1958-1983

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ACCESSION NUMBER RANGES

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

STAR (N-10000 Series)	N83-27950 - N83-30353
IAA (A-10000 Series)	A83-36992 - A83-40665

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NASA SP-7037(166)

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 166)

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 September 1983 in

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

NASA Scientific and Technical Information Branch 1983
National Aeronautics and Space Administration
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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 558 reports, journal articles, and other documents originally announced in September 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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NASA ACCESSION NUMBER — TITLE — AUTHOR — CONTRACT OR GRANT — REPORT NUMBER — CORPORATE SOURCE — PUBLICATION DATE — AVAILABILITY SOURCE — COSATI CODE

N83-11061*# Applied Inst. of Mathematics, Inc., Evanston, Ill.
A NONLINEAR STRUCTURAL CONCEPT FOR COMPLIANT WALLS Final Report
E. L. REISS Washington NASA Oct. 1982 40 p refs
(Contract NAS1-14717)
(NASA-CR-3628; NAS 1.26:3628) Avail: NTIS HC A03/MF A01 CSCL 01A

Two mechanisms of drag reduction for flow over flat plates were investigated. The first mechanism employs Bushnell's hypothesis that compliant walls produce drag reduction by interfering with the formation of the turbulent spots in a turbulent boundary layer. It is shown that the amplitudes and frequencies of compliant wall motions for drag reduction might be achieved by using slightly curved walls and the resulting large amplitude motions of snap buckling. A simple structural model of an arch is used in the analysis, and an asymptotic method is developed. The required wall motions can be obtained by using materials like mylar. In addition, the delay of transition from laminar to turbulent flow by driven walls was studied for Poiseuille channel flow. The walls are driven by a periodic traveling wave. A significant increase in the transitional Reynolds number is obtained by appropriately prescribing the wavelength and phase velocity of the wall motion. Previously developed asymptotic methods are used in the analysis. M.G.

TYPICAL CITATION AND ABSTRACT FROM *IAA*

AIAA ACCESSION NUMBER — AVAILABLE ON MICROFICHE — AUTHOR — TITLE — TITLE OF PERIODICAL — AUTHOR'S AFFILIATION — PUBLICATION DATE

A83-12857#
LIFE DEVELOPMENT OF COMPONENTS/SYSTEMS OF AIRCRAFT
R. DUGGAL (Indian Airlines, Bombay, India) Aeronautical Society of India, Journal, vol. 33, Feb.-May 1981, p. 35-39.

Three aspects of a maintenance program are described. The first, referred to here as hard time limit (HTL), involves the removal and complete overhaul of an aircraft component at fixed time intervals. A second type of maintenance procedure, referred to as 'on condition,' is used with parts that are allowed to remain in service until there is a failure, suspected failure, or scheduled inspection. The third type of procedure is called condition monitoring. This is used on items that are neither overhauled nor inspected on a regular basis. The unit or part is operated until failure occurs. Economies in maintenance can be achieved by a judicious combination of these procedures. C.R.

AERONAUTICAL ENGINEERING

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OCTOBER 1983

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AERONAUTICS (GENERAL)

A83-37856#
NEW TECHNOLOGIES FOR GENERAL AVIATION
Dornier-Post (English Edition) (ISSN 0012-5563), no 2, 1983, p 20-26

Activities undertaken within the framework of the West German aviation research and technology program that are amined at the improvement of the performance and economy of general aviation aircraft are discussed Following a brief review of the principal parameters determining general aviation aircraft performance and economy, consideration is given to developments in the areas of structures, propellers and wing aerodynamics aimed at improving these parameters Such developments are reflected in the New Technology Wing, which makes use of integral construction and fiber composite materials, and in improved propeller profiles and optimized planforms Work is also under way on a gust alleviation system, intended to improve passenger comfort at low altitudes Areas for future improvements are also indicated A L W

A83-38683*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SOME LESSONS FROM NACA/NASA AERODYNAMIC STUDIES FOLLOWING WORLD WAR II
M L SPEARMAN (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 15 p refs
(AIAA PAPER 83-1856)

An historical account is presented of the new departures in aerodynamic research conducted by NACA, and subsequently NASA, as a result of novel aircraft technologies and operational regimes encountered in the course of the Second World War. The invention and initial development of the turbojet engine furnished the basis for a new speed/altitude regime in which numerous aerodynamic design problems arose These included compressibility effects near the speed of sound, with attendant lift/drag efficiency reductions and longitudinal stability enhancements that were accompanied by a directional stability reduction Major research initiatives were mounted in the investigation of swept, delta, trapezoidal and variable sweep wing configurations, sometimes conducted through flight testing of the 'X-series' aircraft Attention is also given to the development of the first generation of supersonic fighter aircraft O C

A83-38901
LIGHTER-THAN-AIR SYSTEMS CONFERENCE, ANAHEIM, CA, JULY 25-27, 1983, COLLECTION OF TECHNICAL PAPERS
Conference sponsored by the American Institute of Aeronautics and Astronautics New York, American Institute of Aeronautics and Astronautics, 1983, 187 p

The present conference on lighter-than-air (LTA) vehicles covers barriers and possibilities associated with the use of airships in developing countries, the market potential of the light utility airship concept, the effect of buoyancy and power design parameters on hybrid airship performance, thermal effects on a high altitude surveillance airship, patterning techniques for inflatable LTA vehicles, a dynamic analysis of the magnus effect-lift LTA 20-1 heavy lift aircraft, and the application of the panel method to airships Also considered are a six degree of freedom heavy lift airship simulation, the lateral response of an airship to turbulence, recent LTA program progress in Japan, tethered aerostat operations in Arctic weather, the Cyclo-Crane hybrid aircraft concept, and the preliminary design of a very large pressurized airship for civilian and military applications O C

A83-38906#
APPLICATIONS AND MARKET POTENTIALS FOR THE LIGHT UTILITY AIRSHIP CONCEPT
T S BERGER (Ulita Manufacturing, Inc , Sheboygan, WI) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 40-51 refs
(AIAA PAPER 83-1975)

An assessment is presented of the market potential of small airships designed for such light utility and general surveillance missions as border patrol, municipal law enforcement, pollution monitoring, etc Attention is given to a proprietary small airship design, the LUA-1, which is expected to demonstrate performance improvements over comparable aircraft in such areas as fuel consumption, maintenance down time, slow flight characteristics, vehicle vibration and noise levels, pilot and crew fatigue, equipment stowage capabilities, and operating costs O C

A83-39221
MAINTENANCE ACCORDING TO TECHNICAL CONDITIONS [WARTUNG NACH TECHNISCHEM ZUSTAND]
F KIESSLING (Interflug Gesellschaft fuer internationalen Flugverkehr mbH, Berlin, East Germany) Technisch-oekonomische Information der zivilen Luftfahrt (ISSN 0232-5012), vol 18, no 6, 1982, p 222-226 In German

In the case of all air transportation organizations, there are increasing demands related to safety, the performance of the transportation process without disturbance, and the enhancement of economic efficiency In connection with these demands, approaches have been considered for reducing nonproductive time and cost for maintenance and repair It was found that the conventional method concerning the conduction of maintenance and repair operations on a time-related basis is not very satisfactory with respect to the new demands According to the new methods, the time and the extent of the maintenance operations are determined on the basis of the actual condition of the considered object Attention is given to the procedure of condition determination, the technical parameters involved, changes concerning the object characteristics, failure and conditions preceding failure, methods of technical maintenance and repair, and technical maintenance and repair according to condition on the basis of a control of parameters and the reliability level G.R

A83-39346
DFVLR RESEARCH ON HELICOPTER NOISE [HUBSCHRAUBERLAERMFORSCHUNG IN DER DFVLR]
H HELLER and W SPLETTSTOESSER (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Entwurfs-Aerodynamik, Brunswick, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), June 1983, p. 35-40 In German

Investigations of the certification testing procedures for helicopter noise levels, as incorporated in the ICAO Annex 16 guidelines, are reported. The start, overflight, and landing patterns required in the guidelines were flown by three modern helicopters, and the effective perceived noise (EPNL) levels were calculated and evaluated in relation to the weight of the aircraft. The results are compared to those of other testing facilities and other helicopters Further tests showed that the EPNL test is insensitive to variations in overflight altitude or weight, but quite sensitive to blade-tip Mach number above Mach 0.80 Tests performed by DFVLR in 1978 and 1981 and by the US TSC/FAA in 1981 on the same aircraft are shown to reproduce EPNL well, and similar results were obtained in a 13-test-facility roundrobin comparison of data reduction techniques (using a tape recording of helicopter noise) The value of legal noise standards is seen in stimulating industry research on quieter helicopter designs. T K.

A83-39801
SCIENTIFIC BALLOONING - III; PROCEEDINGS OF THE WORKSHOP, OTTAWA, CANADA, MAY 16-JUNE 2, 1982
W RIEDLER, ED. and M FRIEDRICH (Graz, Technische Universitaet, Graz, Austria) Workshop sponsored by COSPAR Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, 149 p In English and French

The present conference on the technologies, operations, instrumentation and study results of scientific research balloons covers the radiation-controlled balloon (RACOON), balloon materials and designs, balloon film strain measurement, new systems for extending the useful float duration of standard zero-pressure balloon flights, global telecommunications requirements for the long duration balloon environment, geostationary satellite techniques for the retrieval of data from long duration flights, power supplies for long duration balloon flights, and navigation for balloon payloads. Also considered are a novel static launch method for plastic balloons, stratospheric electrodynamics, the directions of solar neutrons on a long duration balloon flight, X-ray astronomy balloon probes, and a large aperture, balloon-borne telescope for the submillimeter-wavelength survey of the galactic plane O C

A83-39838
BALLOON RESEARCH AND COOPERATIVE PROGRAMMES
W. RIEDLER (Graz, Technische, Universitaet, Graz, Austria) (COSPAR and Committee on Science and Technology for Developing Countries, Workshop on Role and Impact of Space Research in Developing Countries, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 7, 1983, p. 103-110 refs

Scientific ballooning as well as the use of balloons for operational projects, deserves and indeed enjoys a high degree of attention in developing countries. Balloon projects are in most cases relatively inexpensive and - besides the scientific merits in their own realm - lend themselves also as 'training' projects for larger space programmes. An important aspect of scientific ballooning is the necessity of cooperation, in many cases on an international scale Examples for these are given and the relevance of balloon projects for developing countries are discussed Author

A83-39941*# General Electric Co., Cincinnati, Ohio
COMPOSITE ENGINE DUCT FABRICATION
R D PRATT, C. L. STOTLER, and A. J WILSON (General Electric Co, Aircraft Engine Business Group, Cincinnati, OH) U.S Army Materials and Mechanics Research Center, Conference on Fibrous Composites in Structural Design, 6th, New Orleans, LA, Jan 24-27, 1983, Paper. 9 p
(Contract NAS3-21854; N00019-82-C-0077)

The trimonomer polyimide resin reinforced with graphite fibers, PMR15, is lower in weight (by 20 percent) and less expensive than titanium The duct walls are of solid laminate and are made of woven T300 graphite cloth The original concept for the duct involved a solid shell of T300/PMR15 made up of seven plies of cloth tapered to eleven plies at each end. The bosses and built-up areas around the cutouts are also of T300/PMR15 The end flages riveted to the shell, however, are of titanium A buckling test demonstrated the ability of the composite analytical design techniques employed to predict the buckling strength of the composite shell. Engines tests are described, noting that the successful repair of a hole demonstrated an important advantage over titanium The development work now being done to eliminate the titanium end flanges is described, noting that an all-composite duct is in prospect. The savings estimated with a titanium-flanged composite duct are $16,891,000 (1982 dollars) and $35,504,000 (then-year dollars), the savings possible with an all-composite duct are put at $27,025,000 (1982 dollars) and $56,806,000 (then-year dollars) C.R

A83-40331
B-1B MANUFACTURING - ROCKWELL MANAGEMENT PLAN SAVING COSTS, TIME
W B SCOTT Aviation Week and Space Technology (ISSN 0005-2175), vol 119, Aug. 1, 1983, p. 40-43.

Rockwell International, the prime contractor for the U.S. Air Force's B-1B bomber program, has together with its subcontractors instituted a management system which employs weekly reviews, highlighting problem areas and thereby enabling program officials to formulate solutions that will maintain the established schedule Many of the management personnel involved in the B-1B program have had experience with the development of the original B-1 aircraft As of July 1983, all engineering drawings have been completed, together with 99 percent of manufacturing and tool orders, and 94 percent of the planned aircraft tooling has been constructed By using a set of interim milestones to monitor overall program progress, managers can quickly identify potential problem areas Milestones are monitored at each level of the organization through a series of information centers which display schedules, cost data, and status reports O C

A83-40332
B-1B MANUFACTURING - GENERAL ELECTRIC F101 PRODUCTION NEARS
K F MORDOFF Aviation Week and Space Technology (ISSN 0005-2175), vol 119, Aug 1, 1983, p 47-49, 51.

Component manufacturing methods being planned for application in the production of the B-1B bomber's F101-GE-102 engines include near net shape forgings, structural castings, rolled ring processes, and laser drilling. Laser drilling of high pressure turbine blades and vanes is faster, cleaner and more flexible than either electrodischarge machining or electrostream drilling Near net shape investment castings will replace forgings in some engine structural components in order to reduce machining labor costs. Other novel fabrication techniques whose incorporation is being planned are automated tube bending, closed loop machining, near net forging of high pressure turbine nozzle vanes, and the spot welding of exhaust nozzle flaps by means of a robot The F101-GE-102 turbofan engine develops over 30,000 lbs of augmented thrust. O C.

A83-40333
B-1B MANUFACTURING - AVCO MODIFIES PROTOTYPE PROCESSES FOR PRODUCTION
J C. LOWNDES Aviation Week and Space Technology (ISSN 0005-2175), vol 119, Aug 1, 1983, p 52, 53, 55, 57
Tooling changes have streamlined the process of development from prototype to production B-1B bomber configurations, and advanced manufacturing technologies are being applied to save time and improve quality control The manufacturing process modifications which have been introduced, or are being planned, for B-1B wing structure production include the milling of integral skin stringers, skin autoclave shaping, automated wing skin deburring, metal surface treatment and painting in a new facility, borescope gap inspections, fuel soak testing of the wing integral tanks, and the computer-aided forming of hydraulic tubing Each wing is 55 ft long and 7.5 ft wide at the point of maximum chord, and weighs 15,330 lb when fully equipped Skin thicknesses vary from 1.9 to 0 3 in O C

N83-27951*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
FLOW VISUALIZATION OF THE WAKE OF A TRANSPORT AIRCRAFT MODEL WITH LATERAL-CONTROL OSCILLATIONS
F L JORDAN, JR Jun 1983 28 p refs
(NASA-TM-84623, L-15106, NAS 1 15 84623) Avail NTIS HC A03/MF A01 CSCL 01B
An exploratory flow visualization study conducted in the Langley Vortex Research Facility to investigate the effectiveness of lateral control surface oscillations as a potential method for wake vortex attenuation on a 0 03 scale model of a wide body jet transport aircraft is described Effects of both asymmetric surface oscillation (control surfaces move as with normal lateral control inputs) and symmetric surface oscillation (control surfaces move in phase) are presented The asymmetric case simulated a flight maneuver which was previously investigated on the transport aircraft during NASA/FAA flight tests and which resulted in substantial wake vortex attenuation. Effects on the model wake vortex systems were observed by propelling the model through a two dimensional smoke screen perpendicular to the model flight path Results are presented as photographic time histories of the wake characteristics recorded with high speed still cameras. Effects of oscillation on the wake roll up are described in some detail, and the amount of vortex attenuation observed is discussed in comparative terms Findings were consistent with flight test results in that only a small amount of rotation was observed in the wake for the asymmetric case A possible aerodynamic mechanism contributing to this attenuation is suggested M G

N83-27952*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
PSUEDOSPECTRAL CALCULATION OF SHOCK TURBULENCE INTERACTIONS Final Report
T. A ZANG (Coll. of William and Mary, Williamsburg, Va), D A KOPRIVA, and M Y HUSSAINI May 1983 14 p refs
(Contract NAS1-16394, NAS1-17070 , NAS1-17130, NAG1-109)
(NASA-CR-172133, ICASE-83-14, NAS 1 26·172133) Avail· NTIS HC A02/MF A01 CSCL 01B
A Chebyshev-Fourier discretization with shock fitting is used to solve the unsteady Euler equations. The method is applied to shock interactions with plane waves and with a simple model of homogeneous isotropic turbulence The plane wave solutions are compared to linear theory Author

N83-29171# Textron Bell Helicopter, Fort Worth, Tex.
ADAPTATION OF PULTRUSION TO THE MANUFACTURE OF HELICOPTER COMPONENTS Final Report, Jan. 1980 - Jan. 1982
E E BLAKE Army Aviation Research and Development Command Oct. 1982 107 p
(Contract DAAG46-79-C-0089)
(AD-A126291, USAAVRADCOM-TR-82-F-7, AMMRC-TR-82-52)
Avail: NTIS HC A06/MF A01 CSCL 13H
The objective of this program was to produce a helicopter component by pultruding a straight preform, then change the contour of that preform during cure without affecting its cross section Tooling for pultrusion and postforming was designed Sixteen lower aft cargo door tracks for the Model UH-1 were manufactured Author (GRA)

N83-29250# Royal Netherlands Air Force, Volkel
OPERATIONAL AND MAINTENANCE ASPECTS OF THE INTRODUCTION OF AN ADVANCED FIGHTER TYPE
J T BAKKER and C HUURMAN *In* AGARD Eng Handling 12 p Feb. 1983
Avail NTIS HC A18/MF A01
In 1979 the first F-16 aircraft entered service with the Royal Netherlands Air Force Operational and maintenance aspects, which were found significantly different from previous experience, are described L.F M.

02

AERODYNAMICS

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

A83-37179#
FLOW OVER A BICONIC CONFIGURATION WITH AN AFTERBODY COMPRESSION FLAP - A COMPARATIVE NUMERICAL STUDY
J S SHANG (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) and R W. MACCORMACK (Washington, University, Seattle, WA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 11 p. refs
(AIAA PAPER 83-1668)
Three-dimensional Navier-Stokes solutions were obtained for flow over a biconic configuration with an afterbody compression flap The simulated flow was achieved for a Mach number of 7 97, a characteristic Reynolds number of 9.23 million and at a zero degree angle of attack. A comparative study was conducted using the vectorized MacCormack's explicit and implicit numerical schemes Results from both the explicit and the implicit algorithms correctly yielded the detailed flow field structure and the heat transfer information in comparison with experimental data However, the implicit numerical procedure exhibited a significant improvement in numerical efficiency over the explicit method For fine mesh clustering near the solid body surface, necessary to resolve surface shear stress and heat transfer rates, the implicit scheme achieved an order of magnitude reduction in computing time Author

A83-37184*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
NAVIER-STOKES CALCULATIONS FOR THE VORTEX WAKE OF A ROTOR IN HOVER
C. H. LIU, J. L THOMAS (NASA, Langley Research Center, Low-Speed Aerodynamics Div, Hampton, VA), and C TUNG (U S Army, Aeromechanics Laboratory, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 9 p refs
(AIAA PAPER 83-1676)
An efficient finite-difference scheme for the solution of the incompressible Navier-Stokes equation is used to study the vortex wake of a rotor in hover The solution procedure uses a vorticity-stream function formulation and incorporates an asymptotic far-field boundary condition enabling the size of the computational domain to be reduced in comparison to other methods The results from the present method are compared with experimental data obtained by smoke flow visualization and hot-wire measurements for several rotor blade configurations Author

A83-37188#
AN EXPERIMENTAL STUDY OF THE TURBULENT BOUNDARY LAYER ON A TRANSPORT WING IN TRANSONIC FLOW
F W. SPAID and F. W ROOS (McDonnell Douglas Research Laboratories, St. Louis, MO) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 16 p refs
(AIAA PAPER 83-1687)
The upper-surface boundary layer on a transport wing model in transonic flow was extensively surveyed with miniature yaw probes. The data collected show boundary-layer growth associated with shock-wave/boundary-layer interaction, followed by recovery of the boundary layer downstream of the shock Significant variation in flow direction with distance from the surface was observed near the trailing edge, except at the wing root and tip. Measurements of fluctuating surface pressure and wingtip acceleration were also obtained. The influence of flowfield unsteadiness on the boundary-layer data is discussed Author

A83-37204*# Bolt, Beranek, and Newman, Inc, Cambridge, Mass
ENERGETICS AND OPTIMUM MOTION OF OSCILLATING LIFTING SURFACES
A. R AHMADI (Bolt, Beranek, and Newman, Inc., Cambridge, MA) and S E. WIDNALL (MIT, Cambridge, MA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983. 19 p. refs
(Contract NGR-009-818)
(AIAA PAPER 83-1710)
Low-frequency, unsteady, lifting-line theory is used to characterize the energetics and optimum motion of an unswept rigid wing oscillating harmonically in an inviscid, incompressible flow The energetics calculations account for the leading edge suction force, the power absorbed in the wing oscillations, and the energy loss rate produced by vortex shedding. Optimization is achieved by minimizing the average energy loss rate in relation to a given thrust, and a unique solution is found in the three dimensional case for low, reduced frequencies The two-dimensional solution is nonunique, a condition which is examined in terms of the normal modes of the energy loss rate matrix. An invisible mode with a hydrodynamic efficiency of 100 pct is obtained in the two-dimensional case, causing the nonuniqueness of the solution by yielding no fixed positive thrust through perfect unsteady feathering. M.S.K.

A83-37211*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
CONTOURING TUNNEL WALLS TO ACHIEVE FREE-AIR FLOW OVER A TRANSONIC SWEPT WING
G G MATEER (NASA, Ames Research Center, Moffett Field, CA) and A. BERTELRUD (Flygtekniska Forsoksanstalten, Bromma, Sweden) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 10 p 9.
(AIAA PAPER 83-1725)
The effects of wind-tunnel walls on the flow over a swept wing were greatly reduced by wall contouring Significant reductions in spanwise pressure gradients were achieved by shaping all of the walls to conform to the streamlines over the model in free air Surface pressure and oil-flow data were used to evaluate the effects of Mach and Reynolds numbers on the design Comparisons of these data with inviscid calculations indicate that free-air flow is established at a Mach number of 0.74 and at Reynolds numbers above 4 7 million Author

A83-37229*# Princeton Univ, N J.
CONICAL SIMILARITY OF SHOCK/BOUNDARY LAYER INTERACTIONS GENERATED BY SWEPT FINS
F K. LU (Princeton University, Princeton, NJ) and G. S SETTLES American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 9 p. refs
(Contract NAG2-109, F49620-81-K-0018)
(AIAA PAPER 83-1756)
A parametric experimental study has been made of the class of 3D shock wave/turbulent boundary layer interactions generated by swept-leading-edge fins. The fin sweepback angles ranged from 0 to 65 deg at angles of attack of 5, 9, and 15 deg Two equilibrium 2D turbulent boundary layers with a free-stream Mach number of 2 95 and a Reynolds number of 6 3 x 10 to the 7th/m were used as incoming flow conditions. All the resulting interactions were found to possess conical symmetry of surface pressures and skin friction lines beyond an initial inception zone Further, these interactions revealed a simple similarity based on inviscid shock strength irrespective of fin sweepback or angle of attack Author

A83-37233#
EXPERIMENTAL AND COMPUTATIONAL INVESTIGATION OF THE FLOW IN THE LEADING EDGE REGION OF A SWEPT WING
A. BERTELRUD and J. NORDSTROM (Flygtekniska Forsoksanstalten, Bromma, Sweden) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 11 p. Research supported by the Forsvaret Materielwerk refs
(AIAA PAPER 83-1762)
In the paper transition and separation in the leading edge region of a swept wing under real flight conditions is discussed. Comprehensive experimental data is presented concerning pressure distributions and boundary layer data, to allow chracterisation of various flow phenomena Laminar boundary layer computations are made, and based on the calculated laminar boundary layer, the stability of the three-dimensional flow is computed using a new method. Author

A83-37260
CONCERNING A TYPE OF SEPARATED FLOW ON A RECTANGULAR WING OF SMALL ASPECT RATIO [OB ODNOM VIDE OTRYVNOGO TECHENIIA NA PRIAMOUGOL'NOM KRYLE MALOGO UDLINENIIA]
V IA NEILAND and G I STOLIAROV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no. 1, 1982, p. 83-88 In Russian. refs
The steady and unsteady aerodynamic characteristics of a rectangular wing of small aspect ratio (lambda of about 1) were investigated as a function of angle of attack at subsonic speeds and a Reynolds number of 1,000,000 An interesting phenomenon is shown to occur at a moderate value of angle of attack which is

much less than the critical angle of attack corresponding to total separation flow separation occurs at the wing tip which, in the presence of a strong interaction between end vortex cores and the boundary layer, leads to a jumpwise development of a complex separated vortex flow with a large circulation zone in the middle of the wing B J

A83-37381*# Purdue Univ , Lafayette, Ind

THE EFFECT OF A NORMAL SHOCK ON THE AEROELASTIC STABILITY OF A PANEL

M. H WILLIAMS (Purdue University, West Lafayette, IN) ASME, Transactions, Journal of Applied Mechanics (ISSN 0021-8936), vol 5, June 1983, p 275-282
(Contract NSG-2194)
(ASME PAPER 83-APM-28)

The effect of a standing shock wave on the static and dynamic aeroelastic stability of a flexible panel is investigated using a linear structural and aerodynamic theoretical model It is found that the shock is generally stabilizing The lowest critical dynamic pressures are associated with shock positions downstream from the panel, where the panel is uninfluenced by the shock Author

A83-37498#

EXPERIMENTAL RESEARCH ON THE DESIGN OF HIGHLY LOADED AXIAL FANS [EXPERIMENTELLE UNTERSUCHUNGEN ZUR AUSLEGUNG HOCHBELASTETER AXIALVENTILATOREN]

C SCHROEDER Braunschweig, Technische Universitaet, Fakultaet fuer Maschinenbau und Elektrotechnik, Dr -Ing Dissertation, 1982, 164 p. In German Research supported by the Arbeitsgemeinschaft Industrieller Forschungsvereinigungen, Bundesministerium fuer Wirtschaft, and Forschungsvereinigung fuer Lueftungs- und Trocknungstechnik refs

The design of a highly loaded axial fan is discussed, emphasizing the effect of the three-dimensional flow on the coefficient for flow reversal, loss coefficient, and axial velocity ratio The cascade design and the relationship between blade load and diffusion number are addressed Some three-dimensional effects on the blade element exit angle are shown along with possibilities for approximation calculations of machine efficiencies and axial velocity ratios Various highly loaded operational bladings are experimentally studied for a fan with an 0 7 hub ratio C.D

A83-37506

INVESTIGATION OF FLOW PAST AN AIRCRAFT WING SECTION IN FLIGHT AND IN A WIND TUNNEL [ISSLEDOVANIE OBTEKANIIA SECHENIIA KRYLA SAMOLETA V POLETE I V AERODINAMICHESKOI TRUBE]

IU IA GERASIMOV, V S. GRACHEV, I S. KABUROV, V N OZEROV, M. U TABOLOV, V. M. FOMIN, and S G SHISHOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p 1-11. In Russian. refs

Results of flow and boundary layer separation have been obtained for a wing section in a wind tunnel at Reynolds numbers of 2 x 10 to the 6th and in flight at Reynolds numbers up to 20 x 10 to the 6th, experiments were performed on a swept-wing aircraft (chi = 19 deg) and on a geometrically similar model of this aircraft Features of pressure distribution, integral characteristics, and boundary layer separation conditions are identified which are due to differences in the state of the boundary layer and roughness of the wing skin for the aircraft tested in flight and for the wind-tunnel model It is noted that the results obtained can be used to assess the reliability of simulation methods and to improve them B J.

A83-37518

OPTIMAL FORM OF THE MIDDLE SURFACE OF A WING WITH SUPERSONIC LEADING EDGE, ASSURING MINIMUM DRAG FOR A PRESCRIBED LIFT FORCE AND PITCHING MOMENT [OPTIMAL'NAIA FORMA SREDINNOI POVERKHNOSTI KRYLA SO SVERKHZVUKOVOI PEREDNEI KROMKOI, OBESPECHIVAIUSHCHAIA MINIMUM SOPROTIVLENIIA PRI ZADANNYKH POD'EMNOI SILE I PRODOL'NOM MOMENTE]

A B BONDARENKO TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 3, 1982, p 118-124. In Russian refs

The linear theory of supersonic flows is used to examine the variational problem involving the determination of the form of the middle surface of a wing, assuring minimum drag for a prescribed lift force and pitching moment, the problem is a generalization of the problem examined by Burakov (1971) The Ritz method is employed to obtain an approximate analytical solution to this problem A wing whose leading edge is represented by a piecewise-linear function is considered as an example B J.

A83-37519

ON THE ACCURACY OF CALCULATING THE AERODYNAMIC CHARACTERISTICS OF THIN WINGS AND AIRFOILS BY THE METHOD OF DISCRETE VORTICES [O TOCHNOSTI RASCHETA AERODINAMICHESKIKH KHARAKTERISTIK TONKIKH KRYL'EV I PROFILEI METODOM DISKRETNYKH VIKHREI]

N N GLUSHKOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p 125-130 In Russian refs

An analysis is presented of the accuracy with which the method of discrete vortices with a uniform computational grid can be used to calculate the pressure drag of thin wings and airfoils without allowance for suction forces The error in the calculation of drag coefficient, lift force, and pitching moment is assessed for the case of two-dimensional flow Results confirm that the method of discrete vortices with a uniform computational grid can be used to calculate the aerodynamic characteristics of lifting surfaces with high accuracy. B J

A83-37520

USE OF THE PANEL METHOD TO CALCULATE THE DISTRIBUTED AERODYNAMIC CHARACTERISTICS OF A WING WITH PYLON AND NACELLE AT LOW SPEEDS [PRIMENENIE PANEL'NOGO METODA DLIA RASCHETA RASPREDELENNYKH AERODINAMICHESKIKH KHARAKTERISTIK KOMPONOVKI KRYLO S PILONOM I GONDOLOI PRI MALYKH SKOROSTIAKH]

S I. SKOMOROKHOV and L L. TEPERIN TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p 131-135 In Russian

The panel method based on linear theory was used for the numerical analysis of pressure distribution on a rectangular wing, a nacelle being suspended from a pylon under the wing It is shown that calculated values of the pressure coefficient on the wing are in satisfactory agreement with experimental values, excluding the values at the leading edge of the wing. In addition, it is found that calculated values of pressure variations due to the presence of the nacelle are in satisfactory agreement with experimental values practically along the whole chord, including the leading edge of the wing B J

A83-37521

SUPERSONIC FLOW FIELD ANALYSIS FOR A TWIN-ENGINE AIRCRAFT MODEL [RASCHET SVERKHZVUKOVOGO OBTEKANIIA MODELI SAMOLETA, IMEIUSHCHEGO SDVOENNYE DVIGATELI]

M K AUKIN and R K TAGIROV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p. 136-141 In Russian refs

Supersonic flow past a twin-engine aircraft model with lateral air intakes, swept wings, and four empennage surfaces is investigated numerically using three-dimensional steady-state Euler equations in cylindrical coordinates and McCormack's finite-difference scheme. It is assumed that the wings and empennage surfaces have zero thickness and that the gas is nonviscous Results are presented for Mach 2 3 and angles of attack of 0, 5, and 10 deg (all parameters are related to the critical values) V L.

A83-37532

APPLICATION OF NUMERICAL METHODS TO THE CALCULATION OF THE CHARACTERISTICS OF SUPERSONIC AND HYPERSONIC JET-ENGINE AIR INTAKES [PRIMENENIE CHISLENNYKH METODOV K RASCHETU KHARAKTERISTIK SVERKHZVUKOVYKH I GIPERZVUKOVYKH VOZDUKHOZABORNIKOV VRD]

V A. VINOGRADOV, V V DUGANOV, and V. A. STEPANOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no. 2, 1982, p. 62-68 In Russian refs

The numerical method of Vinogradov and Duganov (1979) was used to analyze a mixed-compression axisymmetric intake (freestream Mach = 2-3.5) and a plane intake (freestream Mach = 6), with allowance for the boundary layer under the assumption of nonseparated flow Good agreement between numerical and experimental results is shown for the local flow parameters p and M as well as for the integral characteristics of the intakes nu, f, and Cx B J.

A83-37533

INVESTIGATION OF THE PARAMETERS OF A BOUNDARY LAYER BEFORE THE INLET OF A SUPERSONIC AIR INTAKE MOUNTED UNDER THE SURFACE OF A TRIANGULAR PLATE [ISSLEDOVANIE PARAMETROV POGRANICHNOGO SLOIA PERED VKHODOM PLOSKOGO SVERKHZVUKOVOGO VOZDUKHOZABORNIKA, USTANAVLIAVAEMOGO POD POVERKNOST'IU TREUGOL'NOI PLASTINY]

V P STARUKHIN and A. G TARUSHKIN TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no. 2, 1982, p. 69-77 In Russian. refs

An experimental study of the parameters of the boundary layer before the inlet plane of a plane under-the-wing air intake was made at Mach numbers of 2-5 and angles of attack of 0-10 deg. Attention is given to the change in the integral characteristics of the boundary layer as a function of angles of attack and the distance between the intake and the plate surface. It is noted that the simplest and most effective way to reduce the adverse effect of the boundary layer on the internal characteristics of the intake is to move the intake away from the wing surface. B J.

A83-37551

THE EFFECT OF THE BLUNTING OF THE LEADING EDGES ON THE CHARACTERISTICS OF SEPARATED FLOW PAST DELTA WINGS OF LOW ASPECT RATIO [VLIIANIE ZATUPLENIIA PEREDNIKH KROMOK NA KHARAKTERISTIKI OTRYVNOGO OBTEKONIIA TREUGOL'NYKH KRYL'EV MALOGO UDLINENIIA]

S B ZAKHAROV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no. 4, 1982, p 1-9 In Russian refs

The elongated-body approximation is used to analyze the separated flow of an ideal fluid past delta wings of low aspect ratio with blunt leading edges. The numerical method used is based on a mathematical model of inviscid separation with a smooth surface. Calculations are performed of symmetric flow around wings whose transverse cross sections are ellipses of small relative thickness. An analysis is presented of the effects of the location of the separation line, the blunting of the edges, and wing thickness on the configuration of the vortex sheet and the overall aerodynamic characteristics of the wing. B J.

A83-37552

THE EFFECT OF SLOT SUCTION ON THE AERODYNAMIC CHARACTERISTICS OF AN AIRFOIL AT TRANSONIC VELOCITIES [VLIIANIE SHCHELEVOGO OTSOSA GAZA NA AERODINAMICHESKIE KHARAKTERISTIKI PROFILIA PRI TRANSZVUKOVYKH SKOROSTIAKH]

A M GURUSHKIN, IU G ELKIN, L. K. ZUEV, N N KOKURINA, and F. F FILIMONOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no. 4, 1982, p 10-21 In Russian refs

An experimental study is presented of the effect of slot suction through the surface of an airfoil on its aerodynamic characteristics at transonic velocities Results were obtained on the overall aerodynamic characteristics of a symmetric model at a Mach number of 0.85, a Reynolds number of 2.3 x 10 to the 6th, and angles of attack of 0-6 deg for various flow rates of the sucked gas It is shown that at relative flow rates of 0.0013 the suction leads to an appreciable improvement in the aerodynamic characteristics of the airfoil at angles of attack not exceeding 5 deg B.J.

A83-37553

SEPARATED FLOWS AT THE LEEWARD SIDE OF A DELTA WING AND BODY OF REVOLUTION IN SUPERSONIC FLOW [OTRYVNYE TECHENIIA U PODVETRENNOI STORONY TREUGOL'NOGO KRYLA I TELA VRASHCHENIIA V SVERKHZVUKOVOM POTOKE]

G. I. MAIKAPAR TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no. 4, 1982, p 22-33 In Russian refs

Delta wings and bodies of revolution were investigated at a Mach number of 3 5 and angles of attack up to 50 deg. Vortices formed above the bodies of revolution and the sharp edges of the wings at subsonic speeds. At supersonic speeds, a wake formed near the bodies of revolution in the leeward part of the flow At the leeward side of the wings, regions of separated flow formed, which also became wakes at high angles of attack A vortex was found to be present above the subsonic edge of a sliding wing, while a region of separation was found to proceed from the supersonic edge. Various internal shocks were visible on photographs of the flow. B J

A83-37559

COMPUTATIONAL STUDY OF AN UNREGULATED AIR INTAKE OF A HYPERSONIC RAMJET ENGINE WITH THREE-DIMENSIONAL DECELERATION OF THE FLOW AT FREESTREAM MACH NUMBERS OF 5-7 [RASCHETNOE ISSLEDOVANIE NEREGULIRUEMOGO VOZDUKHOZABORNIKA GPVRD S PROSTRANSTVENNYM TORMOZHENIEM POTOKA PRI CHISLAKH M SUB INFINITY = 5-7]

V A. VINOGRADOV and V A STEPANOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 4, 1982, p. 81-89. In Russian. refs

Results of a numerical study of an unregulated air intake with three-dimensional deceleration of the flow are presented. The study is based on an algorithm which relies on Godunov's finite difference method, making it possible to calculate, in a Cartesian coordinate system, the supersonic flows of an inviscid non-heat-conducting gas in channels with sharp swept edges. Distributions of flow parameters along the channel, isolines of flow parameters over the longitudinal cross section and in the throat of the intake, and its overall aerodynamic characteristics are determined. The results, obtained at freestream Mach numbers of 5-7, are compared with results obtained in the two-dimensional approximation. B J.

A83-37562

AERODYNAMIC LOADS ON THE REAR PART OF A FUSELAGE BEHIND A SWEPT WING IN SUPERSONIC FLOW [AERODINAMICHESKIE NAGRUZKI NA KORMOVOI CHASTI FIUZELIAZHA ZA STRELOVIDNYM KRYLOM V SVERKHZVYKOVOM POTOKE]

V A IRINARKHOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 4, 1982, p. 110-114. In Russian.

The paper presents results of an investigation of load distribution along the rear part of a fuselage behind a wing of variable sweep, including a sweptforward wing, at Mach numbers of 1 5-1.75 The overall aerodynamic characteristics of the rear part with an aspect ratio equal to 2 are calculated An analysis is presented of the effect of this rear part on the lift characteristics and location of the aerodynamic focus of the fuselage with sweptback and sweptforward wings in the sweep angle range of +60 to -60 deg. B J

A83-37626

SUBSONIC COMPRESSIBLE-GAS SEPARATED FLOW PAST A LOW-ASPECT-RATIO WING [OTRYVNOE OBTEKANIE KRYL'EV MALOGO UDLINENIIA DOZVUKOVYM POTOKOM SZHIMAEMOGO GAZA]

S B ZAKHAROV and G G SUDAKOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 5, 1982, p. 1-11. In Russian refs

The method of matched asymptotic expansions is used to analyze the separated flow of an ideal gas past a low-aspect-ratio wing at subsonic speeds An asymptotic analysis of flow in singular regions at the wing tip and the back part of the wing is presented An algorithm for finding a composite solution, uniformly valid for all regions, is developed The effect of freestream Mach number on the aerodynamic characteristics of the wing is assessed. As an example, the aerodynamic characteristics of separated flow past delta wings in a wide range of Mach numbers are calculated B J

A83-37640

AERODYNAMIC CHARACTERISTICS OF THIN WINGS IN A NONEQUILIBRIUM HYPERSONIC GAS FLOW [AERODINAMICHESKIE KHARAKTERISTIKI TONKIKH KRYL'EV V NERAVNOVESNOM GIPERZVUKOVOM POTOKE GAZA]

M M. KUZNETSOV and O IU POLIANSKII TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 5, 1982, p 131-136 In Russian

The method of a thin shock layer is used to develop an approximate procedure for calculating the aerodynamic characteristics of a flat wing of arbitrary planform in a nonequilibrium hypersonic gas flow at a small angle of attack The approximate method proposed here is applicable to any thermodynamic and kinetic gas model. The effect of nonequilibrium on the aerodynamic characteristics of flat delta or rectangular wings, and in particular the shift of the center of pressure, are determined for a simple gas model with relaxation of vibrational degrees of freedom V.L.

A83-37802

A SUPERSONIC VELOCITY FIELD IN THE REGION OF INTERFERENCE BETWEEN A WING AND A BODY HAVING A COMMON APEX [SVERKHZVUKOVOE POLE SKOROSTEI V OBLASTI INTERFERENTSII KRYLA I KORPUSA, IMEIUSHCHIKH OBSHCHUIU VERSHINU]

S I KUSAKIN TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no. 6, 1982, p 8-17. In Russian refs

A three-dimensional field of perturbation velocities generated by a body-wing combination in an inhomogeneous supersonic flow is analyzed.Depending on the incoming flow parameters and body-wing geometry in the vicinity of the surface bounding the body-wing interference region, two flow schemes are shown to be possible: compression flow and expansion flow The two schemes correspond to two branches of solutions to a nonlinear differential equation for an additional velocity potential in the interference region Asymptotic formulas are obtained for the interference boundary and the behavior of perturbation velocities for the two types of flow V L

A83-37803

CALCULATION OF A TURBULENT BOUNDARY LAYER OF AN INCOMPRESSIBLE FLUID OVER SWEPT WINGS OF LARGE ASPECT RATIOS [RASCHET TURBULENTNOGO POGRANICHNOGO SLOIA NESZHIMAEMOI ZHIDKOSTI NA STRELOVIDNYKH KRYL'IAKH BOL'SHOGO UDLINENIIA]

P. P VOROTNIKOV, A. F. KISELEV, and A D. KHONKIN TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 6, 1982, p. 18-31. In Russian refs

A new integral method for calculating a three-dimensional turbulent boundary layer is proposed which is based on a generalized two-parameter representation of the secondary flow velocity profile. For closing the system of boundary-layer equations, a new exact integral relationship is obtained In contrast to the known integral methods, the method proposed here make it possible to investigate boundary layers with S-shaped secondary-flow profiles. Examples of boundary-layer calculations for a swept wing are presented to show the efficiency of the method V.L

A83-37810

THE THEORY FOR A FLEXIBLE SLAT [K TEORII GIBKOGO PREDKRYLKA]

M A BRUTIAN and P L. KRAPIVSKII TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 6, 1982, p. 83-87 In Russian refs

The paper is concerned with the problem of a nonseparated flow of an ideal incompressible fluid past an airfoil section with a flexible slat. The shape of the flexible slat and the increment of the lifting force are determined in quadratures assuming that the Weber number is small. In the limiting case of a zero slot between the slat and the main airfoil section, a finite analytical solution is obtained V L.

A83-37860#

AERODYNAMIC SIMULATION - A KEY TECHNOLOGY NOT ONLY FOR AVIATION

W SCHMIDT Dornier-Post (English Edition) (ISSN 0012-5563), no 2, 1983, p 39-45

The use of numerical flow simulation techniques in aerodynamic design tasks for a variety of applications is discussed Advantages of numerical simulations over analog testing using such facilities as wind and water tunnels are pointed out as they relate to interference and Reynolds number effects in analog facilities, time and cost factors, and the problem of access to test facilities Factors including pre- and post-processing times and computing times are discussed as they relate to the implementation of three-dimensional nonlinear flow calculations, network generators and vector computers The use of numerical simulations is then illustrated for tasks of engine-fuselage integration, the analysis of jet propagation in the engine intake following weapon firing, icing problems, propeller effects on wing and tail flow, and the simulation of flow in a piston engine A.L.W.

A83-37957* Lockheed-Georgia Co , Marietta.

INLET DESIGN FOR HIGH-SPEED PROPFANS

B H. LITTLE, JR and B L. HINSON (Lockheed-Georgia Co., Marietta, GA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 15 p refs

(Contract NAS3-22751)

(SAE PAPER 821359)

A two-part study was performed to design inlets for high-speed propfan installation. The first part was a parametric study to select promising inlet concepts. A wide range of inlet geometries was examined and evaluated - primarily on the basis of cruise thrust and fuel burn performance Two inlet concepts were than chosen for more detailed design studies - one apropriate to offset engine/gearbox arrangements and the other to in-line arrangements In the second part of this study, inlet design points were chosen to optimize the net installed thrust, and detailed design of the two inlet configurations was performed An analytical methodology was developed to account for propfan slipstream effects, transonic flow efects, and three-dimensional geometry effects Using this methodology, low drag cowls were designed for the two inlets Author

A83-37998* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A GENERIC FORWARD-SWEPT-WING AIRCRAFT
J. C. ROSS (NASA, Ames Research Center, Moffett Field, CA) and A. D MATARAZZO (Fairchild Republic Co , Farmingdale, NY) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 13 p refs
(SAE PAPER 821467)
Low-speed wind-tunnel tests were performed on a generic forward-swept-wing aircraft model in the 7- by 10-Foot Wind Tunnel (No 2) at Ames Research Center. The effects of various configurational changes and control-surface deflections on the performance of the model were measured Six-component force measurements were augmented by flow-visualization photographs, using both surface oil-flow and tufts It was found that the tendency toward premature root separation on the forward-swept wing could be reduced by use of either canards or leading-edge wing strakes and that differential canard deflections can be used to produce a direct side-force control Author

A83-38080*# General Electric Co , Cincinnati, Ohio
ADVANCED TECHNOLOGY EXHAUST NOZZLE DEVELOPMENT
D. J DUSA, D W SPEIR, R. K ROWE (General Electric Co., Cincinnati, OH), and L D LEAVITT (NASA, Langley Research Center, Hampton, VA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 17 p refs
(AIAA PAPER 83-1286)
The requirement for greater tactical aircraft operational capabilities has led to increasing research emphasis on the refinement of engine/airframe integration methods and exhaust nozzle flexibility A major prospective advancement in the development of these capabilities takes the form of multifunctional exhaust nozzle systems with thrust reversal and thrust vectoring features, whose operation will be shared by both airframe and powerplant control systems. Attention is presently given to the two-dimensional convergent-divergent and single expansion ramp nozzle designs, with emphasis on the variable geometry mechanical systems by which they assume cruising flight, vectoring, and thrust reversal operations The nozzles have been wind tunnel model-tested for the cases of the F-18 fighter and a supersonic cruise configuration concept O C.

A83-38626*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
CONVAIR 990 TRANSONIC FLOW-FIELD SIMULATION ABOUT THE FORWARD FUSELAGE
D. S CHAUSSEE, P G BUNING, and D B KIRK (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 9 p.
(AIAA PAPER 83-1785)
A three-dimensional, viscous flow code was used to calculate the transonic flow about the forebody of the Convair CV-990 (Galileo II) research aircraft stationed at NASA Ames Research Center. The computations were used to determine the location for a differential pressure system. In addition, attitude sensor placements were verified These instruments comprise a meteorological measurement system, which will be used for global determination of three-dimensional wind data The code solves the thin layer form of the Reynolds-averaged Navier-Stokes equations using an implicit numerical procedure The governing equations are written in a generalized, nonorthogonal coordinate system, and are cast in a strong conservation law form Laminar boundary layer results are presented for free stream Mach number of 0 8 and angles of attack of zero and 2 deg Use of this computational tool reduced the development time for the location of the sensors and aided in the optimal placement on the aircraft of these devices Author

A83-38627#
AN AFTBODY DRAG PREDICTION TECHNIQUE FOR MILITARY AIRLIFTERS
C E KOLESAR and F. W MAY (Boeing Military Airplane Co., Seattle, WA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 11 p refs
(AIAA PAPER 83-1787)
This paper presents a method for estimating the drag of aftbodies for military airlifters. Militry transport aircraft typically incorporate aft ramp loading to comply with Air Force/Army loading and airdrop requirements The drag of the resulting upswept aftbodies can be 10 percent of total cruise drag, a very significant increment for long range aircraft During recent military transport configuration studies, it became evident that available parametric aftbody drag data was inadequate to provide a basis for project design investigations Consequently, a wind tunnel test was designed to specifically establish the effect of upswept and flattened aftbodies on airplane drag. Aftbodies were evaluated for upsweep angles up to 15 deg in combination with several flatness cross-sections and variations in other geometric characteristics (such as keel angle, cross-sectional shape and aftbody length) An empirical drag prediction method was developed based on the parametric set of data acquired during this test The paper describes the new prediction methodology and presents summary plots to be used in conjunction with the technique to make a reasonable estimate of aftbody drag Author

A83-38631#
ADVANCED AIRFOIL DESIGN FOR GENERAL AVIATION PROPELLERS
F TAVERNA (Grumman Aerospace Corp , Aerodynamics Section, Bethpage, NY) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 12 p refs
(AIAA PAPER 83-1791)
The development of suitable computational methods for use on high-speed computers has led to approaches in aircraft wing design which utilize to a large extent computer analysis. Keiter (1981) has pointed out the necessity to improve general aviation propeller technology which currently employs propeller blade airfoils that have existed since World War II. The present investigation is concerned with the application of advanced aerodynamic computational methods to the design of high-efficiency propeller airfoils Airfoil lift-to-drag ratios are maximized for a given set of requirements and restrictions This increases the propeller aerodynamic efficiency. The considered airfoil synthesis methodology is based on the Modified Mapping Modulus (MMM) approach reported by McFadden (1979) It is found that the MMM approach represents a simple formulation which provides the designer with good physical insight. The entire airfoil, including the leading edge, can be synthesized with high resolution. G R

A83-38632*# Lockheed-California Co., Burbank
DESIGN AND TRUE REYNOLDS NUMBER 2-D TESTING OF AN ADVANCED TECHNOLOGY AIRFOIL
J. S REASER (Lockheed-California Co., Burbank, CA), J B HALLISSY, and R L. CAMPBELL (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 12 p.
(AIAA PAPER 83-1792)
A NASA-industry program has been conducted to determine the accuracy of available 2-D airfoil analysis procedures over a wide range of Reynolds numbers The program also served to develop and demonstrate effective wind tunnel model designs for use in a cryogenic environment A Lockheed design, CRYO 12X, supercritical, shockfree airfoil was configured using a continuous curvature analytical definition of the ordinates Test results show a very close ordinate tolerance was necessary to realize the

intended pressure distribution Correlation of test with Korn-Garabedian 2-D analysis pressure data were generally good GRUMFOIL analysis with a sidewall correction gave a better correlation Author

A83-38633#

AERODYNAMIC CHARACTERISTICS OF A CIRCULATION CONTROLLED ELLIPTICAL AIRFOIL WITH BLOWN JETS

J K HARVELL and M E FRANKE (USAF, Institute of Technology, Wright-Patterson AFB, OH) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 8 p refs

(AIAA PAPER 83-1794)

Effects of two blown jets on the aerodynamic characteristics of a 20 percent thick, 8.5 percent cambered elliptical airfoil are described The jet slots are designed so that the jets are tangential to the blunt rear surface of the airfoil Section lift, drag, and moment coefficients are given for the airfoil at zero degrees angle of attack, a free stream wind tunnel velocity of approximately 100 fps, and a Reynolds number of 950,000 Two jets are found to be more effective in producing lift than a single jet at the same total blowing momentum coefficient Author

A83-38638#

VISCOUS EFFECTS ON A SWEPT WING IN TRANSONIC FLOW

V SCHMITT, D DESTARAC, and B CHAUMET (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 11 p refs

(AIAA PAPER 83-1804)

Wind tunnel tests have been conducted on a swept wing in transonic flow with attention to boundary layer profiles at selected stations of the wing and at various Reynolds numbers, in order to gather viscous flow data for comparison with computational method results such as those of the Lazareff and La Balleur (1983) code allowing for viscid-viscous interactions This three-dimensional transonic code is based on a nonconservative solver of the full potential equation, which is coupled, by means of the wall transpiration velocity concept, with a three-dimensional boundary layer method for both the laminar and turbulent regimes The predicted boundary layers agree with measurements when shock-boundary layer interactions are relatively small It is demonstrated that the calculated pressure and load distributions are improved by the present viscous approach O C

A83-38639#

AN EXTENSION OF A TRANSONIC WING/BODY CODE TO INCLUDE UNDERWING PYLON/NACELLE EFFECTS

C R FORSEY (Aircraft Research Association, Ltd, Bedford, England) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 8 p Research supported by the British Aerospace Public Ltd, Co refs

(AIAA PAPER 83-1805)

A production code which calculates transonic flow over wing/body configurations using the full potential equation has been extended to include underwing pylon/nacelle or pylon/store effects The original wing/body grid is distorted to wrap around the pylon/nacelle surfaces and zero normal flow conditions are imposed on these surfaces, except for caps covering the ends of a nacelle where a transpiration condition is used to simulate blowing Minimal changes were required to the wing/body code thus largely avoiding revalidation problems Results are presented for an underwing pylon/store configuration and compared with experimental data for two Mach numbers The agreement obtained suggests that the extension has been worthwhile Author

A83-38643#

THE FLUID MECHANICS OF SLENDER WING ROCK

L E ERICSSON (Lockheed Missiles and Space Co, Inc, Sunnyvale, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 13 p refs

(AIAA PAPER 83-1810)

It is shown that the slender wing rock phenomenon, the limit cycle oscillation in roll observed for very slender delta wings, is caused by asymmetric leading edge vortices and that vortex breakdown can never be the cause of it as it has a damping effect For that reason slender wing rock is only realized for delta wings with more than 74 deg leading edge sweep for which asymmetric vortex shedding occurs before vortex breakdown A simple analysis indicates that the wing rock phenomenon can be predicted by use of experimental static data in an unsteady analysis that represents the time history effect by a lumped time lag Author

A83-38644*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

SOME RECENT APPLICATIONS OF XTRAN3S

D A SEIDEL, R M BENNETT, and R H RICKETTS (NASA, Langley Research Center, Loads and Aeroelasticity Div, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 11 p refs

(AIAA PAPER 83-1811)

A time-marching finite difference code, XTRAN3S, that solves the three-dimensional transonic small perturbation equation for flow over isolated wings has recently been developed During initial applications of the program, problems were encountered in the prediction of unsteady forces The use of a revised grid and force calculation scheme improved those predictions Comparisons are made between predicted and experimental pressure data for a rectangular supercritical wing Comparisons of steady and unsteady data at freestream Mach number = 0 700 show good agreement between calculated and experimental values A comparison of steady data at freestream Mach number = 0.825 shows poor agreement between calculations and experiment Program difficulties have been encountered with swept and tapered configurations Author

A83-38647#

THE IMPACT OF STRAKES ON A VORTEX-FLAPPED DELTA WING

J F MARCHMAN, III and J E TERRY (Virginia Polytechnic Institute and State University, Blacksburg, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 6 p refs

(AIAA PAPER 83-1814)

Wind tunnel tests were conducted on a 60-deg delta wing/fuselage model to determine the relative effectiveness of leading edge strakes, leading edge vortex flaps and a combination of the strakes and vortex flaps It was shown that the strakes were effective in greatly improving the maximum lift coefficient while the vortex flaps gave large increases in the lift-to-drag ratio The combination of flaps and strakes also exhibited a large maximum lift coefficient while representing a compromise in lift-to-drag ratio improvement The strakes also produced large pitch-up tendencies which may limit their usefulness while the vortex flaps do not alter the pitch stability of the base wing/fuselage configuration Author

A83-38648*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va
AN INVESTIGATION OF WING LEADING-EDGE VORTICES AT SUPERSONIC SPEEDS
D S. MILLER and R M WOOD (NASA, Langley Research Center, High-Speed Aerodynamics Div , Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 10 p. refs
(AIAA PAPER 83-1816)

Studies at subsonic and transonic speeds of the fundamental vortex behavior on the leeward surface of wings have led to the design of several unique and novel leading-edge devices commonly referred to as 'vortex flaps'. The present investigation has the objective to provide some fundamental vortex-flow results obtained at supersonic speeds. Experimental studies were performed in which pressure data and several types of flow visualization data were obtained on the leeward surface of a series of flat delta-wing models to identify the various flow mechanisms which can occur and to determine the effect of leading-edge sweep, Mach number, and angle of attack on the vortex strength and location. The reported investigation forms part of a study which is to explore the use of wing leading-edge vortex technology as a supersonic wing-design tool The obtained results indicate that the procedure of distributing the vortex force as a pressure variation about a vortex action line is a promising concept G.R.

A83-38649#
THE LEADING-EDGE VORTEX TRAJECTORIES OF CLOSE-COUPLED WING-CANARD CONFIGURATIONS AND THEIR BREAKDOWN CHARACTERISTICS
J ER-EL (Technion - Israel Institute of Technology, Haifa, Israel) and A SEGINER American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 9 p refs
(AIAA PAPER 83-1817)

Flow visualization and force measurement experiments have been carried out for close-coupled wing-canard and wing-alone configurations. The effect of canard sweep-angle and longitudinal position on the leading-edge vortex trajectories, their breakdown characteristics and the aerodynamic coefficients, were studied In the experiments, a narrow canard of 75-deg sweep and a wide one of 56-deg sweep, equal in area were compared. The canards tested displaced the leading-edge vortices of the wing upward and outboard. Increase of angle-of-attack resulted in an upward displacement of these vortices, while the spanwise displacement was considerably smaller. The angle-of-attack in which vortex breakdown on these vortices appears to cross the trailing-edge is 8 deg-10 deg higher than those of the wing alone configuration. Increase of longitudinal separation distance of the canard and the wing reduces wing-canard interference Force measurements show that at high incidence, the normal force curve of the wing-narrow canard configuration is less than that of the wing-alone. This may indicate that the strong leading-edge vortices of the narrow canard, which are very close to the wing-surface at the trailing-edge, alter the lee-side flow structure there and reduce the lift Author

A83-38653*# Joint Inst. for Advancement of Flight Sciences, Hampton, Va.
THE AERODYNAMICS OF PROPELLERS AND ROTORS USING AN ACOUSTIC FORMULATION IN THE TIME DOMAIN
L. N. LONG (Joint Institute for Advancement of Flight Sciences, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 15 p. refs
(Contract NCC1-14)
(AIAA PAPER 83-1821)

The aerodynamics of propellers and rotors is especially complicated because of the highly three-dimensional and compressible nature of the flow field However, in linearized theory the problem is governed by the wave equation, and a numerically-efficient integral formulation can be derived This reduces the problem from one in space to one over a surface Many such formulations exist in the aeroacoustics literature, but these become singular integral equations if one naively tries to use them to predict surface pressures, i e , for aerodynamics The present paper illustrates how one must interpret these equations in order to obtain nonambiguous results. After the regularized form of the integral equation is derived, a method for solving it numerically is described. This preliminary computer code uses Legendre-Gaussian quadrature to solve the equation. Numerical results are compared to experimental results for ellipsoids, wings, and rotors, including effects due to lift. Compressibility and the farfield boundary conditions are satisfied automatically using this method. Author

A83-38659#
ANALYSIS OF COMPLEX INLET CONFIGURATIONS USING A HIGHER-ORDER PANEL METHOD
J L. HESS and D. M. FRIEDMAN (Douglas Aircraft Co , Long Beach, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 7 p refs
(AIAA PAPER 83-1828)

This paper describes construction and use of a program for calculating compressible flow in and about inlets having auxiliary inlets and, ultimately, leading-edge slats The main calculational tool is a higher-order panel method that generates four fundamental flow solutions. These are linearly combined to yield flow about the inlet at any prescribed set of conditions in the freestream and inside the inlet. Compressibility is accounted for by the Lieblein-Stockman correction This procedure allows flow at a fairly large number of operating conditions to be obtained at a modest increase in cost over a single condition A number of graphical output features render the program highly user-oriented. These include streamline tracing and isobar plots on the surface or over cross-sections. Author

A83-38660*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
PAN AIR MODELING STUDIES
M C TOWNE, S M STRANDE, L L ERICKSON, I M. KROO, F Y. ENOMOTO, R L CARMICHAEL, and K F. MCPHERSON (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 27 p. refs
(AIAA PAPER 83-1830)

PAN AIR is a computer program that predicts subsonic or supersonic linear potential flow about arbitrary configurations The code's versatility and generality afford numerous possibilities for modeling flow problems Although this generality provides great flexibility, it also means that studies are required to establish the dos and don'ts of modeling. The purpose of this paper is to describe and evaluate a variety of methods for modeling flows with PAN AIR The areas discussed are effects of panel density, internal flow modeling, forebody modeling in subsonic flow, propeller slipstream modeling, effect of wake length, wing-tail-wake interaction, effect of trailing-edge paneling on the Kutta condition, well- and ill-posed boundary-value problems, and induced-drag calculations These nine topics address problems that are of practical interest to the users of PAN AIR Author

A83-38661#
HIGH ASPECT RATIO FORWARD SWEEP FOR TRANSPORT AIRCRAFT
P R SMITH and A. J SROKOWSKI (Lockheed-Georgia Co., Marietta, GA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 17 p
(AIAA PAPER 83-1832)

Results are presented for a wind tunnel model test program aimed at evaluating the forward swept wing/canard configuration's application to military transport-sized aircraft, through comparison with an equivalent aft swept wing baseline transport configuration Comparisons of the two wing concepts indicate that the main difference in their performance is the excessive shock strength present at the inboard panel of the forward swept wing. This problem has been overcome through the incorporation of a trailing edge extension at the wing root which reduces the nondimensional thickness/chord ratio O.C.

A83-38664#

WAKE CHARACTERISTICS AND INTERACTIONS OF THE CANARD/WING LIFTING SURFACE CONFIGURATION OF THE X-29 FORWARD-SWEPT WING FLIGHT DEMONSTRATOR

K. E GRIFFIN and F M JONAS (U.S Air Force Academy, Colorado Springs, CO) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 12 p.

(AIAA PAPER 83-1835)

This paper is a summary and analysis of experimental lifting surface wake data taken from a 1/10-scale, reflection-plane model of the X-29 Forward-Swept Wing Demonstrator. The model is configured with and without the canard to illustrate the canard/wing wake interactions. The data collected comprises total, dynamic and static pressures as well as local velocity magnitudes and directions for a series of points around this model The data points are arrayed to include flow regions near the model as well as the freestream wake regions downstream of its canard and wing. Author

A83-38665#

QUALIFICATION OF THE DATCOM FOR SWEPTFORWARD WING PLANFORMS A SUMMARY OF WORK TO DATE

D G. SHARPES (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 12 p refs

(AIAA PAPER 83-1836)

The USAF Stability and Control Datcom is being reviewed to ensure method applicability to swept-forward wing configurations Methods analyzed to date are subsonic wing-alone lift-curve from zero-lift to maximum lift, zero-lift pitching moment and side force, yawing moment and rolling moment due to sideslip and wing-body linear lift-curve slope at subsonic, transonic and supersonic speeds Author

A83-38667#

WIND TUNNEL MEASUREMENTS OF THE MAGNUS INDUCED SURFACE PRESSURES ON A SPINNING PROJECTILE IN THE TRANSONIC SPEED REGIME

M C MILLER (U S Army, Chemical Systems Laboratory, Aberdeen Proving Ground, MD) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 11 p. Army-supported research refs

(AIAA PAPER 83-1838)

Transonic tests using a novel wind tunnel design and instrumentation arrangement have been used to determine the aerodynamic pressures acting on the surface of a spinning projectile, yielding surface pressure values at 36 circumferential positions for each of 20 longitudinal locations with spin rates of zero and 82 Hz, and angles of attack of zero, 4 and 10 deg These tests demonstrate the ability of the new test method to measure small but critical Magnus effect-induced surface pressures on projectiles in the transonic Mach number, circa 4,000,000 Reynolds number regime The results obtained illustrate the large circumferential pressure distribution variation over the boattail region, as well as the nonlinear effect of angle of attack Integrated pressure data indicate the total Magnus force and moment coefficients for the model O.C.

A83-38672#

A MULTIPLE SEPARATION MODEL FOR MULTIELEMENT AIRFOILS

K. K. MANI (Lockheed-California Co, Burbank, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 6 p refs

(AIAA PAPER 83-1844)

The flow field around a multielement airfoil configuration is modeled in the presence of multiple separations from its various elements A method proposed by Maskew and Dvorak is extended for this purpose Computation using this model is compared against laser velocimeter measurements. The wake shape as well as pressure distribution agrees well with the experiments. The method is applied to a case involving multiple separation in order to show the capability of a program (MULSEP) developed using this modified approach Author

A83-38673#

A METHOD FOR PREDICTING LOW-SPEED AERODYNAMIC CHARACTERISTICS OF TRANSPORT AIRCRAFT

L E MURILLO and J H MCMASTERS (Boeing Commercial Airplane Co, Seattle, WA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 10 p.

(AIAA PAPER 83-1845)

A preliminary design level methodology for predicting the global aerodynamic characteristics of transport aircraft in low-speed/high-lift configurations has been developed, based on recent advances in computational aerodynamics analysis methods. The new method involves two economical, user oriented computer programs One, an advanced lifting surface theory for the potential flow analysis of swept-wing/body combinations with multielement high-lift devices, provides the basic theoretical structure The second program combines the potential flow analysis results with available data from previous airplane models to predict the performance of new designs The overall procedure is highly automated and produces generally results for preliminary design purposes Example results based on recent transport aircraft wind tunnel data are shown Author

A83-38675#

DEVELOPMENT OF ADVANCED CIRCULATION CONTROL WING HIGH LIFT AIRFOILS

R J. ENGAR and G G. HUSON (David Taylor Naval Ship Research and Development Center, Bethesda, MD) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 12 p refs

(AIAA PAPER 83-1847)

Recent experimental and flight test programs have developed and confirmed the highlift capability of the Circulation Control Wing (CCW) concept These CCW airfoils employ tangential blowing of engine bleed air over circular or near-circular trailing edges, and are capable of usable lift coefficients triple those of simple mechanical flaps Earlier versions of these blown airfoils made use of relatively complex leading and trailing edge devices which would have to be retracted mechanically for cruise flight In a continuing program to reduce the complexity, size and weight of the CCW system, several series of advanced CCW airfoils have been developed which can provide STOL capability for both military and commercial aircraft using much smaller, less complex high lift systems The paper will describe these configurations and present the experimental results confirming their aerodynamic characteristics, as well as make comparisons to previous CCW and more conventional high lift systems. Author

A83-38676#

POWERED LIFT AERODYNAMICS OF USB STOL AIRCRAFT

M MAITA, H. FUJIEDA, M. MORITA, T TORISAKI, and M MATSUKI (National Aerospace Laboratory, Tokyo, Japan) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 10 p refs

(AIAA PAPER 83-1848)

The present paper describes the summaries of the principal results on the aerodynamic characteristics of the external upper surface blowing propulsive lift system of STOL aircraft as ascertained by the wind tunnel model experiments and full-scale propulsion system ground rig test using FJR710/600 turbofan engine. Also, from the related exhaust flow field surveys over the wing and USB flap surfaces, we discuss the mechanisms of powered lift augmentation by side fences, comparing with these by other devices such as vortex generators Author

A83-38677*# Virginia Polytechnic Inst and State Univ, Blacksburg.

SURFACE PRESSURES INDUCED ON A FLAT PLATE WITH IN-LINE AND SIDE-BY-SIDE DUAL JET CONFIGURATIONS

J A. SCHETZ, A K JAKUBOWSKI (Virginia Polytechnic Institute and State University, Blacksburg, VA), and K AOYAGI (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 10 p refs
(AIAA PAPER 83-1849)

A jet in a crossflow is of interest in numerous practical situations including jet-powered VTOL aircraft Two aspects of the problem have received little prior study First is the effect of the angle of the jet to the crossflow. Second is the performance of dual-jet configurations both in-line and side-by-side. The test plan for this work was designed to address these two aspects The experiments were conducted in the 7 x 10 tunnel at NASA Ames at velocities from 14 5 - 35 8 m/sec (47 6 - 117 4 ft/sec) Detailed pressure distributions are presented for single and dual jets over a range of velocity ratios from 3 to 8, spacings from 2 to 6 diameters and injection angles of 90, 75, and 105 degrees. The effects of the various parameters and the differences between the axisymmetric and flat plate geometries on the nature, size, shape, and strength of the interaction regions on the body surfaces are shown Author

A83-38678#

AN ASSESSMENT OF PANDORA USING A CANARD/WING/BODY CONFIGURATION

J R SIRBAUGH (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 10 p refs
(AIAA PAPER 83-1850)

The transonic small disturbance computer code PANDORA was used to compute surface pressures on the Rockwell Semispan Propulsive Wing/Canard Model. Predicted pressure and force coefficients were compared to experimental data at Mach numbers of 6, .8 and 9. Good agreement in wing and canard pressures was achieved for all cases that converged, but C(L) was in poor agreement for Mach numbers of 8 and 9. The PANDORA code did not converge and was unable to analyze flow conditions above Mach .9 and two degrees (six degrees wing reference) angle of attack, while other transonic codes were identified that converged for higher angles of attack Author

A83-38680#

COMPUTATION OF TRANSONIC FLOW FIELD OVER WING-BODY-PYLON-STORE COMBINATIONS

P SUNDARAM, J. M. WU (Tennessee, University, Tullahoma, TN), and S. N CHAUDHURI American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 11 p refs
(Contract F08635-81-C-0235)
(AIAA PAPER 83-1852)

An approximate scheme incorporating the panel method to represent complex geometries and various finite volume and finite difference methods for supercritical flow to obtain simple and practical solutions of the flow field around several Wing-Fuselage-Pylon-Store configurations at transonic speed is presented The method utilizes the concept of flow matching between near field and far field solutions appropriate to the problems One set of problems investigated include the flow field velocity computations in the gap regions that are formed underneath the wing and a store immediately after its separation. Another set includes the store surface pressure distribution at several transonic Mach numbers with free stream subsonic and supersonic flows and at different angles of attack. A two-dimensional and axi-symmetric small cross flow compressible boundary layer type viscous/inviscid interaction scheme has been incorporated for weak viscous interaction with the outer inviscid flow. The results are compared with Laser Velocimeter flow field survey and pressure instrumented store experimental data The computed results show favorable agreement with the experiments in the flow regions with weak viscous interactions and weak shock waves Author

A83-38685*# Grumman Aerospace Corp., Bethpage, N Y

SC3 - A WING CONCEPT FOR SUPERSONIC MANEUVERING

W H MASON (Grumman Aerospace Corp, Bethpage, NY) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 10 p Research supported by the Grumman Aerospace Corp. refs
(Contract NAS1-15357)
(AIAA PAPER 83-1858)

A supersonic wing design concept that overcomes the problems associated with nonlinear inviscid pressure distribution is presented together with a summary of the supporting theoretical and experimental development program The key design feature is a conical panel supporting a controlled supercritical conical camber (SC3) crossflow expansion and recompression which permits lift on the upper surface to be obtained without producing an adverse pressure gradient or crossflow shock wave strong enough to separate the boundary layer The role of aerodynamics in the design implementation is discussed, as are the concept development, the initial design validation on a fabricated and tested SC3 design, and the body and canard interaction effect The design and testing of an isolated wing with a planform and thickness distribution representative of a practical application are described Wind-tunnel results show that significant performance gains can be obtained for fighter aircraft using this concept. C D

A83-38687#

THRUST REVERSER EFFECTS ON THE TAIL SURFACE AERODYNAMICS OF AN F-18 TYPE CONFIGURATION

A. GLEZER, R V HUGHES, and B L HUNT (Northrop Corp., Aircraft Div, Hawthorne, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 9 p. Research supported by the Northrop Independent Research and Development Program refs
(AIAA PAPER 83-1860)

Wind tunnel studies were conducted using a 0 025-scale model of an F-18 type configuration with thrust reversers in the Northrop 21- by 30-inch low speed wind tunnel at conditions representative of the aircraft on approach. A feature of these tests was a systematic buildup of reverser jets and tail surface components in order to identify and understand the major aerodynamic forces which the reversers generate on the tail surfaces It is shown in this paper that the upper jets produce a blockage between the twin vertical tails and that this plays a key role in the reverser-induced effects In sideslip or with the rudders deflected, this blockage is asymmetric and results in increases in directional stability and rudder effectiveness In pitch, the blockage produces a down-load on the vertical tails but the resulting upwash on the horizontals greatly reduces the incremental pitching moment on the aircraft The reverser jets induce a strong entrainment flow on the horizontal tails, which amplifies the tail load, resulting in either a pitch-up or a pitch-down, depending on the tail setting. Author

A83-38689#

THE COMBINATION OF A GEOMETRY GENERATOR WITH TRANSONIC DESIGN AND ANALYSIS ALGORITHMS

H. SOBIECZKY (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer theoretische Stroemungsmechanik, Goettingen, West Germany) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 11 p. USAF-sponsored research refs
(AIAA PAPER 83-1862)

A fast and simple geometry generator for wing-fuselage configurations has been developed to provide flexible input for operational flow analysis and design algorithms. A precise shape definition at the wing root area with fairing allows for suitable data definition for refined analysis of flow quality Some supercritical design cases computer graphics of aircraftand turbo-components illustrate the applications Author

A83-38690#
SMART AERODYNAMIC OPTIMIZATION
P. V AIDALA, W H DAVIS, JR, and W H MASON (Grumman Aerospace Corp, Bethpage, NY) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 13 p. Research supported by the Grumman Aerospace Corp. refs
(AIAA PAPER 83-1863)

Several new ideas that can be used to dramatically improve optimization methods for transonic aerodynamic design are presented. Current approaches to aerodynamic optimization are reviewed, and aerodynamically smart optimization is discussed in terms of three major elements the objective function or choice of aerodynamic information to be used in assessing the design, the design variables or choice of geometry variables which control the shape, and the optimization algorithm or rules for moving to a better design Several examples are presented which demonstrate the improvements available using the new ideas C D

A83-38691*#
IMPROVED METHOD FOR TRANSONIC AIRFOIL DESIGN-BY-OPTIMIZATION
R A KENNELLY, JR (Informatics General Corp, Palo Alto, CA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 12 p refs
(Contract NAS2-11555)
(AIAA PAPER 83-1864)

An improved method for use of optimization techniques in transonic airfoil design is demonstrated FLO6QNM incorporates a modified quasi-Newton optimization package, and is shown to be more reliable and efficient than the method developed previously at NASA-Ames, which used the COPES/CONMIN optimization problem The design codes are compared on a series of test cases with known solutions, and the effects of problem scaling, proximity of initial point to solution, and objective function precision are studied In contrast to the older method, well-converged solutions are shown to be attainable in the context of engineering design using computational fluid dynamics tools, a new result The improvements are due to better performance by the optimization routine and to the use of problem-adaptive finite difference step sizes for gradient evaluation Author

A83-38692*# Lockheed-Georgia Co, Marietta
COMPUTATIONAL AERODYNAMIC DESIGN METHODOLOGY
C B BURRIS, H P. HANEY (Lockheed-Georgia Co, Marietta, GA), and N N SANKAR (Georgia Institute of Technology, Atlanta, GA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 7 p Research supported by the Lockheed-Georgia Independent Research and Development Program and NASA refs
(AIAA PAPER 83-1865)

The transonic wing design process has been vastly improved at Lockheed-Georgia. The revised design procedure enhances useability and reliability by combining numerical optimization and inverse design into a single wing design code with transonic analysis provided by a modified version of FLO22 A more versatile set of geometric decision variables has been integrated into the optimization portion for geometry perturbations An automatic restart feature permits the interchangeability of solutions between optimization and inverse design as the design progresses In combination, these improvements enable practical utilization of a VAX 11/780 computer and significantly reduce the elapsed time required to complete a transonic wing design Author

A83-38693#
SUPERCRITICAL INLET DESIGN
D C IVES (United Technologies Corp., Pratt and Whitney Group, East Hartford, CT) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 9 p refs
(AIAA PAPER 83-1866)

A semi-inverse method has been developed to design supercritical axisymmetric inlets having specified pressure distributions This method has its roots in a number of current airfoil design techniques, and this paper extends and unifies some of these seemingly diverse approaches The present design method is a direct method as far as the flow solver is concerned since it uses a flow solver only to evaluate pressure distributions corresponding to specified geometries The present design method is an inverse method based on conformal mapping from an overall viewpoint, however, so the description 'semi-inverse design' is used This semi-inverse capability prevents premature obsolescence by adapting easily to new flow analyses as they are developed The method has good accuracy (typically 1/10 percent) except for a small (1 percent) error following a rapid expansion or compression The stability of this method is moderate, requiring some underrelaxation in the early stages of a design, but no smoothing has been necessary The capability of this method is illustrated by the design of a segment of an inlet holding the remainder of the inlet fixed, and by the design of an axisymmetric supercritical natural laminar flow inlet. Author

A83-38748
RADAR DETECTION OF WINGTIP VORTICES
R B CHADWICK, J JORDAN, and T DETMAN (NOAA, Wave Propagation Laboratory, Boulder, CO) IN Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p 235-240 FAA-supported research refs

Experiments with a short-range, clear-air radar have conclusively established that a 10-cm radar can detect and locate vortices of large commercial jet aircraft (737 and larger) at a range of 1 km On the basis of measurements presented here of the radar cross section of vortices, it is projected that modest radars should be able to detect vortices at ranges of 2-3 km Also included is a discussion of vortex detection algorithms It is believed that calibration-free techniques for determining whether a vortex is in a resolution cell can probably be developed In view of the finding by Chadwick et al (1979) that clear-air Doppler radars can measure hazardous wind shear, it is considered possible that these radar systems could locate vortex hazards and detect wind shear hazards in approach zones C R

A83-38798* Flow Research, Inc, Kent, Wash
AN EXPERIENCE IN MESH GENERATION FOR THREE-DIMENSIONAL CALCULATION OF POTENTIAL FLOW AROUND A ROTATING PROPELLER
W-H JOU (Flow Research Co, Kent, WA) IN Numerical grid generation, Proceedings of the Symposium on Numerical Generation of Curvilinear Coordinate Systems and Their Use in the Numerical Solution of Partial Differential Equations, Nashville, TN, April 13-16, 1982 . New York and Amsterdam, North-Holland, 1982, p 547-561 refs
(Contract NAS3-22148)

An attempt is made to develop a three-dimensional, finite volume computational code for highly swept, twisted, small aspect ratio propeller blades with supersonic tip speeds, in a way that accounts for cascade effects, hub-induced flow, and nonlinear transonic effects. Attention is presently given to the generation of a computational mesh for such a complex propeller configuration, with the aim of sharing developmental process experience. The problem treated is unique, in that blade chord, blade length, hub length and blade-to-blade distance represent several characteristic length scales among which there is considerable disparity An ad hoc mesh-generation scheme is accordingly developed O.C

A83-38803* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

GRID GENERATION BY ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS FOR A TRI-ELEMENT AUGMENTOR-WING AIRFOIL

R L SORENSON (NASA, Ames Research Center, Moffett Field, CA) IN: Numerical grid generation, Proceedings of the Symposium on Numerical Generation of Curvilinear Coordinate Systems and Their Use in the Numerical Solution of Partial Differential Equations, Nashville, TN, April 13-16, 1982 . New York and Amsterdam, North-Holland, 1982, p 653-665 refs

Two efforts to numerically simulate the flow about the Augmentor-Wing airfoil in the cruise configuration using the GRAPE elliptic partial differential equation grid generator algorithm are discussed The Augmentor-Wing consists of a main airfoil with a slotted trailing edge for blowing and two smaller airfoils shrouding the blowing jet The airfoil and the algorithm are described, and the application of GRAPE to an unsteady viscous flow simulation and a transonic full-potential approach is considered The procedure involves dividing a complicated flow region into an arbitrary number of zones and ensuring continuity of grid lines, their slopes, and their point distributions across the zonal boundaries The method for distributing the body-surface grid points is discussed C.D.

A83-38909#

APPLICATION OF THE PANEL METHOD TO AIRSHIPS

W. W TSENG (U S. Naval Material Command, Naval Air Development Center, Warminster, PA) and R. E LLORENS (Pennsylvania State University, King of Prussia, PA) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 70-76. refs
(AIAA PAPER 83-1978)

An investigation of the application of the PAN AIR panel method program to airships was initiated For small angles of attack boundary layer effects were restricted to the end of the airship so that they could be neglected Therefore, uncorrected data obtained utilizing PAN AIR exhibited excellent agreement with classical experimental data. Separation effects were evident at large angles of attack Preliminary analysis with a three-dimensional boundary layer program was not sufficiently exact to predict the location of the separation surface Attempts to represent separation effects by a wake led to numerical instabilities. Correlation of theory and experiment was excellent in regions of the airship removed from the separation surface. Author

A83-38915#

THE LATERAL RESPONSE OF AN AIRSHIP TO TURBULENCE

D M LAYTON (U S. Naval Postgraduate School, Monterey, CA) and J. J WROBLESKI, JR (U S. Navy, Washington, DC) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p 116-123 Research supported by the U.S Coast Guard. refs
(AIAA PAPER 83-1989)

A method is derived for finding the linear response and loading transfer functions for the lateral aerodynamic case of an airship flight through turbulence. The functions are in a form that can be applied to the various spectral analysis methods currently used by designers to predict survivability The results show that the peak motion response and loading occur when the spectral component has a wavelength equal to the airship length, and that simple feedback of heading angle does not reduce this peak significantly. Author

A83-39099#

THE LANN PROGRAM - AN EXPERIMENTAL AND THEORETICAL STUDY OF STEADY AND UNSTEADY TRANSONIC AIRLOADS ON A SUPERCRITICAL WING

S Y. RUO, J B MALONE (Lockheed-Georgia Co , Marietta, GA), J J HORSTEN, and R HOUWINK (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 18 p refs
(Contract AF-AFOSR-80-0136; F33615-80-C-3212)
(AIAA PAPER 83-1686)

An international test program was completed to acquire high quality transonic experimental data suitable for evaluations of three-dimensional, steady and unsteady aerodynamics computational methods. An advanced technology wing, typical of modern transport configurations, was fabricated and then tested in the High Speed Tunnel at NLR, Amsterdam. A comprehensive test program was performed to obtain steady and unsteady aerodynamic data for variations of Mach number, mean angle of attack, and amplitude and frequency of wing pitching oscillations Selected portions of the data were used to correlate numerical results obtained from the XTRAN3S code, a version of Bailey-Ballhaus/McNally code and a quasi-three-dimensional method. Author

A83-39267*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INTERACTIONS OF AIRFOILS WITH GUSTS AND CONCENTRATED VORTICES IN UNSTEADY TRANSONIC FLOW

W. J MCCROSKEY and P M GOORJIAN (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983. 23 p refs
(AIAA PAPER 83-1691)

Unsteady interactions of concentrated vortices and distributed free-stream gusts with a stationary airfoil have been analyzed in two-dimensional transonic flow. A simple method of introducing such disturbances has been implemented numerically in the well-known transonic small-disturbance code LTRAN2, and calculations have been performed for two important classes of current aerodynamic problems The first, which demonstrates many of the essential features of the interactions between helicopter rotor blades and their trailing-vortex wakes, is that of a discrete potential vortex convecting past an airfoil The second is the response of a transonic airfoil to a transverse periodic gust, with and without the alleviation that can be achieved by the proper active control motion of a trailing-edge flap In both cases, unsteady effects are found to play important roles in the shock-wave motion, in the overall flow-field development, and consequently, in the air loads on the airfoil. Author

A83-39356*# Rockwell International Science Center, Thousand Oaks, Calif

A CONSERVATIVE TYPE-DEPENDENT FULL POTENTIAL METHOD FOR THE TREATMENT OF SUPERSONIC FLOWS WITH EMBEDDED SUBSONIC REGIONS

V. SHANKAR, K -Y. SZEMA (Rockwell International Science Center, Thousand Oaks, CA), and S OSHER (California, University, Los Angeles, CA) IN Computational Fluid Dynamics Conference, 6th, Danvers, MA, July 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 36-47 refs
(Contract NAS1-15820)
(AIAA PAPER 83-1887)

A nonlinear method based on the full potential equation in conservation form, cast in an arbitrary coordinate system, has been developed to treat predominantly supersonic flows with embedded subsonic regions This type of flow field occurs frequently near the fuselage-canopy junction area and wing leading edge regions for a moderately swept fighter configuration The method uses the theory of characteristics to accurately monitor the type-dependent flow field A conservative switching scheme is developed to transition from the supersonic marching algorithm to a subsonic relaxation procedure, and vice versa An implicit approximate factorization scheme is employed to solve the finite-differenced equation Results are shown for a few configurations, including a wing-body-wake realistic fighter model having embedded subsonic regions Author

A83-39378#

TRANSONIC EULER SIMULATIONS BY MEANS OF FINITE ELEMENT EXPLICIT SCHEMES

F ANGRAND, A DERVIEUX (Institut National de Recherche en Informatique et en Automatique, Le Chesnay Yvelines, France), V BOULARD, J PERIAUX (Avions Marcel-Dassault-Breguet Aviation, Saint-Cloud, Hauts-de-Seine, France), and G VIJAYASUNDARAM (Tata Institute of Fundamental Research, Bangalore, India) IN Computational Fluid Dynamics Conference, 6th, Danvers, MA, July 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 267-273 refs
(AIAA PAPER 83-1924)

Attention is given to methods which make it possible to solve the full Euler equations for compressible inviscid fluids The considered methods include triangular finite element procedures and explicit time marching approaches Triangular finite element methods are useful in connection with the high versatility of triangles (or tetrahedra) for external flows past complex geometries Explicit time marching methods have the advantage of easier implementation and interpretation, and of smaller memory requirements Finite element simulations for the aerodynamic design of aircraft are considered Several upwind schemes are explored. A Godunov upwind scheme is considered along with a Richtmyer Galerkin scheme, numerical comparisons for a flow in a channel, flows past a NACA 0012 airfoil, and flow past an inlet G.R

A83-39380#

INVISCID DRAG CALCULATIONS FOR TRANSONIC FLOWS

N. J YU, H. C CHEN, S S SAMANT (Boeing Commercial Airplane Co , Seattle, WA), and P. E. RUBBERT IN Computational Fluid Dynamics Conference, 6th, Danvers, MA, July 13-15, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p 283-292 Research supported by the Boeing Independent Research and Development Program refs
(AIAA PAPER 83-1928)

It is pointed out that an accurate prediction of aerodynamic drag is essential to advanced aircraft design. For configurations more complex than a simple wing, there arise certain difficulties concerning the computation of drag values by means of surface pressure integration The present study explores, therefore, several ways of improving drag calculation methods by utilizing far-field approaches Methods of separating the wave drag and the induced drag from the total drag through a momentum or entropy integration approach are developed In two-dimensional potential flow analysis, the drag can be calculated accurately through the integration of momentum flux along a closed contour enclosing the shocks This is shown to be more accurate than a surface pressure integration In three-dimensional potential flow, the induced drag can be predicted accurately through a far-field momentum integral enclosing the complete configuration. The wave drag is obtained through the integration of momentum loss along a closed contour enclosing all shocks G R

A83-39381#

SOLUTION OF THE EULER EQUATIONS FOR COMPLEX CONFIGURATIONS

A JAMESON and T. J BAKER (Princeton University, Princeton, NJ) IN Computational Fluid Dynamics Conference, 6th, Danvers, MA, July 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 293-302. refs
(AIAA PAPER 83-1929)

Transonic flow codes using the potential flow assumption have provided remarkably accurate results It is pointed out, however, that the assumption of potential flow is not strictly correct when shock waves are present and this inconsistency must set limits to the obtainable accuracy For a correct description of inviscid transonic flow it is necessary to solve the Euler equations. The present investigation is concerned with a fast accurate method fol solving the Euler equations. A mesh generation scheme is developed which is capable of producing meshes for wing/body/tail-plane/fin combinations The scheme makes use of a sequence of conformal mappings and shearings. An enhanced Euler scheme with a fast convergence rate is linked to the mesh generator and initial results are now available A calculation for a typical high tail configuration is conducted on a mesh of 120 x 16 x 24 points for a freestream Mach number of 0 84 and incidence of 3 degrees G R

A83-40008#

AXISYMMETRIC NOSE INLET EFFECTS ON SUPERSONIC AIRLOADS

M R FINK (United Technologies Corp , Norden Systems, Norwalk, CT) and W E ANDERSON (United Technologies Corp , Chemical Systems, Sunnyvale, CA) Journal of Spacecraft and Rockets (ISSN 0022-4560), vol 20, July-Aug 1983, p. 346-350 refs
(Contract DAAK10-80-C-0114)

Previously cited in issue 19, p. 2970, Accession no A82-39087

A83-40472*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

COMPARISON OF SUPERCRITICAL AIRFOIL FLOW CALCULATIONS WITH WIND-TUNNEL RESULTS

L S KING and D A. JOHNSON (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 17 p refs
(AIAA PAPER 83-1688)

Navier-Stokes calculations have been performed for a supercritical airfoil at a transonic design condition and at a subsonic condition. Wind-tunnel pressure-rail measurements were employed as boundary data in the calculations to account for wall-interference effects A fine mesh was used so that most details of the flows were resolved, particular attention having been given to the trailing-edge region. Detailed comparisons are made with the experimental data Good agreement was obtained on the airfoil except at the trailing edge where separation occurred. Flow details in the trailing-edge region are examined and differences are shown to be attributable to the turbulence model employed Author

A83-40473#

SURVEY OF INLET DEVELOPMENT FOR SUPERSONIC AIRCRAFT

L E SURBER and C P ROBINSON (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983. 31 p refs
(AIAA PAPER 83-1164)

It is pointed out that a new era in the development of air intakes for tactical aircraft began in the 1940s with the use of gas turbine power plants in military aircraft. Inlet trends and methods in the period from 1945 to 1965 are considered, taking into account propulsion integration trends, subsonic cruise performance, the boundary layer capture design of early side-mounted inlets with internal diverters, examples of external boundary layer diversion, aspects of increased inlet complexity with increase of speed, design/analysis methods, and the peak hammer-shock pressure ratio. During the late 1960s and early 1970s, the need for increased transonic/supersonic maneuverability became more apparent At this time, airframe-inlet integration technology was not far enough advanced to design high performance inlets Additional inlet development work was necessary to support the next generation of supersonic fighter aircraft Attention is given to technology implementation in current aircraft, and future applications. G R

N83-27953 Purdue Univ, Lafayette, Ind
AEROTHERMODYNAMICS OF AXIAL-FLOW COMPRESSORS WITH WATER INGESTION Ph.D. Thesis
T TSUCHIYA 1982 326 p
Avail: Univ Microfilms Order No DA8225778

In order to establish the extent and nature of overall performance changes in an axial-flow air compressor with water-ingestion, an experimental investigation was conducted on a six-stage machine with (1) air-water droplet mixture flow and (2) air-methane mixture flow (methane substituted for water vapor) The results showed the manner in which various overall performance parameters became affected and deteriorated due to the presence of water and water vapor in the working fluid The effect of water ingestion into a compressor was examined in terms of five processes related to the two-phase nature of the flow (1) changes in the thermo-physical properties, (2) droplet-fluid-blade interaction, (3) aerodynamic performance change, (4) centrifugal action, (5) heat and mass transfer between the two phases and (6) droplet size adjustment A numerical-computational program, the PURDU-WICSTK Code, was developed by incorporating the aforementioned six processes into a meanline scheme for the calculation of performance of compressors Dissert Abstr.

N83-27956 Arizona Univ, Tucson
NONLINEAR AERODYNAMICS OF CONICAL DELTA WINGS Ph.D. Thesis
S S SRITHRAN 1982 101 p
Avail Univ Microfilms Order No. DA8227370

Steady, inviscid, supersonic flow past conical wings is studied within the context of irrotational, nonlinear theory. An efficient numerical method is developed to calculate cones of arbitrary section at incidence The method is fully conservative and implements a body conforming mesh generator. The conical potential is assumed to have its best linear variation inside each cell; a secondary interlocking cell system is used to establish the flux balance required to conserve mass In regions of supersonic cross flow, the discretization scheme is desymmetrized by adding the appropriate artificial viscosity in conservation form The algorithm is nearly an order of magnitude faster then present Euler methods It predicts known results as long as the flow Mach numbers normal to the shock waves are near 1, qualitative features, such as nodal point lift-off, are also predicted correctly Results for circular and thin elliptic cones are shown to compare very well with calculations using Euler equations. Dissert Abstr.

N83-27957*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
AERODYNAMIC PERFORMANCE OF A FAN STAGE UTILIZING VARIABLE INLET GUIDE VANES (VIGVS) FOR THRUST MODULATION
R R. WOOLLETT 1983 17 p refs Presented at the 19th Joint Propulsion Conf., Seattle, 27-29 Jun 1983, sponsored by AIAA, SAE and ASME
(NASA-TM-83438; E-1376; NAS 1 15 83438) Avail NTIS HC A02/MF A01 CSCL 01A

An experimental research program was conducted in the Lewis Research Center's 9x15-foot (2 74x4.57 m) low speed wind tunnel to evaluate the aerodynamic performance of an inlet and fan system with variable inlet guide vanes (VIGVs) for use on a subsonic V/STOL aircraft. At high VIGV blade angles (lower weight flow and thrust levels), the fan stage was stalled over a major portion of its radius In spite of the stall, fan blade stresses only exceeded the limits at the most extreme flow conditions It was found that inlet flow separation does not necessarily lead to poor inlet performance or adverse fan operating conditions. Generally speaking, separated inlet flow did not adversely affect the fan blade stress levels. There were some cases, however, at high VIGV angles and high inlet angles-of-attack where excessive blade stress levels were encountered An evaluation term made up of the product of the distortion parameter, K alpha, the weight flow and the fan pressure ratio minus one, was found to correlate quite well with the observed blade stress results. Author

N83-27961*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON ISSUES CONCERNING FLOW SEPARATION AND VORTICAL FLOWS IN 3 DIMENSIONS
D J PEAKE and M TOBAK Jun 1983 34 p refs Presented at the AGARD Fluid Dyn Panel Symp on Aerodyn of Vortical-Type Flows in 3 Dimensions, Rotterdam, Apr. 1983
(NASA-TM-84374; A-9375, NAS 1 15 84374) Avail NTIS HC A03/MF A01 CSCL 01A

This review provides an illustrated introduction laying the knowledge base for vortical flows about three dimensional configurations that are of typical interest to aerodynamicists and researchers in fluid mechanics. The paper then compiles a list of ten issues, again in illustrative format, that the authors deem important to the understanding of complex vortical flows These issues and our responses to them provide, it is hoped, a skeletal framework on which to hang the ensuing conference proceedings Author

N83-27962# General Dynamics Corp, Fort Worth, Tex.
FORCE AND PRESSURE MEASUREMENTS ON A RESEARCH MODEL WITH A LOW-, MID- AND T-TAIL AT MACH NUMBERS OF 0.60 TO 0.90. VOLUME 1: SUMMARY REPORT Final Report, 15 Apr. - 14 Dec. 1982
R A. COX Dec 1982 64 p 2 Vol
(Contract N00014-82-C-0340, RF41411801)
(AD-A124067; FZA-540-VOL-1) Avail NTIS HC A04/MF A01 CSCL 01C

An investigation of the effects of a low-, mid-, and T-Tail on configuration aerodynamics was carried out in the NASA/Ames Research Center 14-Foot Transonic Wind Tunnel. A baseline wing and a wing refined with the use of numerical optimization were tested alone and in conjunction with a horizontal tail in a low-, mid-, and T-Tail arrangement. Wing and horizontal tail pressure data and force data were obtained in the Mach number range 0.60 to 0 90 and at angles of attack from -6 to +28 deg The all-flying horizontal tail was tested at deflection angles of -10, 0, and +10 deg The refined wing showed positive drag improvements over most of the Mach number range. The low-tail proved to be slightly more favorable than the T-Tail at low CL's.
Author (GRA)

N83-27963# Nielsen Engineering and Research, Inc, Mountain View, Calif
WING-ALONE AERODYNAMIC CHARACTERISTICS TO HIGH ANGLES OF ATTACK AT SUBSONIC AND TRANSONIC SPEEDS Final Technical Report, 1 Apr. 1979 - 15 Sep. 1982
M M. BRIGGS, R. R. REED, and J N NIELSEN Nov. 1982 358 p
(Contract DAAG29-79-C-0020)
(AD-A125764, NEAR-TR-269; ARO-16030 1-EG) Avail: NTIS HC A16/MF A01 CSCL 20D

This report documents the results of a wind tunnel test conducted to determine the aerodynamic characteristics of unbanked wings from low to high angles of attack at subsonic and transonic speeds Several wing models with differing planform geometry were tested. All wings were full-span with straight taper, zero trailing-edge sweep, constant bevel angle normal to all edges and constant thickness The aerodynamic data obtained consisted of normal-force, axial-force, pitching-moment, yawing-moment, and semispan root bending-moment coefficients Longitudinal, spanwise, and vertical aerodynamic centers of pressure were computed from the force and moment data GRA

N83-27965# European Space Agency, Paris (France)
DRAG REDUCTION BY MEANS OF PNEUMATIC TURBULATORS
K H HORSTMANN and A QUAST Sep 1982 53 p refs Transl into ENGLISH of "Widerstandsverminderung durch Blasturbulatoren" rept DFVLR-FB-81-33 DFVLR, Brunswick, Sep 1981
(ESA-TT-743, DFVLR-FB-81-33) Avail NTIS HC A04/MF A01, original German version available from DFVLR, Cologne DM 11,40

Drag mechanisms of laminar separation bubbles and the impact on airfoil section design of drag reduction by pneumatic turbulators are discussed At Reynolds number (R) = 1 million, drag reduction is of the order of 15%, the reduction decreasing as R increases From about R = 4 million, hardly any further drag reduction occurs Dynamic pressure can be admitted into the turbulator orifices, the drag caused by the turbulator air amounting to about 1% of the reduction in drag. The design philosophy applicable to airfoil sections with pneumatic turbulators should be based on the maximum R for the airfoil range of operation and not on the average R The use of pneumatic turbulators enlarges the R range with low drag compared with previous airfoil sections
Author (ESA)

N83-27966# European Space Agency, Paris (France)
LAMINAR BOUNDARY LAYERS IN THE VICINITY OF THE ATTACHMENT LINE ON WINGS AND WINGLIKE BODIES AT INCIDENCE
D SCHWAMBORN Dec. 1982 194 p refs Transl into ENGLISH of "Laminare Grenzschichten in der naehe der Anlegelinie an Fluegeln u fluegelaehnlichen Koerpern mit Anstellung" rept DFVLR-FB-81-31 DFVLR, Goettingen, West Germany, Aug. 1981
(ESA-TT-752, DFVLR-FB-81-31) Avail NTIS HC A09/MF A01, original German version available from DFVLR, Cologne DM 29,80

A three dimensional model of the boundary layer flow in the vicinity of the leading edge of winglike bodies was developed, emphasizing flow characteristics close to the attachment line The three dimensional laminar and incompressible flow equations around an ellipsoid are solved by finite difference methods For the integration of these equations close to the attachment line, a difference scheme is presented, the stability and convergence of which are discussed The existence of quasi-two dimensional streamlines outside the flow symmetry plane is treated Results of computations for different angles to attack are shown Computations proceed until detachment occurs The existence of a pressure maximum and a shear stress minimum in the vicinity of the attachment line is established Author (ESA)

N83-27967# Technische Hogeschool, Delft (Netherlands) Dept of Aerospace Engineering
AERODYNAMIC MODEL IDENTIFICATION FROM DYNAMIC FLIGHT TEST DATA AND WIND TUNNEL EXPERIMENTS
J A MULDER, J G DENHOLLANDER, and H BINKHORST Oct 1982 23 p refs
(VTH-LR-361) Avail NTIS HC A02/MF A01

The identification of multi-input, single output linear static models from flight test data is discussed Models based on least squares are considered. Wind tunnel scale model and flight test data on a propeller slipstream are compared Dynamic flight test data were analyzed by reconstructing the flight path and forming a data base for the identification of aerodynamic models Given the relatively low Reynolds number of the wind tunnel experiments, a reasonable correspondence exists between the dynamic flight test results and model predictions Author (ESA)

N83-29172 Virginia Polytechnic Inst and State Univ, Blacksburg
A CONTINUOUS VORTICITY PANEL METHOD FOR THE PREDICTION OF STEADY AERODYNAMIC LOADS ON LIFTING SURFACES Ph.D. Thesis
A T. YEN 7 Jul 1983 111 p
Avail Univ Microfilms Order No DA8226913

A continuous vorticity panel method is developed and utilized to predict the steady aerodynamic loads on lifting surfaces having sharp-edge separation Triangular and semi-infinite panels with linearly varying vorticity are used. The velocity field generated by an individual element is obtained in closed form A concentrated core of vorticity is employed to simulate the leading-edge-vortex core and its feeding sheet An optimization scheme is constructed for finding the vorticity at the nodes of the elements The method is not restricted by aspect ratios, angles of attack, planforms, or camber The numerical results are in good agreement with the experimental data for both rectangular and delta wings for incompressible flows Dissert Abstr

N83-29173*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EXTENDED MOMENT ARM ANTI-SPIN DEVICE Patent Application
R D WHIPPLE, inventor (to NASA) 27 Jun. 1983 14 p
(NASA-CASE-LAR-12979-1, US-PATENT-APPL-SN-508371)
Avail NTIS HC A02/MF A01 CSCL 01A

A device which corrects aerodynamic spin with collapsible boom which extends an aircraft moment arm, and an antispin parachute force that is exerted upon the end of the moment arm to correct intentional or inadvertent aerodynamic spin is described This configuration effects spin recovery by means of a parachute whose required diameter decreases as an inverse function of the increasing length of the moment arm. The collapsible boom enables the parachute to avoid the aircraft wake without mechanical assistance, retracts to permit steep takeoff, and permits a parachute to correct spin while minimizing associated aerodynamic, structural and in-flight complications. NASA

N83-29174*# United Technologies Research Center, East Hartford, Conn
AXIAL COMPRESSOR MIDDLE STAGE SECONDARY FLOW STUDY Final Report
J H WAGNER, R P DRING, and H D JOSLYN Washington NASA Jul 1983 98 p refs
(Contract NAS3-23157, DA PROJ 1L1-62209-AH-76)
(NASA-CR-3701, NAS 1.26 3701) Avail NTIS HC A05/MF A01 CSCL 01A

This report describes an experimental investigation of the secondary flow within and aft of an axial compressor model with thick endwall boundary layers. The objective of the study was to obtain detailed aerodynamic and trace gas concentration traverse data aft of a well documented isolated rotor for the ultimate purpose of improving the design phases of compressor development based on an improved physical understanding of secondary flow. It was determined from the flow visualization, aerodynamic, and trace gas concentration results that the relative unloading of the midspan region of the airfoil inhibitied a fullspan separation at high loading preventing the massive radial displacement of the hub corner stall to the tip Radial distribution of high and low total pressure fluid influenced the magnitude of the spanwise distribution of loss, such that, there was a general decreases in loss near the hub to the extent that for the least loaded case a negative loss (increase in total pressure) was observed The ability to determine the spanwise distribution of blockage was demonstrated Large blockage was present in the endwall regions due to the corner stall and tip leakage with little blockage in the core flow region Hub blockage was found to increase rapidly with loading. Author

N83-29175*# Cornell Univ, Ithaca, N Y School of Mechanics and Aerospace Engineering

A THEORY OF ROTATING STALL OF MULTISTAGE AXIAL COMPRESSORS Final Report

F. K MOORE Washington NASA Jul. 1983 91 p refs
(Contract IPA-810-626-1)
(NASA-CR-3685; NAS 1 36 3685) Avail. NTIS HC A05/MF A01 CSCL 01A

A theoretical analysis was made of rotating stall in axial compressors of many stages, finding conditions for a permanent, straight-through traveling disturbance, with the steady compressor characteristic assumed known, and with simple lag processes ascribed to the flows in the inlet, blade passages, and exit regions For weak disturbances, predicted stall propagation speeds agree well with experimental results. For a locally-parabolic compressor characteristic, an exact nonlinear solution is found and discussed. For deep stall, the stall-zone boundary is most abrupt at the trailing edge, as expected When a complete characteristic having unstalling and reverse-flow features is adopted, limit cycles governed by a Lienard's equation are found Analysis of these cycles yields predictions of recovery from rotating stall, a relaxation oscillation is found at some limiting flow coefficient, above which *no solution exists. Recovery is apparently independent of lag* processes in the blade passages, but instead depends on the lags originating in the inlet and exit flows, and also on the shape of the given characteristic diagram. Small external lags and tall diagrams favor early recovery Implications for future research are discussed. Author

N83-29176*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.

WIND-TUNNEL INVESTIGATION OF AERODYNAMIC LOADING ON A 0.237-SCALE MODEL OF A REMOTELY PILOTED RESEARCH VEHICLE WITH A THICK, HIGH-ASPECT-RATIO SUPERCRITICAL WING

T A BYRDSONG and C. W BROOKS, JR Jun 1983 214 p refs
(NASA-TM-84614; L-15536, NAS 1.15 84614) Avail· NTIS HC A10/MF A01 CSCL 01A

Wind-tunnel measurements were made of the wing-surface static-pressure distributions on a 0 237 scale model of a remotely piloted research vehicle equipped with a thick, high-aspect-ratio supercritical wing. Data are presented for two model configurations (with and without a ventral pod) at Mach numbers from 0 70 to 0 92 at angles of attack from -4 deg to 8 deg Large variations of wing-surface local pressure distributions were developed, however, the characteristic supercritical-wing pressure distribution occurred near the design condition of 0 80 Mach number and 2 deg angle of attack. The significant variations of the local pressure distributions indicated pronounced shock-wave movements that were highly sensitive to angle of attack and Mach number. The effect of the vertical pod varied with test conditions, however at the higher Mach numbers, the effects on wing flow characteristics were significant at semispan stations as far outboard as 0 815. There were large variations of the wing loading in the range of test conditions, both model configurations exhibited a well-defined peak value of normal-force coefficient at the cruise angle of attack (2 deg) and Mach number (0 80) Author

N83-29178*# Hamilton Standard, Windsor Locks, Conn

SMALL TRANSPORT AIRCRAFT TECHNOLOGY PROPELLER STUDY Final Report

B M BLACK, B MAGLIOZZI, and C ROHRBACH 11 Apr 1983 145 p refs
(Contract NAS3-22039)
(NASA-CR-186045, NAS 1 26 186045; HSER-8826) Avail NTIS HC A07/MF A01 CSCL 01A

A study to define potential benefits of advanced technology propeller for 1985-1990 STAT commuter airplanes was completed Two baselines, a Convair, 30 passenger, 0 47 Mach number airplane and a Lockheed, 50 passenger, 0 70 Mach number airplane, were selected from NASA-Ames sponsored airframe contracts. Parametric performance, noise level, weight and cost trends for propellers with varying number of blades, activity factor, camber and diameter incorporating blade sweep, tip proplets, advanced composite materials, advanced airfoils, advanced prevision synchrophasing and counter-rotation are presented The resulting DOC, fuel burned, empty weight and acquisition cost benefits are presented for resizings of the two baseline airplanes Six-bladed propeller having advanced composite blades, advanced airfoils, tip proplets and advanced prevision synchrophasers provided the maximum DOC improvements for both airplanes DOC and fuel burned were reduced by 8.3% and 17 0% respectively for the Convair airplane and by 24 9% and 41.2% respectively for the Lockheed airplane The larger reductions arose from a baseline definition with very heavy fuselage acoustic treatment. An alternate baseline, with a cabin noise 13dB in excess of the objective, was also studied B.W.

N83-29180*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE EVALUATION OF THE ROLLING MOMENTS INDUCED BY WRAPAROUND FINS

A SEGINER and B. BAR-HAIM (Technion - Israel Inst of Tech.) Jun 1983 13 p refs
(NASA-TM-84381, A-9399, NAS 1.15 84381) Avail NTIS HC A02/MF A01 CSCL 01A

A possible reason is suggested for the induced rolling moments occurring on wraparound-fin configurations in subsonic flight at zero angle of attack The subsonic potential flow over the configuration at zero incidence is solved numerically The body is simulated by a distribution of sources along its axis, and the fins are described by a vortex-lattice method It is shown that rolling moments can be induced on the antisymmetric fins by the radial flow generated at the base of the configuration, either over the converging separated wake, or over the diverging plume of a rocket motor Author

N83-29182# Neilsen Engineering and Research, Inc., Mountain View, Calif.

A NUMERICAL STUDY OF STRAKE AERODYNAMICS Final Report, Jul. 1980 - Mar. 1982

G D. KERLICK, G H. KLOPFER, and D NIXON Jul 1982 137 p refs
(Contract N00014-78-C-0388)
(AD-A125882; NAR-TR-270) Avail NTIS HC A07/MF A01 CSCL 20D

As part of a combined experimental and analytical study of vortex shedding at sharp edges characteristic of strakes on fighter aircraft, numerical simulations were made of a two dimensional and a three dimensional case The former is a sharp-edge flat plate normal to the flow, for which some experimental data were taken earlier in this program. The latter is a double-delta, sharp-edged wing at angle of attack. In both cases, a free-stream Mach number of 0 5 was used. The objective of the work was to investigate the suitability of using the numerical simulation to augment experimental flow field data, after the major features of the simulation were verified by data Two existing Navier-Stokes codes developed at Ames Research Center NASA were used for the numerical simulations Neither code had been used in an application involving flow separation, sharp edges, and the aggregation of vorticity into small regions in the flow such as the two present applications demonstrate. The applications of the codes were largely successful, in that for both applications the numerical flow fields generally reproduced the gross flow features exhibited by experimental data GRA

N83-29184# Dornier-Werke G m b H , Friedrichshafen (West Germany) Abt. Flugzeug-Project-Aerodynamik.
DESIGN, CONSTRUCTION AND TEST OF AN EXPERIMENTAL PROPELLER IN THE POWER RANGE 750 HP Final Report, Apr. 1982
H ZIMMER, I U BORCHERS, and H FRIEDEL Bonn Bundesministerium fuer Forschung und Technologie Apr 1983 54 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-83-004, ISSN-0170-1339) Avail NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 11,50

Flight and wind tunnel tests of several propeller types are described. Aerodynamic and acoustic calculations show possibilities for improvement, mainly in the lower and medium speed range Improved propeller designs were investigated, using profiles with high lift drag ratios and minimal noise emission A set of experimental propellers was developed, constructed and flight tested Improvements were achieved in the whole flight regime The developed blades in three, four or five blade propeller configuration can be used for the propulsion of aircraft from 5 to 14 tons takeoff weight Author (ESA)

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents

A83-37960
OFFSHORE HELICOPTER OPERATIONS - GULF OF MEXICO
H J. CHRISTIANSEN (FAA, Fort Worth, TX) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 9 p
(SAE PAPER 821366)

Features of the FAA program, performed in concert with the NWS, to upgrade flight safety for operations serving oil and gas exploration and production facilities in the Gulf of Mexico are outlined The onshore and offshore points number 2000 launching pads dealing with 850 helicopters and 4 million passengers annually Since 1979, 25 IFR routes have been defined and use Loran C for navigation Additionally, helicopters now use shipboard radar to approach and land on oil gas rigs. A visual flight rule aeronautical chart has been developed, as has military flight operations, procedures, and communications to upgrade the safety of military flight training operations in the area Aviation weather conditions are now tracked by satellite Finally, an avionics interface box between the Loran C receiver and VHF radio automatically transmits helicopter position coordinates to a Houston installation for displaying helicopter positions over the Gulf M S.K.

A83-37967
IMPACT PROTECTION IN AIR TRANSPORT PASSENGER SEAT DESIGN
R G SNYDER (Michigan, University, Ann Arbor, MI) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 28 p refs
(SAE PAPER 821391)

Knowledge of human impact tolerance(s) is a basic consideration in the improved design of air transport seat-restraint systems and occupant crash protection This paper discusses biological factors which influence tolerance, defines tolerance levels, variables including whole body and regional impact, and effect of seat and body orientation It is concluded that the ultimate inertial forces on the occupant specified in FAR 25 561 are not based upon human tolerance considerations, that human impact survival is estimated to be four to ten times the voluntary levels cited, that improved occupant protection requires dynamically tested structural improvements, and that currently available technology such as the NASA air transport seat, or rear-facing seats, should be utilized. Author

A83-38002
STATUS OF FAA CRASH DYNAMICS PROGRAM - TRANSPORT CATEGORY AIRCRAFT
S SOLTIS (FAA, Washington, DC) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 14 p. refs
(SAE PAPER 821483)

The FAA's current crash dynamics program plan is discussed The development of candidate crash scenarios to provide a data base for the program is described, focusing on crash scenarios, causal factors for fatalities and injuries, the relationship between a crash scenario and structural damage to the aircraft, and the importance of airport environs in increasing or decreasing injury and fatality levels. Crash dynamic analytical tools are discussed, emphasizing the digital computer programs KRASH and DYCAST currently being evaluated for application to transport aircraft Validation procedures are addressed, including the use of models for passengers and airframes, fuselage drop tests, and full-scale crash tests. Progress in human tolerance studies is summarized and the correlation of data for the individual elements of the FAA program plan is discussed C D

A83-38003
EFFECTIVENESS OF SEAT CUSHION BLOCKING LAYER MATERIALS AGAINST CABIN FIRES
C P SARKOS and R G HILL (FAA, Washington, DC) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 11 p refs
(SAE PAPER 821484)

Materials are available for preventing or retarding aircraft cabin fires involving urethane foam seat cushions. Realistic fire tets performed in a wide-body test article demonstrate that some in-flight and ramp fires can be prevented, and that the allowable time for safe evacuation can be significantly extended during a survivable postcrash fuel fire, when the urethane foam seat cushion is covered by a 'blocking layer' material Author

A83-38005
AN FAA ANALYSIS OF AIRCRAFT EMERGENCY EVACUATION DEMONSTRATIONS
S A BARTHELMESS (FAA, Washington, DC) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 12 p
(SAE PAPER 821486)

Average continuous flow rates for each type of aircraft exit were examined in 89 full-scale evacuation demonstrations Passengers tend to form continuous lines at available exits when evacuating an airplane. The study concludes that, with rare exception, the passenger rates of egress from the same type exit on different make and model airplanes are not significantly different Passenger cabin configuration, seat pitch, and aisle width have no significant bearing on the egress rates provided the aircraft certification requirements for minimum aisle width and exit accessibility are met Injuries resulting from actual emergency evacuations and evacuation demonstrations are also examined. Author

A83-38009
HELICOPTER IFR - THE ECONOMICS OF SCHEDULE REGULARITY
L R NAIL (Tenneco Oil Exploration and Production, Intracoastal City, LA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 5 p
(SAE PAPER 821501)

A83-38010
ALL-WEATHER SMALL-DECK OPERATIONS IN THE U.S. NAVY
J N. BROOKS (U S Navy, Rotary Wing Aircraft Test Directorate, Patuxent River, MD) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 4 p.
(SAE PAPER 821503)
The maturation of the utility helicopter into a sensor and torpedo-carrying ASW platform has required the development of night and image motion compensation landings aboard destroyer flight decks in support of the Light Airborne Multi-Purpose System (LAMPS) An improved version of the Aviator's Night Vision Imaging System will allow the LAPS helicopter pilot to make 'daylight' approaches at night while the ship on which it is landing remains totally unillumined Additional landing capability improvements are noted in the use of vertical instrument displays rather than dials for the LAMPS MK III Seahawk ASW helicopter, as well as in CRT multipurpose displays currently under development The Recovery, Assist, Securing and Traversing system will provide mechanical assistance for landing, securing of the helicopter while on deck, and powered traversing between flight deck and hangar.
O C

A83-38011
U.S. ARMY HELICOPTER ICING DEVELOPMENTS
R N. WARD (U S Army, Washington, DC) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 14 p
(SAE PAPER 821504)
Information on icing flight tests as conducted by the U.S Army Aviation Engineering Flight Activity is presented A quick review is conducted of organizations within the U S Army that become involved with icing tests Icing flight test techniques and hardware are shown and discussed. Natural and artificial icing test results are compared Results and conclusions from previous icing evaluations are shown The capabilities and limitations of current techniques and systems are discussed And finally, the process for establishing an airworthiness qualification allowing Army aircraft to fly into a forecast icing environment is presented Author

A83-38076#
EVALUATION OF ADVANCED AIRPLANE FIRE EXTINGUISHANTS
L A DESMARAIS, F F. TOLLE (Boeing Military Airplane Co, Seattle, WA), and T D ALLEN (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983. 10 p refs
(Contract F33615-79-C-2027, F33615-78-C-2063)
(AIAA PAPER 83-1141)
The effectiveness of nitrogen enriched air (NEA) as an airplane fire extinguishant was evaluated experimentally Comparisons were made between NEA and other agents including carbon dioxide, gaseous and liquid nitrogen, Halon 1301 and three dry powder extinguishants. NEA was shown to be a viable candidate for fire extinguishing on airplanes which use on-board inert gas generators for fuel tank inerting Author

A83-38902*# National Aeronautics and Space Administration, Washington, D C.
A STUDY OF DIRIGIBLES FOR USE IN THE PERUVIAN SELVA CENTRAL REGION
N J MAYER (NASA, Washington, DC) IN: Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p. 1-11
(AIAA PAPER 83-1970)
A study to evaluate dirigibles as transport vehicles in the mainly undeveloped and heavily forested Selva Central region of Peru is discussed. The basic requirements for dirigible service in the region are described, including those pertaining to cargoes and routes, airports, weather conditions, ground facilities, operations and maintenance base, hangars, ballast, and helium supply Dirigible types, sizes, and economics were analyzed, and the analytical methods and results are reported Total costs are determined and compared with those for other aircraft. It is concluded that dirigibles can be used as transport in the Selva Central and that conventional dirigibles in normal operation will require expansion of exisiting airfields Conventional dirigibles are more economical as their size increases and are cost effective compared to selected aircraft
C D

A83-38903#
THE USE OF NON-RIGID AIRSHIPS FOR MARITIME PATROL IN CANADA
C L R UNWIN (Department of National Defence, Ottawa, Canada) IN: Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 12-26. refs
(AIAA PAPER 83-1971)
After a brief historical account of such past airship operations in Arctic winter conditions as the late-1920s flights of Amundsen and Nobile, attention is given to the results of the U S. Navy's 1957 All-Weather trials, whose mean low temperture is used as a tool for delineating the months that are suitable for operation over Canada northwards to the Arctic islands By this measure, Arctic conditions appear favorable for summer navigation Possible airship missions are analyzed from the standpoint of wind effects on the AI 500-through-5000 series airships An airship of the size of the AI-5000 seems suitable for convoy operations in the open ocean In all cases, the greater endurance and speed of the larger airships appear desirable because of the strong westerly winds of the northern Atlantic Operational roles are also suggested for smaller airships O C.

A83-38904#
THE UTILITY OF SMALL AEROSTATS FOR SURVEILLANCE MISSIONS
F. A RAPPOLT and R E SHERIDAN (Eaton Corp, AIL Div., Deer Park, NY) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p 27-30.
(AIAA PAPER 83-1973)
Consideration is given to the synergistic advantages resulting from the integration of lightweight antennas, advanced radar, and small, easily transported tethered aerostats employing advanced hull materials, to form mobile radar surveillance systems Cost analyses indicate that acquisition costs for such an airborne surveillance system would be lower than that employing a conventional aircraft by a factor of eight Both bistatic and monostatic radar modes are assessed, and it is noted that the use of the aerostat's hull as a radome will yield greater aperture area and improved radar range. Development work is reported on behalf of the U S Customs services which is aimed at demonstrating the feasibility of a transportable, tethered aerostat/radar system in the border surveillance role O C

A83-38905#
BARRIERS AND POSSIBILITIES FOR THE USE OF AIRSHIPS IN DEVELOPING COUNTRIES
G R A CAHN-HIDALGO IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 31-39 refs
(AIAA PAPER 83-1974)
Case histories are given for experimental programs and projects currently in the planning stage, which involve the use of airships in developing countries A German firm has undertaken airship cargo transport operations in West Africa, and fishing and oceanographic research, in addition to cargo transport, are under consideration in Peru and the Amazon Basin under the sponsorship of the UN's Industrial Development Organization The attractiveness of airships lies in their obviation of extensive, expensive and

therefore often unavailable transportation infrastructures required by both land transportation and conventional aircraft. O.C.

A83-38912#

THERMAL EFFECTS ON A HIGH ALTITUDE AIRSHIP

K. STEFAN (ILC Industries, Inc, Frederica, DE) IN: Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1983, p 94-100
(AIAA PAPER 83-1984)

The performance implications of temperature changes of the gas contained in a high altitude ship are presented and methods for control of temperature discussed An analytical model for estimation of temperature change is developed and thermal effects for various surface possibilities are presented. Experimental data collected from airship 'thermal model' flown on two high altitude balloon flights are compared with computation results from the analytical model. It is concluded that in-flight temperature changes can best be minimized by choice of airship outside surface thermal properties. An attractive candidate for the airship surface is a clear polymeric film such as Tedlar for high infrared emissivity and solar transmittance backed by a shiny metal surface for high solar reflectivity Author

A83-38921#

THE STABLE SENSOR PLATFORM (SSP) TETHERED BALLOON SERIES

R. W WEIS, JR (ILC Industries, Inc, Frederica, DE) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 156-160.
(AIAA PAPER 83-2000)

The use of tethered balloons as stable lifting platforms has grown in the last several years Mission requirements vary and most users are interested in utilizing the minimum size balloon for a specific application This has led to the development of a family of tethered balloons of similar configuration which utilize common components and accessories over a large range of sizes Early development of the configuration, sizing for specific requirements, fabrication and flight history of the various SSP Aerostats is discussed Author

A83-38931

AIR TRAFFIC CONTROL PROBLEMS IN THE FIELD OF GENERAL AVIATION [FLUGSICHERUNGSPROBLEME IM BEREICH DER ALLGEMEINEN LUFTFAHRT]

H ECKHARDT (Bundesanstalt fuer Flugsicherung, Bonn, West Germany) (Deutsche Gesellschaft fuer Luft- und Raumfahrt and Deutsche Gesellschaft fuer Ortung und Navigation, Symposium ueber Probleme und Entwicklungstendenzen in der Allgemeinen Luftfahrt, Friedrichshafen, West Germany, Mar. 24, 25, 1983) Ortung und Navigation (ISSN 0474-7550), no 1, 1983, p 49-57. In German

Recent and planned developments in the regulation of general aviation (GA) in the FRG are discussed. The intense use of FRG airspace, two thirds of which is by GA aircraft, is described in terms of basic conflicts of interest among commercial, military, and GA groups Measures taken to increase the airspace available for VFR and CVFR use, to avoid conflicts with low-altitude military exercises, and to preserve GA privileges at military airfields are reviewed. It is predicted that only very few new airfields can be approved by government agencies The equipping of as many airfields as possible for IFR or at least IFR-CVFR-changeover landings is recommended Efforts are being made to provide regulation updates and clear information as to pilots' responsibilities when landing without ground control The regulation of hang gliders and ultralight aircraft is to be left mainly to the aerial sports organizations themselves T K

A83-39222

AUTOMATION OF PREPLANNING AS A MEANS FOR ENHANCING QUALITY IN OPERATIONAL FLIGHT CONTROL. II [AUTOMATISIERUNG DER VORPLANUNG ALS MITTEL ZUR QUALITAETSSTEIGERUNG BEI DER OPERATIVEN FLUGLEITUNG]

W. KUNERT (Interflug Gesellschaft fuer internationalen Flugverkehr mbH, Berlin, East Germany) Technisch-oekonomische Information der zivilen Luftfahrt (ISSN 0232-5012), vol 18, no 6, 1982, p 229-234 In German

The electronic data processing system for civil air traffic control applications in the German Democratic Republic was first employed during the summer season in 1981. In connection with the employment of the data processing system, a series of technical processes were introduced to ensure the transition from the old to the new procedures without interruption of current operations On the basis of the obtained results, it is concluded that the project 'automation of preplanning' represents a successful, necessary, first step in the direction of the establishment of a complex system for the automation of flight control The efficiency of the project is essentially determined by the quality of primary data collection and the technologies utilized by the air traffic control organization Attention is given to reports concerning planned flights, the processing of the reported data, the processing of reports concerned with changes regarding planned flights, and details of technical implementation. G R.

A83-40356

EXPERIENCES IN MEDICAL COVERAGE OF AIRPORT DISASTERS AT LOGAN INTERNATIONAL AIRPORT IN BOSTON

N DUDANI (Massachusetts General Hospital, Medical Station, Boston, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-0562), vol 54, July 1983, p 612-618 refs

N83-27968# Federal Aviation Administration, Atlantic City, N J

FIRE CONTAINMENT CHARACTERISTICS OF AIRCRAFT CLASS D CARGO COMPARTMENTS Final Report, Aug. 1981 - Sep. 1982

D R BLAKE and R G. HILL Mar 1983 38 p refs
(Contract FAA PROJ 181-350-400)
(FAA-CT-82-156) Avail NTIS HC A03/MF A01

Eighteen tests were conducted in a 640-cubic foot simulated class D cargo compartment test article. Various ceiling lining materials, cargo loading configuration, air leakage rates, and fire sources were examined in a effort to determine the conditions likely to occur during a class D cargo compartment fire. The lining materials used in this project passed the requirements of FAR 25 853 and 25 855 (vertical and forty-five degree bunsen burner lab tests), however, they did not always successfully contain the cargo fires. The major conclusion of this study is that FAR 25 853 and 25 855 do not insure adequate burn-through resistance of class D cargo liners subjected to realistic fires Author

N83-27969# Defence and Civil Inst of Environmental Medicine, Downsview (Ontario)

WATER SURVIVAL: 20 YEARS CANADIAN FORCES AIRCREW EXPERIENCE

C. J BROOKS and K. W ROWE Nov 1982 27 p
(AD-A125401; DCIEM-82-R-61) Avail NTIS HC A03/MF A01 CSCL 01B

The object of this report is to review all the accidents involving the Canadian Forces, the Royal Canadian Air Force, Royal Canadian Navy and Army which involved ditching, ejection or bailing out into the sea or fresh water in the last 20 years in order to identify the incidence of water immersion and the percentage of accidents that occurred in sea or fresh water These have been analysed to obtain knowledge as to which aircrew are at risk, whether the protection that is provided is adequate or could be improved or, indeed, whether some aircrew are over-protected. Finally, during 20 years of peacetime operation, an analysis will be made as to what the threat is to aircrew from the water temperature and sea state, in conjunction with the analysis of rescue times Recommendations will be presented as to how our aircrew should be protected to the end of this decade. With the assistance of the computer at National Defence Headquarters/Directorate of Flight Safety (Ottawa), it was possible to review 595 A, B and C class accidents GRA

N83-27970# Textron Bell Helicopter, Fort Worth, Tex.
YAH-63 HELICOPTER CRASHWORTHINESS SIMULATION AND ANALYSIS Final Report, Jul. 1980 - Jun. 1982
V. L BERRY, J D CRONKHITE, T. J. HAAS, and G PERRY Feb 1983 259 p refs
(Contract DAAK51-80-C-0027, DA PROJ. 1L1-62209-AH-76)
(AD-A125642; USAAVRADCOM-TR-82-D-34) Avail: NTIS HC A12/MF A01 CSCL 14B

Under its ongoing crash research testing program, the Army conducted drop test T-41 using a YAH-63 prototype helicopter as a test article. The YAH-63 was residual hardware from the AAH competition of the mid 70's and incorporated many crashworthy features, including a high energy landing gear, crushable fuselage structure, stroking crew seats, high strength retention of large masses, and a crash-resistant fuel system The test was conducted in July 1981 at the NASA Langley Impact Dynamics Research Facility Many onboard experiments were also evaluated in the drop test with participation from NASA, the Navy, and the Army The KRASH results were compared to test and showed generally good agreement for landing gear energy absorption, fuselage crushing, nose structure failure, and copilot/gunner seat stroking and bottoming The acceleration levels in the fuselage agreed well in the mid fuselage impact, but predicted levels were lower than test levels in the forward fuselage, probably due to the hard armament structure on the test article not represented in the KRASH model The comparison of results was greatly facilitated by the DATAMAP program that processed both the test and KRASH data and automated the plotting, overplotting, scaling, filtering, and integrating of the data GRA

N83-29185# Committee on the Judiciary (U S. House)
AIR DISASTER LITIGATION
Washington GPO 1982 140 p refs Hearings on H.R. 1027 before the Subcomm on Admin Law and Govt Relations of the Comm on the Judiciary, 97th Congr., 1st and 2d Sess, 10 Dec 1981 and 24 Feb. 1982
(GPO-97-336) Avail Subcommittee on Administrative Law and Governmental Relations

Hearings on the bill H.R. 1027 to amend title 28 of the United States Code are presented A Federal cause of action for, and Federal court procedures with respect to aviation activity, and for some other purposes are established S L.

N83-29186*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
MODELING OF THE MODE S TRACKING SYSTEM IN SUPPORT OF AIRCRAFT SAFETY RESEARCH
J A SORENSEN and T. GOKA Dec. 1982 91 p refs
(Contract NASA ORDER A-98346-B)
(NASA-CR-166486, NAS 1.26 166486) Avail: NTIS HC A05/MF A01 CSCL 01C

This report collects, documents, and models data relating the expected accuracies of tracking variables to be obtained from the FAA's Mode S Secondary Surveillance Radar system. The data include measured range and azimuth to the tracked aircraft plus the encoded altitude transmitted via the Mode S data link A brief summary is made of the Mode S system status and its potential applications for aircraft safety improvement including accident analysis FAA flight test results are presented demonstrating Mode S range and azimuth accuracy and error characteristics and comparing Mode S to the current ATCRBS radar tracking system Data are also presented that describe the expected accuracy and error characteristics of encoded altitude. These data are used to formulate mathematical error models of the Mode S variables and encoded altitude A brief analytical assessment is made of the real-time tracking accuracy available from using Mode S and how it could be improved with down-linked velocity Author

N83-29187# National Aeronautical Establishment, Ottawa (Ontario). Structures and Materials Lab.
A SURVEY OF SERIOUS AIRCRAFT ACCIDENTS INVOLVING FATIGUE FRACTURE. VOLUME 1: FIXED-WING AIRCRAFT
G S CAMPBELL and R. T. C LAHEY Apr. 1983 266 p 2 Vol
(NAE-AN-7, NRC-21276) Avail· NTIS HC A12/MF A01

Fixed-wing aircraft accidents are listed by failure type and by aircraft type Repeated failures are listed. Accidents are listed by year, fatigue-crack initiation sites, and country. Author

N83-29188# National Aeronautical Establishment, Ottawa (Ontario) Structures and Materials Lab
A SURVEY OF SERIOUS AIRCRAFT ACCIDENTS INVOLVING FATIGUE FRACTURE. VOLUME 2: ROTARY-WING AIRCRAFT
G S CAMPBELL and R. T. C. LAHEY Apr 1983 97 p refs 2 Vol
(NAE-AN-8, NRC-21277) Avail: NTIS HC A05/MF A01

Rotary wing aircraft accidents, repeated failures, and initiation sites are listed. Accidents are listed by year and country Author

N83-29189# National Transportation Safety Board, Washington, D. C Bureau of Accident Investigation
LARGE AIRPLANE OPERATIONS ON CONTAMINATED RUNWAYS Special Investigation Report, May 1982
22 Apr 1983 52 p
(PB83-917003; NTSB/SIR-83-02) Avail NTIS HC A04/MF A01 CSCL 01C

The Safety Board's special investigation examined the issues of maintenance of runway surfaces, the measurement and reporting of runway friction values, the exchange of runway information among ATC, airport personnel and pilots, the airplane certification criteria for operation on contaminated runways, the capability of existing technology to measure runway friction accurately, and the technology available to monitor airplane acceleration The investigation buttressed the need for: (1) reliable, objective means to measure runway friction during all weather conditions; (2) reliable methods of transmitting that information to pilots, and (3) methods of correlating measured runway friction to airplane performance As a result of the special investigation, the Safety Board made a number of safety recommendations to the Federal Aviation Administration to resolve the problems associated with airplane performance and contaminated runways. Author

N83-29190# Dayton Univ., Ohio
INVESTIGATION OF CREW RESTRAINT SYSTEM BIOMECHANICS Report, May 1979 - Mar. 1981
N S PHILLIPS, R. A. THOMSON, and I B. FISCUS Wright-Patterson AFB, Ohio Aerospace Medical Research Lab May 1982 173 p refs
(Contract F33615-79-C-0525; AF PROJ 7231)
(AD-A126199, AFAMRL-TR-81-103) Avail: NTIS HC A08/MF A01 CSCL 05E

Experimental data were collected and analyses were performed to study the influence of the dynamic mechanical properties of restraint system components on human response to impact and restraint system haulback Tests were accomplished to isolate the characteristics of the restraint system and the human body Three restraint webbing materials were studied at varied strain rates. A pyrotechnically powered inertia reel was tested, but could not be analytically modeled successfully Analytical models of the human and restraint system were used to study the influence of restraint material properties changes on human response parameters An analytical model of a rhesus monkey was also used to study the efficacy of animal tests and scaling techniques to evaluate restraint systems for human use applications 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.

A83-37063#

DESIGN AND ANALYSIS OF A DIGITALLY CONTROLLED INTEGRATED FLIGHT/FIRE CONTROL SYSTEM

J H BLAKELOCK (Applications Research Corp., Dayton, OH) (Digital Avionics Systems Conference, 4th, St. Louis, MO, November 17-19, 1981, Collection of Technical Papers, p 135-143) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol 6, July-Aug 1983, p 251-257 refs
(Contract F33615-78-C-3145)

Previously cited in issue 03, p 318, Accession no. A82-13470

A83-37068#

A NEW STRAPDOWN ATTITUDE ALGORITHM

R B. MILLER (Department of Defence, Aeronautical Research Laboratories, Melbourne, Australia) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol 6, July-Aug 1983, p. 287-291 refs

This paper develops the application to the strapdown attitude problem of the rotation vector concept, in which obtaining a solution for the rotation vector and updating the attitude quaternion are considered entirely separately. A new rotation vector algorithm is derived which takes three samples of gyro data per update, and offers greatly improved coning performance This is obtained by making the assumption that gyro output varies according to a third-order time relationship, rather than second or first order as in other algorithms. Performance of the three sample algorithm is compared with well-known algorithms in a coning environment and in a random motion environment The quaternion updating may be performed to whatever degree of accuracy is required An economical modified fourth-order algorithm is proposed, and its comparative performance shown This approach to the problem gives versatility in that computing resources use may to some extent be tailored according to the relative extents of coning and of fixed axis rotation in the expected environment. Author

A83-37103

SYSTEM DESIGN APPROACHES TO INTEGRATED CONTROLS

L D BROCK (Charles Stark Draper Laboratory, Inc , Cambridge, MA) IN American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1982, p 586, 587

One obstacle to effective control integration, particularly in aircraft systems, is the premature partitioning of the total system into semiautonous subsystems This partitioning results from functional divisions that are based on older technology A requirements definition process is proposed that allows the requirements to be specified independently of an assumed design mechanization The designer is then given more freedom to use the capabilities of new technology to produce more efficient total systems using integrated control techniques Author

A83-37135

ESTIMATION ENHANCEMENT BY TRAJECTORY MODULATION FOR HOMING MISSILES

J L. SPEYER and D G HULL (Texas, University, Austin, TX) IN: American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 . New York, Institute of Electrical and Electronics Engineers, 1982, p 978-984 refs

For bearing-only measurements used in the guidance of homing missiles, guidance laws based upon the separation of estimation and guidance do not seem to be adequate To enhance observability, the trajectory of a bank-to-turn missile is modulated by minimizing the trace of the Fisher information matrix The calculations for constructing this performance index are greatly reduced by noting that the required transition matrix can be obtained in closed form because, in a relative rectangular coordinate system, the missile-target engagement dynamics are linear To show significant improvement in estimation performance, the extended Kalman estimator is tested along both the enhanced observability trajectory and a proportional navigation trajectory A Monte Carlo analysis is performed showing that even for large initial estimation errors in range, range-rate and target acceleration, convergence for the enhanced observability trajectory occurred within the homing period, whereas no convergence occurred for the proportional navigation path. Author

A83-37136

NONLINEAR GENERALIZED LIKELIHOOD RATIO ALGORITHMS FOR MANEUVER DETECTION AND ESTIMATION

J. R DOWDLE, A S WILLSKY, and S W. GULLY (Alphatech, Inc , Burlington, MA) IN American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 . New York, Institute of Electrical and Electronic Engineers, 1982, p 985-987.
(Contract CTF08635-81-C-0170)

The design and application of a nonlinear Generalized Likelihood Ratio (GLR) algorithm for target maneuver detection and estimation for short-range air-to-air missile scenarios is addressed The problem, which is inherently nonlinear, is first reformulated into a linear problem by preprocessing the measurements. The maneuver detection algorithm then consists of a Kalman filter that is tuned to track the target under nonmaneuvering conditions and a GLR which monitors the innovations process of the filter to determine if a maneuver has occurred Maneuver estimation is accomplished via maximum likelihood techniques and, once a maneuver is estimated, the states of the Kalman filter and their error covariances are suitably adjusted Author

A83-37137

INVESTIGATION OF TIME-TO-GO ALGORITHMS FOR AIR-TO-AIR MISSILES

G. K F LEE (Colorado State University, Fort Collins, CO) IN American Control Conference, 1st, Arlington, Va, June 14-16, 1982, Proceedings Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 988, 989.

It is pointed out that the primary objective of the air-to-air missile intercept problem is to minimize terminal miss-distance (hit the target) under unknown target maneuvers Secondary performance objectives may include minimal control effort over the entire scenario, minimal intercept time or minimal relative positions and velocities between missile and target over all time The present investigation is concerned with the develpment of an algorithm for estimating time-to-go, taking into account an objective function which consists of terminal miss-distance and time. The algorithm was found to work well for complex scenarios at low and mid-aspect angles In order to improve missile trajectories under these conditions as well as at high aspect angles, a good estimate of target acceleration is required G.R

A83-37141

DEVELOPMENT OF AIRBORNE COLLISION AVOIDANCE ALGORITHMS COMPATIBLE WITH THE NATIONAL AIRSPACE SYSTEM

W. P NIEDRINGHAUS and A D ZEITLIN (Mitre Corp , Metrek Div , McLean, VA) IN American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1026-1031 Sponsorship U S Department of Transportation
(Contract DOT-FA01-82-C-10003)

The Traffic Alert and Collision Avoidance System is an airborne collision avoidance system which uses altitude-reporting beacon transponders carried by many aircraft to detect potential collision situations The two versions of this system which have been defined include TCAS-I and TCAS-II TCAS-II utilizes a more sophisticated equipment, employing a threat detection and resolution algorithm intended to provide the pilot with a specific resolution advisory, while minimizing disruption of the airspace The present investigation is concerned with this algorithm The algorithm takes into account the measured range and reported altitude of each nearby aircraft. Range and altitude rates are derived by a tracking function. Attention is given to aspects of detection, sense selection and coordination, advisory selection, altimetry tolerances, and alert rate. G R

A83-37142

A COLLISION AVOIDANCE TOOL FOR AIRCRAFT PILOTS

V I. BATEMAN (Sandia National Laboratory, Albuquerque, NM) IN: American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 . New York, Institute of Electrical and Electronics Engineers, 1982, p. 1032-1034 refs

The Federal Aviation Administration (FAA) has recently announced the adoption of a new collision avoidance device This device is the Threat-Alert and Collision Avoidance System (T-CAS) The T-CAS will operate without any assistance from ground equipment These characteristics represent a substantial change from the ground-based, two-part, collision avoidance system currently scheduled for installation in 1984 The T-CAS will become available in about four years. It will signal an alert only if two aircraft, at nearly the same altitude, are in close proximity. Reachability conditions for nonlinear systems and smooth targets with constant control are applied to the problem of a two aircraft encounter The establishment of barriers aids in the determination of the vulnerable areas for an aircraft for a particular heading of the target aircraft G R

A83-37149

DEVELOPMENT OF 4-D TIME-CONTROLLED GUIDANCE LAWS USING SINGULAR PERTURBATION METHODOLOGY

A J M. CHAKRAVARTY and J VAGNERS (Washington, University, Seattle, WA) IN: American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 . New York, Institute of Electrical and Electronics Engineers, 1982, p 1107, 1108. Research supported by the Boeing Co

It is noted that simulation results have shown that in heavy traffic, time-controlled (4-D) guidance in the aircraft will be necessary to use the fuel conservation procedures to fullest advantage Attention is given here to an analysis of the 4-D guidance problem in the longitudinal plane. Singular perturbation theory is used to reduce the computational burden of solving the resulting optimal control problem. The aircraft here is a typical commercial jet transport. Two problems are solved In the first, the solution for the 4-D minimum DOC (direct operating cost) problem is obtained by solving the minimum DOC problem with varying cost of time In the second, the aircraft starts out on a trajectory that minimizes fuel for free terminal time. At some point during the cruise, a decision is made to switch to the 4-D algorithm. Depending on the new initial conditions and the terminal time delay, the appropiate value of the cost of time is selected and used in the minimum DOC algorithm for free terminal time C.R.

A83-37819

THE FUTURE OF CIVIL AVIONICS

A D HELFRICK (Cessna Aircraft Co., ARC Avionics Div , Boonton, NJ) Microwaves & RF (ISSN 0745-2993), vol 22, July 1983, p. 70-74, 76.

The Federal Aviation Administration's National airspace plan, which was published in December 1981, covers a civil avionics and air traffic control systems renovation period lasting until the year 2000 The plan's purview extends to en route navigation, terminal navigation, flight service stations, ground-to-air communications, interfacility communications, and auxiliary systems Because a complete redesign of the National Airspace System would leave most aircraft owners with obsolete equipment, the plan restricts its call for new systems to the following the microwave landing system, mode S transponders, and the threat-alert and collision avoidance system O C.

A83-37821

SIMULATE AIRBORNE RADAR ENVIRONMENTS

D NEMBHARD and R SMALLING (Eaton Corp , AIL Div , Deer Park, NY) Microwaves & RF (ISSN 0745-2993), vol 22, July 1983, p. 97-99, 101-103, 112 refs

Simulation may be the most cost-effective means of testing airborne radars intended for use in hostile environments In addition, mid-design process parameter changes that could be effected in actual equipment only at significant cost may be performed in a simulation system by means of only a few simple coding modifications Attention is given to the realistic simulation of moving target distance and velocity, clutter from airborne animals, objects, and electronic countermeasures such as chaff, weather conditions, and time-varying fluctuations of a target's radar cross section. Simulation models that incorporate many simple routines can be easily verified, and represent the most useful simulation approach O C

A83-38471

AVIONICS ANALYZED. III - THE HIDDEN SENSORS

M. HIRST Air International (ISSN 0306-5634), vol 25, July 1983, p. 19-23

The heart of an inertial navigation system (INS) is a gyroscopically stabilized reference which serves as a very accurate source of attitude and heading data. On any flight, an INS is told the latitude and longitude of the point of departure and it thereafter provides a continuous record of position Commercial INS installations allow an eight-hour transatlantic flight to be completed without radio aid assistance, and in any weather, in full confidence that the aircraft will arrive within 4-8 nautical miles of its destination. Attention is given to the operating principles of laser ring and optical fiber gyroscopes employed in latest-generation INS installations Once its production technology is perfected, it is expected that optical fiber gyroscopes will be considerably less expensive to produce than laser ring devices. O C.

A83-38932

RADIO-NAVIGATION PREREQUISITES FOR IFR OPERATION OF REGIONAL AIRPORTS AND CIVIL AIRFIELDS [FUNKNAVIGATORISCHE VORAUSSETZUNGEN FUER INSTRUMENTENFLUGBETRIEB AUF REGIONALFLUGHAEFEN UND VERKEHRSLANDEPLAETZEN]

W TOEPEL (Bayerisches Staatsministerium fuer Wirtschaft und Verkehr, Muenchen, Hochschule der Bundeswehr, Munich, West Germany) (Deutsche Gesellschaft fuer Luft- und Raumfahrt and Deutsche Gesellschaft fuer Ortung und Navigation, Symposium ueber Probleme und Entwicklungstendenzen in der Allgemeinen Luftfahrt, Friedrichshafen, West Germany, Mar. 24, 25, 1983) Ortung und Navigation (ISSN 0474-7550), no. 1, 1983, p 58-62. In German.

Technical and regulatory considerations in equipping smaller airfields in the FRG for instrument operation are discussed, with comparison to current US developments. The economic importance of providing dependable air service to areas poorly accessible to major airports is pointed out. Instrumentation for nonprecision landings (with NDB or VOR plus DME and LLZ) or for precision landings (with LLZ, GP, and DME as marker, or with MLS) is considered. Political factors, the structure of the FRG airspace, international guidelines, and costs are found to be the major obstacles to the IRF-upgrading of German regional airfields Federal-state agreement on the training of personnel and procurement of equipment, revision of the ICAO-Appendix-14 specifications for IFR runways, adoption of an airfield-instrumentation-criteria catalog, and reduction of equipment-maintenance costs through advanced technology are seen as ways of overcoming these obstacles T K

A83-38934
TALIS - A PROPOSED SYSTEM FOR TAXIWAY CONTROL [TALIS - EIN SYSTEMVORSCHLAGA ZUR ROLLFELDUEBERWACHUNG]
P KREUTZER (Standard Elektrik Lorenz AG, Stuttgart, West Germany) Ortung und Navigation (ISSN 0474-7550), no 1, 1983, p 83-90 In German

The design concept for a Taxiing Aircraft Location and Identification System (TALIS) is presented It is pointed out that the control of the taxiing process under suboptimal weather conditions is necessary to maintain overall airport throughput The design goals of TALIS are the location and identification of all vehicles taxiing on the airfield which could endanger aircraft, with no additional onboard equipment and minimal infrastructural modifications Radio contact, induction loops (STRACS), primary radar (ASDE), and secondary radar using the aircraft SSR-transponders (TAGS, DIS) are evaluated Combination of ASDE and DIS is chosen because it locates all vehicles and identifies all those with transponders The DIS uses numerous small battery-powered interrogation beacons arrayed along the taxiways and three or more receivers to establish location, the beacons can be eliminated by using squitter transponders The outputs of DIS and ASDE are fed to a map generator containing the contours of the airport to produce a complete image of ground traffic on the taxiways T.K.

A83-38935
THE TRACKING OF SHIP ROUTES VIA SATELLITES [SCHIFFSROUTENUEBERWACHUNG UEBER SATELLITEN]
R SCHMID (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, West Germany) Ortung und Navigation (ISSN 0474-7550), no 1, 1983, p. 115-124 In German Sponsorship. Bundesministerium fuer Forschung und Technologie.
(Contract BMFT-WRB-5018-9)

The experimental trial of a system to determine the position of a ship at sea and transmit position, route, and speed to a land station is reported The TRANSIT navigation satellites and MARISAT communications satellites were used to track the 55th voyage of the German research ship Meteor in 1980 The data were transferred by telephone from the MARISAT ground station in the US to the DFVLR data-processing center in the FRG Commercially available hardware components were used, including a TRANSIT receiver (with speed and course inputs for use with no satellite in view), a MARISAT receiver/sender, an onboard computer to process, store, and transmit the data on command, and a laboratory computer system to call up, receive, and analyze the data, producing a map of the ship's route While the results of the trial are considered good, improvements are suggested, including complete automation of the data-transmission process and the use of INMARSAT (with European ground stations) to decrease data-transfer costs and NAVSTAR-GPS to increase position accuracy T K

A83-38937
ALTERNATIVE TECHNIQUES TO GPS/NAVSTAR [ALTERNATIVE TECHNIKEN ZU GPS/NAVSTAR]
E MESSERSCHMID (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Nachrichtentechnik, Oberpfaffenhofen, West Germany) (Deutsche Gesellschaft fuer Ortung und Navigation, Sitzung, Munich, West Germany, Mar 31, 1982) Ortung und Navigation (ISSN 0474-7550), no 1, 1983, p 143-157 In German

A technique for determining geographic position by interferometric goniometry using a single geostationary satellite is proposed The current trend to increasingly large and complex satellites serving multiple functions and the heretofore restricted accessibility of NAVSAR are seen as suggesting such a project The measurement principle is explained, and the results of earlier experiments, as summarized for NASA by Gopalapillai et al (1976), are reviewed. software, hardware, precision, costs, and potential users are considered and compared with those of other existing and proposed systems Principal advantages of a satellite-interferometer system include great precision, broad coverage (95 pct of the earth's surface with three satellites), multiple applications (using the sender/transmitter capability of ground station and satellite), and the simultaneous use of the angle measurements for navigation and satellite control. It is concluded on the basis of these and other factors that a satellite-interferometry system represents a viable alternative or complement to NAVSTAR. T K.

A83-39219
AUTOMATED SYSTEMS OF CONTROL IN CIVIL AVIATION OF THE USSR [AUTOMATISCHE SYSTEME DER LEITUNG (ASL) IN DER ZIVILLUFTFAHRT DER UDSSR]
F. HEINRICH (Dresden, Hochschule fuer Verkehrswesen, Dresden, East Germany) Technisch-oekonomische Information der zivilen Luftfahrt (ISSN 0232-5012), vol 18, no 6, 1982, p. 208-211 In German refs

The employment of modern data processing techniques in the USSR is considered, taking into account the continuous transition process which takes place and leads to the utilization of automated procedures in support of the management of the national economy Concentrated scientific work concerning the development of automated systems of control for Soviet civil aviation was begun approximately 15 years ago The electronic data processing network of civil aviation in the USSR is discussed along with the programs which are providing the specialized personnel required for this network. As a result of the considered developments, Aeroflot has now at its disposal a number of automated systems which it employs for the control, planning, and management of its operations Details regarding the practical experience obtained in connection with the utilization of these systems are evaluated, giving attention to possible applications for Interflug, the airline of the German Democratic Republic. G R

A83-39345
THE COMPAS SYSTEM FOR MORE EFFICIENT APPROACH TRAFFIC [SYSTEM 'COMPAS' FUER EINEN RATIONELLEREN ANFLUGVERKEHR]
U VOELCKERS (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Flugfuehrung, Brunswick, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), June 1983, p 23-28 In German

The development of the Computer Orientated Metering Planning and Advisory System (COMPAS) to coordinate the approach paths of aircraft to the Frankfurt airport is discussed The present problems are described: increasing air traffic with limited runway space, arrival peaks and valleys due to an effectively random approach process, greater landing-time separation required by large-capacity aircraft, and the need to reduce close-in waiting time because of higher fuel costs COMPAS is designed to assign an aircraft a place in the landing order at a distance of about 100 NM, allowing any waiting time to be taken in fuel-saving gradual descent before reaching the metering-fix distance of 30 NM The system is intended to aid human air-traffic controllers, who still must make the final decisions. COMPAS is being evaluated using the air-traffic management and operations simulator at the Institut fuer Flugfuehrung, development should be completed by 1986 T.K

A83-39810
GLOBAL TELECOMMUNICATIONS NEEDS FOR THE LONG DURATION BALLOON ENVIRONMENT
S L WAYMIRE (National Scientific Balloon Facility, Palestine, TX) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p 59-66. refs

Attention is given to the long duration scientific research balloon operational environment, the planned National Scientific Balloon Facility support environment, and long duration scientific mission telecommunications requirements The characteristics of an ideal long duration balloon mission telecommunications network are projected, in terms of those generic attributes required for a comparative evaluation of satellite telecommunication alternatives

It is noted that the most desirable telecommunication multichannel techniques involve various forms of multiplexing or concentration
O C

A83-39812
A REVIEW OF GEOSTATIONARY SATELLITE ALTERNATIVES FOR RETRIEVING DATA FROM LONG DURATION BALLOON FLIGHTS
J N DE VILLIERS (ESA, Toulouse, France) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no. 6, 1983, p. 71-75.

Low speed data from high altitude scientific balloon flights can be retrieved by geostationary satellites through existing data collection platform systems Higher speed data of the order of 1 kbit/s create a more difficult problem, particularly if a response is to be made to the balloon payload in near real time Different geostationary satellite methods to achieve these more demanding requirements are reviewed, and the more interesting cases identified for possible future experiments. Author

A83-39813
A GLOBAL HF TELECOMMAND SYSTEM FOR LONG DURATION BALLOON FLIGHTS
R W. KING, D COLPUS, S HOLDER, and D. RAMSDEN (Southampton, University, Southampton, England) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p. 77-80 refs

An HF telecommand system for the control of long duration balloon flights at any point on the globe is described. The system proposed consists of a network of low-power transmitters operating at the same carrier frequency The choice of transmitter frequency power, and location are presented. Control of the transmitters may be performed remotely by means of the public switched telephone network; an assessment of the error-rate in the system as a whole is given. Author

A83-39814
NAVIGATION FOR BALLOON PAYLOADS - RECENT EXPERIENCE WITH OMEGA IN THE US AND A NEW SLANT RANGE SYSTEM
E KENDZIORRA, E GOETZ, and R. STAUBERT (Tuebingen, Universitaet, Tuebingen, West Germany) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p. 81-85 refs

The hyperbolic navigation system OMEGA is the only global radio navigation system which allows continuous position fixings At least three of the eight stations of the system must be received in order to determine geographic position. The replacement of OMEGA station G from Trinidad to Australia has adversely affected scientific research balloon navigation over the United States. Attention is given to experiences with OMEGA during a hard X-ray astronomy payload-carrying balloon flight from Palestine, Texas, in which three different OMEGA receivers were used Degraded receiving conditions have been circumvented by means of a slant range system. A combination of range, azimuth, and a single OMEGA line-of-position, provides reasonably accurate balloon positions O C.

A83-40301
THE INTEGRATION OF MULTIPLE AVIONIC SENSORS AND TECHNOLOGIES FOR FUTURE MILITARY HELICOPTERS
A. J SHAPIRO (Singer Co , Kearfott Div , Wayne, NJ) Navigation (ISSN 0028-1522), vol. 30, Spring 1983, p. 1-21.

A discussion is presented of multisensor navigation systems already available and in use in helicopters It is shown that technological advances in navigational electronics such as Doppler navigation radar, computers, integrated avionic control and display systems, etc , are now able to provide automated navigation with vital benefits in cost, size, weight, and power which permit incorporation of these advances into helicopters. The system trade-offs and considerations leading to new systems that use more advanced digital electronic techniques to achieve the goals of reduced pilot workload, improved performance at minimum size, weight, and cost are examined. The beneficial impact of ongoing technological advances in improving the operating capabilities of future avionics systems is considered. Also presented are detailed discussion of the AN/ASN-128 Lightweight Doppler Navigation system and the AN/ASN-137 Doppler Navigation system which employ advanced digital data bus technology N B.

A83-40623
UTILIZATION OF THE TRIDENT RADAR SYSTEM FOR AIR NAVIGATION, PHOTOGRAMMETRY, AND GEODESY AT THE NATIONAL GEOGRAPHIC INSTITUTE: FIRST RESULTS - ONGOING TESTS [UTILISATION DU SYSTEME DE RADIOLOCALISATION TRIDENT AL'INSTITUT GEOGRAPHIQUE NATIONAL EN NAVIGATION AERIENNE, PHOTOGRAMMETRIE ET GEODESIE: PREMIERS RESULTATS - ESSAIS EN COURS]
R BROSSIER and A. REYNES (Institut Geographique National, Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no 89, 1983, p 13-21 In French.

N83-27971 Bundesanstalt fuer Flugsicherung, Frankfurt am Main (West Germany).
ACTIVITIES REPORT ON AIR TRAFFIC SECURITY Annual Report, 1981 [JAHRESBERICHT 1981]
Jun 1982 44 p In GERMAN
Avail Issuing Activity

Measures for better air traffic safety, navigation and radiotelephony technology, information transmission technology, radar technology, and aerial survey technology are described
Author (ESA)

N83-27972# Naval Postgraduate School, Monterey, Calif Dept of Oceanography
APPLICATION OF ADDITIONAL SECONDARY FACTORS TO LORAN-C POSITIONS FOR HYDROGRAPHIC OPERATIONS M.S. Thesis
G. E WHEATON Oct 1982 130 p refs
(AD-A125620) Avail: NTIS HC A07/MF A01 CSCL 08J

The application of LORAN-C in the hyperbolic mode as a positioning system for hydrographic surveys was investigated. Observed LORAN-C time differences from a field test conducted in Monterey Bay, California were compared to calculated time differences determined from geographic positions based on a microwave positioning system Four methods were used to determine the calculated time differences The first three methods were (1) applying only the seawater Secondary Factory, (2) computing the time difference based on a Semi-Empirical TD Grid, and (3) applying ASF Correctors from the DMAHTC LORAN-C Correction Table. The final method applied multiple observed ASF Correctors at five minute latitude and longitude intervals By applying multiple observed ASF Correctors, which was the most accurate method, a 38 3 meter 1 drms with a lane offset of 3 to 12 meters using the 9940 X-Y LORAN-C combination was obtained Based upon the results presented, it may be possible to use LORAN-C for hydrographic surveys at scales of 1:80,000. GRA

N83-27973# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Kreiselgeraete und Traegheitsnavigation.
FLIGHT TESTING OF A STRAPDOWN SYSTEM. RESULTS OF A SPECIAL FLIGHT TEST
H J. HOTOP Oct. 1982 44 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-818)
(DFVLR-MITT-83-02, ESA-TT-818) Avail· NTIS HC A03/MF A01; DFVLR, Cologne DM 16,60

Instruments and data evaluation used in flight testing of the modular strapdown system (MSS) are described. Reference data, based on an inertial navigation system and optimal smoothing techniques, are shown for a flight test on the HFB 320 aircraft The MSS flight tests were limited to the navigation part. The results show position errors of 10 km/hr maximum, speed errors of 8 m/sec maximum, elevation angle errors 0 4, and course error drift of 0.4/hr Author (ESA)

N83-27974# European Space Agency, Paris (France).
FLIGHT TESTING OF INERTIAL NAVIGATION SYSTEMS: HARDWARE AND SOFTWARE DESCRIPTION
W LECHNER, H. J HOTOP, and H P ZENZ Mar 1983 93 p refs Transl into ENGLISH of "Flugerprobung von Traegheitsnavigationssystemen Beschreibung der Mess- u Auswertechnik" rept. DFVLR-Mitt-81-14 Brunswick, West Germany, May 1981
(ESA-TT-772, DFVLR-MITT-81-14) Avail· NTIS HC A05/MF A01, original German version available from DFVLR, Cologne DM 20,20

Hardware and software were developed for the data evaluation of a flight measurement system consisting of inertial sensors on board the aircraft and ground-based flight path measurement stations The results obtained are reference data for flight path, velocity, attitude angles and gyro drift External measurements such as radar, cinetheodolites or TACAN, together with inertial data recorded in the aircraft, are evaluated by optimum smoothing techniques Flight test results are presented Author (ESA)

N83-29191 Virginia Univ, Charlottesville
MINIMUM NOISE IMPACT AIRCRAFT TRAJECTORIES Ph.D. Thesis
R G MELTON 1982 210 p
Avail. Univ. Microfilms Order No DA8228602

A method was developed for studying the feasibility of reducing annoyance due to aircraft noise by modifying the flight trajectories over a community. Numerical optimization is used to compute the optimum flight paths, based upon a parametric form that implicity includes some of the problem restrictions The other constraints are formulated as penalties in the cost function Various aircraft on multiple trajectories (landing and takeoff) can be considered The modular design employed allows for the substitution of alternate models of the population distribution, aircraft noise, flight paths, and annoyance, or for the addition of other features (e g, fuel consumption) in the cost function A reduction in the required amount of searching over local minima was achieved through use of the presence of statistical lateral dispersion in the flight paths Three annoyance models have been studied noise impact index, level weighted population, and highly annoyed population number Dissert Abstr

N83-29192# Federal Aviation Agency, Atlantic City, N.J Technical Center
LORAN-C NONPRECISION APPROACHES IN THE NORTHEAST CORRIDOR Final Report, Sep. 1981 - Jan. 1982
F LORGE Jun. 1983 75 p refs
(Contract FAA PROJ. 045-330-130)
(FAA-RD-82-78, FAA-CT-82-76) Avail NTIS HC A04/MF A01

A flight test designed to investigate the suitability of LORAN-C as a nonprecision approach aid in the Northeast Corridor (NEC) is described Approaches were flown at six selected airports in the NEC by a CH-53A helicopter using LORAN-C for course guidance Accuracy criteria specified in Advisory Circular (AC) 90-45A were used as the standard for acceptability Data were recorded for LORAN in area calibrated and uncalibrated modes along with very high frequency omnidirectional radio range (VOR)/distance measuring equipment (DME) raw sensor data for comparison The results show that the group repetition interval (GRI)-9960 Northeast U S LORAN-C chain met AC 90-45A requirements for nonprecision approaches in all cases when a local area calibration was applied The uncalibrated mode met AC 90-45A requirements at four of the six airports It was determined that the Seneca, Nantucket, Carolina Beach triad should be used for navigation throughout the flight test area Author

N83-29193*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
DEVELOPMENT AND EVALUATION OF A KALMAN-FILTER ALGORITHM FOR TERMINAL AREA NAVIGATION USING SENSORS OF MODERATE ACCURACY
G KANNING, L. S CICOLANI, and S F SCHMIDT (Analytical Mechanics Associates, Inc, Mountain View, Calif) Jul 1983 147 p refs
(NASA-TP-2035, A-8955, NAS 1 60 2035) Avail· NTIS HC A07/MF A01 CSCL 17G

Translational state estimation in terminal area operations, using a set of commonly available position, air data, and acceleration sensors, is described Kalman filtering is applied to obtain maximum estimation accuracy from the sensors but feasibility in real-time computations requires a variety of approximations and devices aimed at minimizing the required computation time with only negligible loss of accuracy Accuracy behavior throughout the terminal area, its relation to sensor accuracy, its effect on trajectory tracking errors and control activity in an automatic flight control system, and its adequacy in terms of existing criteria for various terminal area operations are examined The principal investigative tool is a simulation of the system Author

N83-29194# Rosenberg (Paul) Associates, Pelham, N. Y
NAVIGATION: NATIONAL PLANS; NAVSTAR-GPS; LASER GYROS Final Technical Report, 3 Sep. 1980 - 31 Aug. 1982
P. ROSENBERG Warren, Mich Army Tank-Automotive Command 31 Aug 1982 158 p refs
(Contract DAAK30-80-C-0073; DA PROJ 1L1-62601-AH-91)
(AD-A125533, TACOM-TR-12686, PRA-8049) Avail NTIS HC A08/MF A01 CSCL 17G

Three navigation topics are reviewed, analyzed and summarized (1) United States national plans for navigation; (2) the NAVSTAR-Global Positioning System, (3) laser gyros including Sagnac interferometer laser gyros and fiberoptic laser gyros This study is a sequel to USATARADCOM Technical Report No 12496, Position-Location/Navigation Systems Overview for Military Land Vehicles (AD-A088070) Author (GRA)

N83-29195# Defense Mapping School, Fort Belvoir, Va. Dept of Topographic Sciences.
THE INFLUENCE OF REFERENCE SYSTEM DISPARITY ON NAVIGATION AND POSITIONING
G A ROBINSON and D. E MILLER 23 Mar. 1983 15 p refs Presented at the Natl Aerospace Meeting, Crystal City, Va, 23 Mar 1983
(AD-A125546) Avail: NTIS HC A02/MF A01 CSCL 08E

There are many geodetic datums in use throughout the world today Each of these datums serves as a reference surface for the mapping, charting, and geodetic work done in a specific geographical area Each datum is defined by fitting a specific ellipsoid to the earth in such a manner as to minimize departures of this reference model from the geoid over the area of concern Historically, these datums have been relatively oriented. Consequently the position of the center of an ellipsoidal model relative to the center of the mass of the earth is not known The positions determined on one datum cannot be related accurately to positions on another datum. The development of absolutely-oriented datums incorporating satellite and gravity data has led to the development of datum transformations to relate positions on one datum to those on another Sophisticated new electronic navigation and targeting technology requires highly precise input data to obtain output on the order of design accuracies To obtain positions on the order of +/- 1000 feet, care should be taken by the users of such equipment that the datum to which positions are referred is taken into account GRA

N83-29196# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Abt Anthropotechnik und Simulation
EVALUATION OF AN AIRBORNE TERMINAL FOR A DIGITAL DATA LINK IN AVIATION
R UCKERMANN and H RADKE Nov. 1982 54 p refs In ENGLISH; GERMAN summary
(DFVLR-FB-83-05) Avail NTIS HC A04/MF A01; DFVLR, Cologne DM 30,70

Pilot acceptance of an airborne link terminal (ALT), intended as an interface of a data link between aircraft and air control was studied in an Airbus A300 flight simulator. Response time and eye point of regard measurements as well as a questionnaire data were assessed Results show that the introduction of the ALT has no negative effect on pilots' work pattern and that pilots can benefit from the additional information and control functions offered by the ALT A significant reduction of ambiguous voice communication between pilot and air traffic controller is achieved Author (ESA)

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology

A83-37064*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
PILOTED SIMULATION OF HOVER AND TRANSITION OF A VERTICAL ATTITUDE TAKEOFF AND LANDING AIRCRAFT
G. C. HILL (NASA, Ames Research Center, Moffett Field, CA) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol 6, July-Aug 1983, p 258-263 refs

Previously cited in issue 05, p 654, Accession no A82-16910

A83-37148
MICROPROCESSOR CONTROLLED OPTIMAL HELICOPTER TURRET CONTROL SYSTEM
N K LOH (Oakland University, Rochester, MI) and N COLEMAN (U S Army, Armament Research and Development Command, Dover, NJ) IN: American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p. 1088-1094 refs

The design and implementation of microprocessor-based optimal controllers for the XM-97 helicopter turret control system is considered. Nonfiring and firing test results are presented Significant performance improvement of the optimal turret over the original turret has been obtained in terms of percent overshoots, settling times, and shot pattern dispersions The system investigated in this paper may be considered as an interesting and important case study in the design of optimal control systems Author

A83-37267
OPTIMAL MASS DISTRIBUTION BETWEEN THE STAGES OF A TWO-STAGE AIRCRAFT FOR MAXIMIZATION OF THE FLIGHT CRUISE RANGE [OPTIMAL'NOE RASPREDELENIE MASSY MEZHDU STUPENIAMI DVUKHSTUPENCHATOGO SAMOLETA DLIA MAKSIMIZATSII KREISERSKOI DAL'NOSTI POLETA]
V V. SKIPENKO TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no. 1, 1982, p 116-123. In Russian. refs

The paper considers the problem of choosing the optimal distribution of initial mass between the stages of a two-stage aircraft for the maximization of cruise range. A solution is obtained in analytic form which makes it possible to derive certain general relationships valid for two-stage aircraft in a wide range of flight velocities Attention is given to the case of the free choice of the point of landing of the first stage and to the case of its return to the point of takeoff The cruise ranges of one-stage and two-stage aircraft are compared, and the relative advantages of the two designs are indicated. B J.

A83-37857#
DORNIER DO 24 TT(TECHNOLOGY TESTBED) EXPERIMENTAL AMPHIBIAN
Dornier-Post (English Edition) (ISSN 0012-5563), no. 2, 1983, p 27-30.

The experimental program for the development of new technologies in amphibious aircraft based on the TT version of the Dornier Do 24 flying boat is presented Objecteives of the programs in the areas of seaworthiness, operational flexibility, performance and cost are noted, and the major design features of the Do 24 TT configuration are outlined. Particular attention is given to the use of a strutted carbane-type high-wing monoplane with reduced drag and increased lift The schedule of flight tests subsequent to the first successful flight of the experimental configuration in April, 1983 iis indicated. A L W.

A83-37859#
CONFIGURATION STUDIES FOR FUTURE FIGHTERS
R. WEISS Dornier-Post (English Edition) (ISSN 0012-5563), no. 2, 1983, p 34-38.

Studies undertaken with a view towards the introduction of a new generation of tactical fighter aircraft for the air superiority role in the 1990's are discussed. Demands on the aerodynamic design parameters of future aircraft in the areas of performance, flexibility, short take-off and landing, and radar signature are noted, and technologies with a major influence on aerodynamic configuration are considered with particular attention given to those of active flight control and vectored thrust control. The process of configuration development, which determines the appropriateness of individual technologies with respect to cost effectiveness for the entire fleet, is then outlined. Characteristics of three alternative horizontal tail configuration types under consideration (aft tail, no horizontal tail and canard) are compared in the areas of performance, stability and control, and complexity of flight control systems. Vectored thrust control is then mentioned as a technology enabling the combination of the advantages of the aft-tail configuration with those of tailless aircraft A L W.

A83-37879
PERFORMANCE ASSESSMENT OF A RECLINED EJECTION SEAT
J. G BRISTER and R F YURCZYK (Boeing Military Airplane Co, Seattle, WA) SAFE Journal, vol 13, Summer 1983, p 21-24
(Contract F33615-80-C-3404)

New concepts are currently being developed regarding the design of ejection seats with the objective to meet the requirements of advanced technology combat aircraft. The present investigation is concerned with studies conducted in connection with a program, titled 'Reclined Ejection Seat Development'. The objective of this program is related to the development of an esape system which can be integrated with a low profile cockpit. The design is to provide safe escape during emergency conditions encountered throughout the flight performance envelope of aircraft capable of sustaining high speed flight at dynamic pressure to 1600 psf A one-half scale model of the reclined seat was fabricated for wind tunnel testing. It was found that the reclined ejection seat incorporating a repositioning catapult and ejection rocket with thrust vector control is a feasible concept for escape throughout the flight envelope of a high performance aircraft. G.R

A83-37952
NGT SUB-SCALE FLIGHT DEMONSTRATOR - A COST-EFFECTIVE APPROACH TO AIRCRAFT DEVELOPMENT
G ROSENTHAL (Fairchild Republic Co , Farmingdale, NY) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 11 p
(SAE PAPER 821341)

During December 1981, proposals were submitted for the U.S Air Force Next Generation Trainer (NGT) The NGT, a primary jet trainer, is to replace the present Air Training Command fleet of T-37B's Since mid-1977, investigations have been conducted by a U.S. aerospace company with the aim to select the most suitable NGT configuration and to validate that design to eliminate technical risk Since many dynamic flying qualities characteristics are not directly obtainable from wind tunnel measurements, it is desirable to compare estimates with flight test data for a similar aircraft In connection with the NASA initiative in acquiring and testing the AD-1 skew-wing research aircraft, attention was given to the feasibility of a scaled demonstrator for the NGT design. The total program was conducted for less than a half million dollars and required a total of 10 months from start of fabrication The demonstrator program provided a large volume of useful design data in areas which could not be explored with high confidence in a wind tunnel G.R

A83-37955
DESIGN OF AN AEROBATIC AIRCRAFT WING USING ADVANCED COMPOSITE MATERIALS
L E LOUDENSLAGER (H D Neubert and Associates, Inc , Anaheim, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 7 p
(SAE PAPER 821346)

CAD efforts at tailoring a new configuration for a competition aerobatics aircraft are described One goal of the privately funded program was to minimize structural weight, thus enhancing the thrust/weight ratio critical to aerobatic maneuvers The new design featured an optimized tubular steel fuselage, advanced composite wings (graphite epoxy), horizontal and vertical tail, landing gear legs, and secondary structure and fairings NASA performed computations of the expected aerodynamic loads with a doublet fortex formulation expressed as a two-dimensional inviscid flow finite element model The NASTRAN program yielded stress contour pilots and the first ten natural frequencies, which were found to reside above the design maneuvering speed due to the use of composite materials M S K.

A83-37958
CABIN NOISE WEIGHT PENALTY REQUIREMENTS FOR A HIGH-SPEED PROPFAN-POWERED AIRCRAFT - A PROGRESS REPORT
J D. REVELL, F J BALENA, and R A PRYDZ (Lockheed-California Co , Burbank, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 14 p. refs
(SAE PAPER 821360)

A non-dimensional parameter is developed and data provided to estimate the required mass penalty to achieve satisfactory interior cabin noise levels for advanced propfan powered aircraft The cabin noise criterion is 80 dBA which is representative of present-day turbofan-powered aircraft interiors and was used by NASA in a related study. Numerical results are given here for an advanced narrow-body powered by two 10-bladed propfans, cruising at 0 70 and 0 80 Mach number, designated as the ATX-100 Author

A83-37965* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
SUPERSONIC STOVL RESEARCH AIRCRAFT
S. B WILSON, III, G H. KIDWELL, JR (NASA, Ames Research Center, Moffett Field, CA), G E TURNEY (NASA, Lewis Research Center, Cleveland, OH), and A. ROGERS (Grumman Aerospace Corp , El Segundo, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 18 p. refs
(SAE PAPER 821375)

Two powered-lift concepts, the tandem fan and the longitudinally-arrayed ejector, are integrated with two existing fighter aircraft, the F-14A and F-16A respectively, to indicate the benefits and/or penalties involved with providing STOVL capability to CTOL aircraft It is shown that properly designed powered-lift aircraft can achieve either comparable or superior mission performance relative to CTOL aircraft Author

A83-37968
RECENT AIRCRAFT TIRE THERMAL STUDIES
R N DODGE and S K. CLARK (Michigan, University, Ann Arbor, MI) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 14 p
(SAE PAPER 821392)

A method has been developed for calculating the internal temperature distribution in an aircraft tire while free rolling under load The method uses an approximate stress analysis of each point in the tire as it rolls through the contact patch, and from this stress change the mechanical work done on each volume element may be obtained and converted into a heat release rate through a knowledge of material characteristics The tire cross-section is then considered as a body with internal heat generation, and the diffusion equation is solved numerically with appropriate boundary conditions at the wheel and runway surface. Comparisons with buried thermocouples in actual aircraft tires shows good agreement Author

A83-37969* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REVIEW OF NASA ANTISKID BRAKING RESEARCH
J A. TANNER (NASA, Langley Research Center, Hampton, VA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 14 p. refs
(SAE PAPER 821393)

NASA antiskid braking system research programs are reviewed These programs include experimental studies of four antiskid systems on the Langley Landing Loads Track, flights tests with a DC-9 airplane, and computer simulation studies Results from these research efforts include identification of factors contributing to degraded antiskid performance under adverse weather conditions, tire tread temperature measurements during antiskid braking on dry runway surfaces, and an assessment of the accuracy of various brake pressure-torque computer models. This information should lead to the development of better antiskid systems in the future Author

A83-37978
VALIDATION OF THE KC-10 REFUELING BOOM DIGITAL CONTROL SYSTEM
L. G BEKEMEYER (Douglas Aircraft Co., Long Beach, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-29, 1982. 12 p.
(SAE PAPER 821421)

The refueling boom on the KC-10 tanker is controlled by a digital fly-by-wire system Use of a three-level verification procedure was begun early in the development cycle to detect design and coding errors The software code was exercised in a hardware/software interface which became more complete with each succeeding level. The supplier's validation facility was used to provide first-level code checks A multipurpose man-in-loop simulator which contained most of the flight-type operator's station components was used for second-level checks The KC-10 ground and flight test activities provided the final verification Inservice history (nearing two years) indicates a completely successful validation program Author

A83-37982* National Aeronautics and Space Administration Langley Research Center, Hampton, Va.

THE ALL ELECTRIC AIRPLANE-BENEFITS AND CHALLENGES

C R SPITZER and R. V HOOD (NASA, Langley Research Center, Hampton, VA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 7 p refs

(SAE PAPER 821434)

The all electric aircraft considered in the present investigation is an aircraft which has digital flight crucial controls, electromechanical actuators, and electrical secondary power There are no hydraulic or pneumatic systems. The characteristics of an all electric aircraft are related to reduced acquisition cost, reduced weight, reduced fuel consumption, increased reliability, reduced support equipment, simpler maintenance, an expanded flight envelope, and improved survivability An additional benefit is the dramatically increased design flexibility and mission adaptability. However, the implementation of the all electric aircraft concept requires the resolution of a number of major technology issues. Issues in the digital flight controls area are related to achieving the required levels of safety and reliability in a cost effective manner Other challenges which have to be met are concerned with electromechanical actuators, environmental control and ice protection systems, and engine technology. G R

A83-37983

ELECTROMECHANICAL PRIMARY FLIGHT CONTROL ACTIVATION SYSTEMS FOR FIGHTER/ATTACK AIRCRAFT

J. B. LEONARD (Grumman Aerospace Corp, Bethpage, NY) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 20 p. Navy-supported research

(SAE PAPER 821435)

Electromechanical Actuation Systems (EMAS) using advanced state-of-the-art technology offer significant benefits in primary flight control applications Fighter and attack aircraft present the greatest challenge, but studies have shown feasibility for those applications The use of samarium cobalt 'inside-out' DC motors, solid-state power switching, and microprocessor control of commutation, current, and frequency are the advances that have made EMAS contenders for military aircraft applications. Benefits include elimination of hydraulic systems, improved logistics, increased reliability, and lower life-cycle costs The studies addressed actuation of canard and rudder control surfaces on supersonic Navy fighter aircraft Author

A83-37984

DESIGN ASPECTS OF SYSTEMS IN ALL-ELECTRIC AIRCRAFT

M J. CRONIN (Lockheed-California Co, Burbank, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 13 p. refs

(SAE PAPER 821436)

The advanced technologies relevant to the development of all-electric aircraft are briefly reviewed In particular, attention is given to the propulsion system, engine starting technology, environmental control systems, avionics, powered wheels, electric brakes, and vortex turbine generators The results of several technology studies are reported which illustrate the potential of all-electric aircraft for yielding very attractive fuel-savings and aircraft support/acquisition cost reductions. V L.

A83-37989

THE RECIPE FOR RE-ENGINING JET TRANSPORTS

L B ASCHENBECK (Cammacorp, El Segundo, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 13 p refs

(SAE PAPER 821441)

The relative newness of the DC-8-60's plus their advanced aerodynamic and structural technology combined with the CFM56-2 high by-pass engine results in a modern, economic aircraft FAR Part 36 Noise Requirements and the prospect of ever increasing fuel costs make the retrofit DC-8-60's a prudent investment The type certificate for these re-engined aircraft will designate them at DC-8-70's Performance improvements, noise reduction and reduced fuel consumption provide distinct and quantifiable benefits to the operators of the DC-8-70's These benefits are verified by the results of certification flight testing and will be presented in detail. Author

A83-37990

RE-ENGINING THE 737

J. C BAER and A L SCHUEHLE (Boeing Commercial Airplane Co, Seattle, WA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 9 p.

(SAE PAPER 821442)

Opportunities exist to re-engine commercial airliners with new high-bypass-ratio engines One such example is the Model 737-300, a derivative of the Advanced 737-200 airplane with two CFM56-3 engines. The ground clearance of the 737 and the increased engine diameter present a unique design problem A close coupled nacelle/wing, a new leading edge slat, and a horizontal tail extension are required along with increased operational weights About 20 passenger seats have been added Noise levels and fuel consumption have been substantially reduced Author

A83-37991

727, B-52 RETROFIT WITH PW2037 MEETING TODAY'S REQUIREMENTS

R ALTMAN (United Technologies Corp., Commercial Products Div, East Hartford, CT) and E. P FLYNN (United Technologies Corp, Government Products Div., West Palm Beach, FL) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 13 p.

(SAE PAPER 821443)

The suitability of 727 and B-52 PW2037 powerplant retrofit options are examined The potential PW2037 gains over JT8D, TF33, and J57 in cycling and component technology are identified, and engine installation and aircraft modification tasks for the 727 and B-52 are addressed Adjustments in the nacelle, cases, plumbing, and aircraft system interface of the 727 that will be needed for installing the PW2037 are described, and resulting improvements in range, fuel economy, and noise are stated Reengining in the B-52 is discussed, including the resulting benefits for maritime missions and conventional bombing B-52 engine modifications required for high altitude operations of the PW2037 are given. C D

A83-37992

RE-ENGINING APPLICATIONS OF T56 DERIVATIVE ENGINES

D. MELCHIORIS (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) and F J VERKAMP (General Motors Corp, Detroit Diesel Allison Div., Detroit, MI) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 10 p.

(SAE PAPER 821444)

The T56 is a constant speed, single-shaft turboprop engine Approximately 12,000 T56 engines have been delivered for commercial and military applications to 49 countries. U.S. military aircraft employing the T56 include the C-130 transport aircraft, the P-3 antisubmarine warfare aircraft, and the E-2 aircraft. The T56 entered production 28 years ago in 1954 as a 3460 shaft horsepower (SHP) engine Derivative Series II and III engines with increased horsepower entered production in 1958 and 1964. The current production model, the T56 Series III, has 33 percent more power than the original Series I engine In 1977, Congress recognized the need for cost effective derivative engines, such as a T56 Series IV, and approved an Engine Model Derivative Program (EMDP) EMDP is to provide existing military aircraft systems with the latest advances in engine technology with a minimal amount of investment By reenging U S military aircraft it will be possible to achieve fuel savings and improve aircraft performance G R

A83-37993

RE-ENGINING STUDIES ON THE P-3 AIRCRAFT

J L. BENSON, J D DUPCAK, and A J SCHUETZ (Lockheed-California Co , Burbank, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 13 p. refs
(SAE PAPER 821445)

An analysis of the benefits and costs of installing new, derivative-type (DTP) or all-new, advanced (ATP) turboprop engines in the US Navy P-3 antisubmarine warfare patrol aircraft is presented The design parameters are discussed: increased fuel efficiency, range, endurance, and payload are to be achieved while maintaining the nacelle size, gearing, and propellor of the present P-3C-Update II The current status of DTP and ATP development is reviewed, and the modifications required to install an ATP in the P-3 are outlined It is shown that significant improvements are obtainable in all areas by both DTP and ATP, and that the maximum performance would be achieved with ATP, but at greater cost The question of the overall cost-benefit tradeoffs among continuation of the present P-3, reengining with DTP, or reengining with ATP is seen as not yet answerable T.K

A83-37999* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif

OPTIMAL TURNING CLIMB-OUT AND DESCENT OF COMMERCIAL JET AIRCRAFT

F NEUMAN and E KREINDLER (NASA, Ames Research Center, Moffett Field, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 12 p. refs
(SAE PAPER 821468)

Optimal turning climb-out and descent flight-paths from and to runway headings are derived to provide the missing elements of a complete flight-path optimization for minimum fuel consumption The paths are derived by generating a field of extremals, using the necessary conditions of optimal control Results show that the speed profiles for straight and turning flight are essentially identical, except for the final horizontal accelerating or decelerating turn. The optimal turns, which require no abrupt maneuvers, could easily be integrated with present climb-cruise-descent fuel-optimization algorithms Author

A83-38078#

PERFORMANCE TESTS OF TWO INERT GAS GENERATOR CONCEPTS FOR AIRPLANE FUEL TANK INERTING

C. L ANDERSON, A F. GRENICH, F F TOLLE, W J. YAGLE (Boeing Military Airplane Co , Seattle, WA), and G W GANDEE (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p.
(Contract F33615-78-C-2063)
(AIAA PAPER 83-1140)

Attention is given to two novel concepts for the prevention of aircraft fuel tank fires and explosions through inerting, which involves the reduction of the oxygen concentration level in the fuel tank vapor space to a level which will not support combustion. The two inerting system alternatives are the permeable membrane inert gas generator (PMIGG) and the molecular sieve inert gas generator (MSIGG) The PMIGG and MSIGG have been evaluated in a U.S Air Force program involving the inerting of the wing fuel tanks of the KC-135 in-flight refueling tanker aircraft O.C

A83-38079*# Lockheed-California Co , Burbank

EFFECTS OF NACELLE POSITION AND SHAPE ON PERFORMANCE OF SUBSONIC CRUISE AIRCRAFT

L H BANGERT, D. K KRIVEC, and R. N. SEGALL (Lockheed-California Co., Burbank, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983. 9 p. refs
(Contract NAS1-16644)
(AIAA PAPER 83-1124)

The reduction of installed-propulsion-system drag by installing circular and D-shaped-cross-section nacelles in an underwing-aft position is investigated experimentally in the NASA-Langley 16-foot transonic wind tunnel Measurements were made at Mach 0.70 to 0 85, -2 5 to 4.1-deg angle of attack, and 3 4 to 4.0 million/ft Reynolds numbers using the NASA USB full-span transonic transport model, and results were compared with those for the wing-body and underwing-forward/pylon-mounted-nacelle (UTW) configurations While all nacelle configurations are found to have interference drag, which can probably be reduced by eliminating supersonic flows, both aft configurations are shown to reduce drag relative to UTW and increase lift coefficients The aft D-nacelle had the lowest drag, 6.8 percent of airplane drag lower than UTW at Mach 8.0 and lift coefficient 0 45 Wing pressure distributions and the effects of deflectors are discussed T K.

A83-38102

AIRCRAFT FLEXIBLE TANKS GENERAL DESIGN AND INSTALLATION RECOMMENDATIONS

SAE Aerospace Recommended Practice, ARP 1664, June 30, 1982, 36 p
(SAE ARP 1664)

Various flexible tanks and tank-mounted fittings for adapting the tank to the surrounding structure and the fluid systems plumbing in aircraft are described The tanks are intended for extra fuel carriage and for easy removal and replacement Attention is given to dimensioning the tanks for easy placement and to facilitate manufacture. Installation requirements for self-sealing, nonself-sealing, and crash resistant tanks are examined, with consideration for the aircraft dimensions and mission, as well as military specifications M S K.

A83-38329

NEW AIRCRAFT. II [NOUVEAUTES EN MATIERE D'AERONEFS. II]

L. ROSENTHAL L'Aeronautique et l'Astronautique (ISSN 0001-9275), no 99, 1983, p 3-14. In French

New models of civil aircraft for airlines, regional traffic, business applications, and sport flying displayed at Farnborough 1983 are described The airline aircraft, i e, the 747-200B, 767-200, the A310-202, the 757-200, and the A320-100 all feature cruise speeds of about Mach 0.8, with the number of passengers ranging from 150-442 and the ranges extending from 3200-9625 km. The engines installed include the JT9D-7fW, JT9D-7R4, the CF6-80AI, RB211-535C, and the CFM56-2K2, with thrusts of 21,393-10,000 daN. Several types of regional aircraft, for carrying 30-50 passengers at takeoff masses of 10-15 tons and ranges up to 1600 km were also shown Aircraft in the 40-110 seat class with ranges of 1350-2130 km were presented, together with 20 seat aircraft with ranges of 430-1610 km and business jets for 7-20 passengers, Mach 0 7 cruise speeds, and ranges of 2350-7325 km. Finally, small aircraft and ultralight aircraft were exhibited, with the ultralights having cruise speeds up to 100 km/hr and total masses as low as 103 kg M.S.K

A83-38470

DASHING AHEAD IN COMMUTERLINERS

D GODFREY Air International (ISSN 0306-5634), vol. 25, July 1983, p. 7-12, 23, 24

An account is given of the design features, performance capabilities and development history of the 36-passenger Dash 8 twin-turboprop transport aircraft for regional airlines. The aircraft primary structure is composed of the conventional 2014, 2024, and 7075 aluminum alloys Composites are employed in the radome, tail cone, undercarriage doors, engine lower cowlings and aft nacelles, wing fairings, and wing tips, accounting for approximately 10 percent of structural weight Extensive use is made of adhesive bonding Cabin pressurization is microprocessor-controlled, and the DFZ-800 digital automatic flight control system has built-in test equipment. An entirely new family of engines has been developed by the propulsion system manufacturer for aircraft of the present type, and the resulting PW100-series design employs a two-stage centrifugal compressor to yield a 15:1 pressure ratio O C

A83-38654#

AERODYNAMIC DEVELOPMENT FOR EFFICIENT MILITARY CARGO TRANSPORTS

G W. WEBBER (Lockheed-Georgia Co , Marietta, GA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 9 p

(AIAA PAPER 83-1822)

A development history is presented for next-generation military transport configurations conceived in the course of an ongoing aerodynamic efficiency improvement program that employs computational aerodynamics, design procedures based on practical experiences, and wind tunnel testing in the subsonic-transonic speed regime. An initial Advanced Transport Aircraft configuration was replaced by the L610 design in the wake of the U S Air Force's CX requirement, and this configuration has in turn been used as the basis of an advanced aerodynamic technology test vehicle Attention is given to considerations of cruise efficiency, component design, the effects of winglets and the incorporation of high lift systems O C

A83-38655*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

PARAMETRIC STUDY OF FACTORS AFFECTING THE FUEL EFFICIENCY OF ADVANCED TURBOPROP AIRPLANES

V. S JOHNSON (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 9 p. refs

(AIAA PAPER 83-1823)

Results of a parametric study to determine the effects of design variables and penalties on the fuel efficiency of Mach 0 8, 125-passenger, advanced turboprop airplanes show that propeller-wing interference penalty has a major effect Propeller tip speed has a minor effect, and could be decreased to alleviate the noise problem without significant effects on fuel efficiency The anticipated noise levels produced by the propfan will require additional acoustical treatment for the fuselage, this additional weight can have a significant effect on fuel efficiency The propfan advantage over an equivalent technology turbofan is strongly dependent on the interference penalty and acoustical treatment weight. Lowering the cruise Mach number to around 0.73 would result in greatly increased fuel efficiency Author

A83-38656#

HOVER AND TRANSITION FLIGHT PERFORMANCE OF A TWIN TILT-NACELLE V/STOL CONFIGURATION

M PIRERA (Grumman Aerospace Corp , Bethpage, NY) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 11 p.

(AIAA PAPER 83-1824)

The Grumman designed V/STOL tilt-nacelle concept is powered by two turbofan engines with a high fan pressure ratio The engine nacelles are side mounted on one tilting carry-through structure. The innovative means of control power in the hover and transition mode is the vertical and horizontal vane assembly, submersed in the turbofan exhaust. The nacelles contain all the VTOL functions (propulsive forces, thrust modulation, and vectoring) as well as controls about all three axes There is no need for additional lift fans or other devices, such as reaction control nozzles The rate of climb, the flight path angle, and the power required to trim for variations in nacelle deflection and angle of attack are more than adequate throughout the entire VTOL speed range These conclusions were drawn from both full and model scale powered tests, which disclosed an aerodynamic effect in connection with the flow into the fan nacelle (a boundary layer separation on the lower nacelle lip under certain operational conditions during descent) Further configuration development of the internal nacelle lines and the vertical vane assembly has already alleviated the separation effect. Author

A83-38657*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.

DESIGN STUDY FOR REMOTELY PILOTED, HIGH-ALTITUDE AIRPLANES POWERED BY MICROWAVE ENERGY

C E K MORRIS, JR. (NASA, Langley Research Center, Aeronautical Systems Office, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 8 p. refs

(AIAA PAPER 83-1825)

A design study has been conducted for unmanned, microwave-powered airplanes that must fly with long endurance at high altitude They are proposed to conduct communications-relay, observation, or various scientific missions above approximately 55,000 feet altitude. The special characteristics of the microwave-power system and high-altitude, low-speed vehicle are reviewed Examples of both sizing and performance analysis are used to suggest design procedure guidelines. Author

A83-38662#

APPLICATION OF FORWARD SWEEP WINGS TO AN AIR COMBAT FIGHTER

B D MILLER and S. K HADLEY (General Dynamics Corp , Fort Worth, TX) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 12 p refs

(AIAA PAPER 83-1833)

Forward-swept wings (FSWs) have aerodynamic characteristics similar in most respects to those of aft-swept wings However, for some conditions important to an air combat fighter, such as takeoff and roll control, FSW designs offer good aerodynamic and stability advantages Designs applying FSW to the F-16 have been wind-tunnel tested, and their aerodynamic characteristics compared relative to two aft-sweep wing designs and to the basic F-16 for reference. One aft-sweep wing design has the same aspect ratio, maximum thickness, and airfoil (supercritical) as the FSW design. The second aft-sweep wing design encompasses all the design disciplines and is optimized for the requirements of an air combat fighter similar to the FSW design. Overall, when designing to the F-16 air superiority mission, an aft-sweep wing design was found to be best Author

A83-38663#

X-29 FORWARD SWEPT WING AERODYNAMIC OVERVIEW

M MOORE and D. FREI (Grumman Aerospace Corp., Bethpage, NY) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 9 p. refs

(AIAA PAPER 83-1834)

The X-29 Advanced Technology Demonstrator is a proprietary attempt to demonstrate the performance potential of canard/forward swept wing fighter configurations and employs a wing primary box of graphite/-epoxy composite covers that are bolted onto titanium and aluminum spars Attention is presently given to the configurational integration of aeroelastically tailored composites, the close coupled variable incidence canard, relaxed static stability, and variable wing camber, in conjunction with the thin, supercritical airfoil of the forward swept wing. Reynolds number effects at high angles of attack, and the implementation of three-surface trimming (using strake flaps) are also discussed in light of wind tunnel tests O.C

A83-38679*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va
COMPUTATIONAL ANALYSIS FOR AN ADVANCED TRANSPORT CONFIGURATION WITH ENGINE NACELLE
E G WAGGONER (NASA, Langley Research Center, Theoretical Aerodynamics Branch, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 13 p refs
(Contract NAS1-16055)
(AIAA PAPER 83-1851)

A small-disturbance transonic analysis code is used to calculate the flow-field effects of adding an engine nacelle to a wing/body configuration Analyses are performed on an advanced transport configuration with and without engine nacelles Two nacelle shapes are analyzed and the effects of the nacelle installation on pressure distributions are compared with experimental results obtained by shifting the nacelle longitudinally and vertically relative to the wing. Effects of varying the nacelle installation yaw angle are also analyzed and compared with experimental data These comparisons show that the analysis code is adequately sensitive to variations in nacelle shape, longitudinal and vertical location beneath the wing, and the nacelle installation yaw angle Results indicate that the code can be used as an effective guide during the design process Author

A83-38684*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
STATUS REVIEW OF A SUPERSONICALLY-BIASED FIGHTER WING-DESIGN STUDY
R M WOOD, D S MILLER, D E HAHNE (NASA, Langley Research Center, Hampton, VA), L G. NIEDLING, and J R KLEIN (McDonnell Aircraft Co, St Louis, MO) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 13 p refs
(AIAA PAPER 83-1857)

Results from an ongoing supersonically-biased fighter wing-design study are summarized The study has been conducted to explore the effects of supersonic aerodynamic performance, transonic maneuvering, low-speed/high angle-of-attack characteristics, and airframe system integration requirements on fighter aircraft wing design The approach adopted involves the theoretical and experimental investigation of four advanced aircraft configurations which differ only in wing geometry Supersonic and low-speed/high angle-of-attack wind tunnel results have been obtained for 20 deg trapezoidal, 65 deg delta, 70/30-deg advanced cranked, and 70/66-deg advanced cranked wing configurations The supersonic data show that the advanced cranked wings outperform the trapezoidal and delta wings at cruise and moderate lift conditions Low-speed/high angle-of-attack results show that all wings have significant stability problems above an angle of attack of 20 deg Aircraft sizing analysis results show that the advanced cranked-wing configurations are significantly lighter, based upon take-off gross weight, than either the trapezoidal or the delta wings Author

A83-38686*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
AERODYNAMIC DESIGN FOR IMPROVED MANEUVERABILITY BY THE USE OF THREE-DIMENSIONAL TRANSONIC THEORY
M J MANN, R L CAMPBELL, and J. C FERRIS (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 10 p refs
(AIAA PAPER 83-1859)

This study has examined the level of transonic maneuver performance that can be achieved by the use of three-dimensional transonic theory. The FLO-27 code of Jameson and Caughey (1977) was used to lower maneuver drag by the reduction of shock strength on the wing upper surface A design procedure was used to provide a set of guidelines for the iterative application of FLO-27 during the wing design process The fighter configuration utilized had a leading-edge sweep of 45 deg and an aspect ratio of 3 28 Tests were conducted at Mach numbers from 0.60 to 0 95 and angles of attack from -5 to 18 deg. The accurate prediction of wing shock systems required the inclusion of fuselage effects in the theory. The FLO-27 code gave a reasonable estimate of the experimental wing pressure distributions at transonic maneuver conditions in the region of the wing where the flow was attached For Mach numbers between 0 60 and 0.95 and lift coefficients near 0 9, a wing designed by the use of FLO-27 showed substantially lower drag than an empirically developed, supercritical maneuver wing and a maneuver wing designed primarily by two-dimensional transonic theory For some maneuver conditions, the drag of the two-dimensional design was somewhat lower Author

A83-38688#
AERODYNAMICS CRITICAL TO THE OPERATIONS OF TACTICAL FIGHTERS FROM BOMB DAMAGED RUNWAYS
N. J KRONE, D N BEATTY (BDM Corp, McLean, VA), D J PIERRE (USAF, Tyndall AFB, FL), and L. BOEHMANN (Dayton, University, Dayton, OH) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 11 p refs
(AIAA PAPER 83-1861)

To meet current demands of combat, tactical fighters must operate from bomb-damaged runways, and so doing, encounter a debris environment significantly higher than that found in peacetime It is necessary to qualitatively determine the risk and source of risk to aircraft operations The paper covers the status of current research in inlet and exhaust aerodynamics to ascertain how these impact aircraft vulnerability and the governing parameters and phenomena The paper covers off-body inlet flow fields, inlet vortices, and exhaust flows The relative impact of these flows on risk aircraft during various aircraft operations is shown The paper shows that using very conservative assumptions, the vortex ingestion phenomena can produce very high risk unless surfaces are extremely clean The limitations of knowledge in critical areas are identified, such as ingestion probabilities and the need to efficiently produce off-body inlet flow fields The paper ends with an observation on the impact that current research may have on F-4 operations. Author

A83-38700
SUPER CHOPPERS
P KINNUCAN High Technology (ISSN 0277-2981), vol 3, Aug. 1983, p 32-37, 40, 41

A discussion is presented of the new features being developed for the fourth generation of helicopters which will appear in the early 1990s Various features of this new generation of helicopters are examined, including novel rotor and wing configurations, all-composite construction, electronic cockpits, advanced vibration suppression systems, and stealth technology These new features will help this new generation of helicopters to far excel present helicopters in nearly every performance category, including speed, altitude, endurance, agility, and survivability, while also being more reliable, able to fly in all kinds of weather and during night and day, and able to be flown by a single pilot. Several programs undertaken by the US Army and NASA, among others, in order to developed these new, fourth generation features for helicopters are discussed N B.

A83-38907*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
EFFECT OF BUOYANCY AND POWER DESIGN PARAMETERS ON HYBRID AIRSHIP PERFORMANCE
P D TALBOT and P. A. GELHAUSEN (NASA, Ames Research Center, Moffett Field, CA) IN: Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 52-59. refs
(AIAA PAPER 83-1976)

The effects of several design parameters on the performance of hybrid airships having rotors and propellers were examined with a simple mathematical model. The parameters included buoyancy ratio, Froude number, ratio of rotor power to total power, and rotor shaft tilt Performance variations resulting from changes in these parameters were calculated, and are presented and discussed Performance quantities included best climb rate, equivalent vehicle L/D, and maximum speed. Performance at all speeds between hover and maximum speed was found to be sensitive to power distribution between rotors and propellers, and to rotor shaft tilt Author

A83-38908#
DYNAMIC ANALYSIS OF THE MAGNUS AEROSPACE CORPORATION LTA 20-1 HEAVY-LIFT AIRCRAFT
H. S. B SCHOLAERT (Toronto, University, Toronto, Canada) IN: Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p 60-69
(AIAA PAPER 83-1977)
A new concept in lighter-than-air vehicles has been proposed by the Magnus Aerospace Corporation This new design, designated the LTA 20-1, utilizes buoyancy, Magnus lift, and vectored thrust to provide payload carrying capabilities in the range of 50 tons The purpose of this work has been the assessment of the flight dynamics of the LTA 20-1. In order to accomplish this task, a nonlinear eight-degree-of-freedom computer simulation was designed. This simulation has enabled a detailed analysis of the vehicle response to various control inputs, adverse wind profiles, and suspended payload oscillations As an aid in the qualitative assessment of the dynamics involved, a graphic simulation has also been designed For each calculated state in time, a graphic representation of the vehicle can be drawn to provide the basis for a near real-time animation of the vehicle response. Author

A83-38910#
WIND TUNNEL DEMONSTRATION OF AN OPTIMIZED LTA SYSTEM WITH 65 PERCENT POWER REDUCTION AND NEUTRAL STATIC STABILITY
F. R GOLDSCHMIED IN: Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 77-88. refs
(Contract DARPA ORDER 4045-1; N00167-80-M-4800; N00167-81-C-0075)
(AIAA PAPER 83-1981)
A self-propelled wind tunnel model of an axisymmetric airship hull having fully integrated envelope pressure distribution/boundary layer control suction slot/stern jet propulsion/exhaust-immersed empennage design has achieved a 65 percent power reduction by comparison to conventionally powered airships of comparable dimensions and operating speeds Efficient and stable boundary layer control has been found to require a single suction slot at 85 percent length, a Ringloeb cusp at the suction slot's leading edge, and a slender rear tailboom Neutral static stability has also been achieved, with a tail planform area that corresponds to the blimp criterion O C.

A83-38911#
PATTERNING TECHNIQUES FOR INFLATABLE LTA VEHICLES
J. R THIELE (ILC Industries, Inc , Frederica, DE) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 89-93
(AIAA PAPER 83-1983)
This paper is a review of methods for patterning inflatable lighter-than-air envelopes and their relative merits of performance in terms of stress distribution, and shaping Two conventional patterning methods, the gore method and the zone method (conic frustum sections) are examined in detail. In particular, the use of high modulus material like Kevlar is examined and the impact of patterning is evaluated in overall performance Included in this evaluation is an introduction to surface shaping requirements for the maintenance of laminar flow and the patterning necessary to meet those requirements A new method of patterning which optimizes shaping is proposed and examined with respect to its advantages for laminar flow hulls. Author

A83-38914#
A SIX-DEGREE OF FREEDOM HEAVY LIFT AIRSHIP FLIGHT SIMULATION
J D LOWE and J. D. DELAURIER (Toronto, University, Toronto, Canada) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 108-115 Research supported by the Transport Canada and Natural Sciences and Engineering Research Council of Canada refs
(AIAA PAPER 83-1988)
A six-degree of freedom, nonlinear flight simulation developed for classical rigid airships has been extended to study the dynamics of flight of heavy lift airships Mathematical models of the airship's various aerodynamic components are detailed Simulated flight responses of a typical heavy lift airship to various control inputs are presented Author

A83-38917#
FLIGHT TEST OF THE HX-I RADIO-CONTROLLED HYBRID AIRSHIP
D. R. SANDLIN (California Polytechnic State University, San Luis Obispo, CA) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 132-136.
(AIAA PAPER 83-1992)
This paper discusses a controllability study of a radio-controlled hybrid airship Hover, slow speed flight and station keeping capabilities were investigated Two helicopter rotor assemblies were tested, one with collective pitch and the other with cyclic and collective pitch capabilities, with various combinations of a nose and tail thruster The study reveals that a hybrid airship with a collective pitch rotor assembly in combination with a yawing nose and tail thrusters can perform all flight maneuvers and is easy to control A hybrid airship with collective and cyclic pitch rotor assemblies and a yawing tail thruster can also perform all maneuvers and is controllable The yawing tail thruster is a very effective method of controlling yaw and tail position The controllability of the vehicle increases with buoyancy ratio
Author

A83-38918#
RECENT PROGRESS OF LIGHTER-THAN-AIR PROGRAMS IN JAPAN
K. IINUMA and C OHI (Japan Buoyant Flight Association, Tokyo, Japan) IN: Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 137-142
(AIAA PAPER 83-1993)
An account is given of lighter-than-air vehicle developments in Japan since 1979, with attention to the design, construction and testing of the JBFA-1 radio controlled Buoyant Helicopter System (BHS) model This vehicle, employing four helicopters connected to the airship hull by a truss structure, experienced numerous truss breakages due to excessive vibration. New truss structures have been designed and built in response to this problem. O.C.

A83-38919#
TETHERED AEROSTAT OPERATIONS IN ARCTIC WEATHER
A. S CARTEN (USAF, Geophysics Laboratory, Bedford, MA), G H MCPHETRES, and R L. ASHFORD (TCOM Corp , Columbia, MD) IN. Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 143-151
(AIAA PAPER 83-1998)
The Small Tethered Aerostat Relocatable System (STARS) units employed in the North Warning demonstration project in Arctic weather accumulated a total of 831 7 flight hours. Heavy snow

was experienced during two significant winter storms without significant detrimental effect on the aerostat, although icing was frequently encountered and none of the airborne ice removal mechanisms employed proved effective. The use of heated ethylene glycol and scraper boards was, however, effective for snow and ice load removal once the aerostat was moored O C.

A83-38920#

FLIGHT TESTING AND OPERATIONAL DEMONSTRATIONS OF A MODERN NON-RIGID AIRSHIP

N. T. BENNETT and N RAZAVI (Airship Industries, Ltd, London, England) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 152-155

(AIAA PAPER 83-1999)

The 5,131 cu m-volume Skyship 500 nonrigid airship employs such state-of-the-art materials and construction methods as Kevlar-reinforced plastic, and incorporates a novel thrust vectoring propulsion system Attention is presently given to the flight testing which the SKS 500 is undergoing en route to certification according to the British Civil Airworthiness Requirements Section 'Q' The instrumentation employed serves in the determination of control balance, static pressure, and the structural stress and strain of such components as the propellers and drive shafts Performance data are also obtained for thrust vectoring system performance, propeller pitch variation, airship trimming capability, static thrust, cruise duration, takeoff and landing, and maneuverability O C

A83-38922#

DEVELOPMENT OF THE MAGNUS AEROSPACE CORPORATION'S ROTATING-SPHERE AIRSHIP

J D. DELAURIER, W. D MCKINNEY, W L KUNG, G M GREEN, and H S B SCHOLAERT (Toronto, University, Toronto, Canada) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 161-170 refs

(AIAA PAPER 83-2003)

The Magnus Aerospace Corporation's LTA 20-1 is a unique heavy-load aircraft which obtains lift from buoyancy, vectored thrust, and the Magnus effect. The design analysis for this aircraft requires much original derivation and wind-tunnel testing, and it is the purpose of this paper to describe this work. In particular, this involves three distinct, but mutually supporting, activities (1) wind-tunnel tests on rotating spheres with various gondola designs, (2) nonlinear flight-dynamic simulation, (3) analysis of structural loads, weights, and flight performance Author

A83-38923#

THE PRELIMINARY DESIGN OF A VERY LARGE PRESSURE AIRSHIP FOR CIVILIAN AND MILITARY APPLICATIONS

T A BOCKRATH IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 176-184 refs

(AIAA PAPER 83-2005)

The present pressurized semirigid airship, for which nuclear power is considered as a propulsion system option, is 2000 ft in length, 500 ft in diameter, and is designed for a cruise speed of 200 mph at an altitude of 2000 ft, over a 12, 000-mile range The airship can withstand wind shears of over 150 ft/sec at cruise speed, and can withstand a gauge pressure of 6 psi, as a result of the extensive use of Kevlar cable and fabric in its construction Civilian applications of this vehicle include the transport of cargo in standard, 40-foot containers, and of natural gas in internal membrances Military uses range from the transport of either an entire infantry division and up to 50 tanks, to the highly mobile deployment of 24 MX ICBMs housed internally in 300-foot long vertical launch tubes O.C.

A83-38950

ON THE CONCEPTUAL DESIGN OF SUPERSONIC CRUISING AIRCRAFT WITH SUBSONIC WING LEADING EDGES

E TORENBEEK (Delft, Technische Hogeschool, Delft, Netherlands) Delft Progress Report, vol 8, Jan 1983, p. 55-80 refs

Applying results from slender wing and slender body theories, a derivation is given for the overall drag coefficient of supersonic cruising aircraft. Using this simplified computational model, applicable to conceptual designs, the qualitative effects of variations in some major shape parameters and design conditions on the lift/drag (L/D) ratio are discussed. Generalized analytical solutions are presented, resulting in a maximum or optimum L/D ratio, for configurations with discrete wing and fuselage, and for integrated configurations The design variables are wing loading, wing semi-span to length ratio ('box ratio'), fuselage slenderness ratio, and cruise altitude. In addition to the L/D ratio, the mass fraction of fuel and powerplant installation has been used as a figure of merit An example illustrating the differences between the concepts and the sensitivity of the optimum indicates that the drag model, in spite of its simplicity, yields a reasonably accurate approximation Author

A83-39102#

EXHAUST NOZZLE CONCEPTS FOR STOL TACTICAL AIRCRAFT

S. G CURRY (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH), G R BARNES (Rolls-Royce, Inc, Atlanta, GA), T J JONES (Rolls-Royce, Ltd, Bristol, England), and W R HARTILL (Rockwell International Corp, Los Angeles, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983. 10 p

(AIAA PAPER 83-1226)

The four concepts studied are the aero balanced deflected thrust concept, the vectored fan thrust concept, the vectored total thrust concept, and the jet balanced deflected thrust concept It is found that STOL tactical aircraft can be configured to meet the same mission requirements as conventional takeoff and landing aircraft with only a 2 percent increase in life cycle cost and a 3 percent increase in take-off gross weight The aircraft configurations considered here all meet the field length targets, with landing found to be the critical regime. All the aircraft are capable of meeting the takeoff and maneuver requirements without thrust vectoring Improvements beyond the mission performance achieved within this study are therefore considered possible The side nozzle configurations give the shortest landing ground rolls, with vectoring fan thrust aircraft showing the best compromise with low wave drag, weight, and life cycle cost. The vectored total thrust configuration achieves the shortest ground rolls, and since its thrust-to-weight ratio is greater than one, STOVL (short takeoff and vertical landing) or VTOL (vertical takeoff and landing) performance is considered possible with the addition of reaction controls C.R

A83-39485

THE DYNAMICS OF A HELICOPTER ROTOR STRUCTURE [DINAMIKA KONSTRUKTSII NESUSHCHEGO VINTA VERTOLETA]

I F OBRAZTSOV and A S VOLMIR Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol 270, no 4, 1983, p 835, 836. In Russian refs

Two methods were compared in terms of the effectiveness with which they can analyze the dynamic characteristics (especially the frequencies and modes of natural vibrations) of helicopter rotors the conventional finite-element method and the method of multilevel superelements Natural frequencies were determined for bending and torsional vibrations for various rotation velocities The superelement method is found to be superior to the conventinal FEM in that it results in a considerable saving of computer time while determining vibration frequencies and modes with accuracy comparable to that of the conventional method. B.J.

A83-39802

THE THEORETICAL ADVANTAGES AND PRACTICAL CONSIDERATIONS OF GAS REPLENISHMENT TECHNIQUES IN LONG-DURATION SCIENTIFIC BALLOONING

A S CARTEN, JR (USAF, Geophysics Laboratory, Bedford, MA) and C F SINDT (National Bureau of Standards, Thermophysical Properties Div , Boulder, CO) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no. 6, 1983, p. 5-18 refs

(AD-A129841; AFGL-TR-83-0154)

The weight of the expendable ballast used on long duration scientific research balloon flights to compensate for daily lift loss typically approaches or even exceeds the weight of the balloon and payload. Attention is presently given to a technique of gas replenishment which replaces lost He inflatant from an onboard dewar, and the design problems associated with the dewars and heat exchangers required are discussed. Net load, dewar weight and He quantity curves are plotted for specific balloons and float altitudes as a function of daily loss rate O C

A83-39803

THE RADIATION CONTROLLED BALLOON (RACOON)

V. E LALLY (National Center for Atmospheric Research, Boulder, CO) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol. 3, no 6, 1983, p 19-24.

The RACOON concept permits the flight of large, low-cost polyethylene balloons for several weeks at stratospheric altitudes without ballast. The theory of operations is described The RACOON balloon ascends each morning and descends at night. This movement of 15 to 20 km in altitude provides an ideal platform for vertical soundings and sampling measurements in the stratosphere Results of a number of globe-circling flights are presented. Author

A83-39804

AN ATMOSPHERIC SOUNDING BALLOON WITH BALLAST - AN AUTOMATIC NUMERICAL MODEL FOR ITS MANUFACTURE AND SIMULATION OF ITS EVOLUTION [BALLON DE SONDAGE D'ATMOSPHERE ADELESTAGE - AUTOMATIQUE MODELES DE CALCUL POUR SA REALISATION ET LA SIMULATION DE SON EVOLUTION]

R REGIPA (Centre National d'Etudes Spatiales, Division Balloons, Toulouse, France) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p. 25-28 In French

A numerical model has been developed to characterize the dynamical behavior and dimensioning, as well as material stresses and performance, of an atmospheric sounding balloon equipped with a ballast nacelle The balloon is equipped with an interpolar link (IPL) between the upper tip of the balloon and the ballast nacelle dangling from the bottom, with the wire fixed to the outside of the balloon. Loss of volume of the balloon creates tension on the IPL, which signals the ballast mechanism to release weight, thereby allowing the balloon to maintain a relatively constant altitude. The balloon was modelled by means of the finite element method, taking into account the shape of the balloon and the stresses upon it, the sum of the masses of the balloon equipment and the payload, and the changes in the balloon shape during flight M.S.K

A83-39805

NEW SYSTEMS FOR EXTENDING THE USEFUL FLOAT DURATION OF STANDARD ZERO-PRESSURE BALLOON FLIGHTS

S HOLDER and D RAMSDEN (Southampton, University, Southampton, England) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p. 29-32 refs

Attention is given to a model payload which has been devised for the testing of a cryogenic gas replenishment system, and to the details of a telecommunications relay which can receive the complex L-band video transmissions from a scientific balloon at a range of 1200 km. The combination of the techniques presented should permit longer flights with heavy scientific payloads. The cryogenic gas replenishment system should allow experiments typically weighing 500 kg to be maintained above 3 mb for 8-10 days O C.

A83-39806

BALLOON MATERIALS AND DESIGNS

J. R NELSON and S. E BORGERSEN (Winzen International, Inc , Bloomington, MN) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no. 6, 1983, p 33-43. refs

Novel materials applicable to the construction of superpressure balloons can result in mission duration extension, weight reduction in sounding balloons, and a launch technique that minimizes relative wind problems, in addition to general improvements in payload weight and altitude attained Attention is given to StratoFilm, Nylon 12 and SFX-370, which are compared with respect to relative tensile biaxial strength, high elongation, tear and abrasion resistance, cold temperature ductility, thinness, low radiation absorptivity/emissivity ratio, and low permeability to helium and hydrogen. O C.

A83-39808

INSTANTANEOUS, PREDICTABLE BALLOON SYSTEM DESCENT FROM HIGH ALTITUDE

K HAZLEWOOD (National Scientific Balloon Facility, Palestine, TX) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p. 49-51 refs

The 13 in. diameter helium valve has long been the only method for initiating and controlling balloon system descent. As greater altitudes have become standard, the 13 in valves have become less and less effective It takes as long as a half hour or more to effect a noticeable descent, even with two or three valves, at altitudes in excess of 120,000 ft. The project that prompted this study called for a descent rate of more than 1000 ft/min from 131,000 ft to 60,000 ft The method by which this was accomplished is presented along with recommendations for future work to provide closer control of rapid descents Author

A83-39811

RELAY BALLOON

J. NISHIMURA, H HIROSAWA, O OHTA, H. AKIYAMA, and T YAMAGAMI (Tokyo, University, Tokyo, Japan) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p 67-70.

A relay balloon system for long-duration or large-area observations is described. The system consists of a balloon for scientific observations and a relay balloon for a data-relay terminal between a ground station and the balloon for observation The system was successfully applied to the observation of electrically charged fields (50 and 60 Hz) over the Pacific ocean The maximum distance between two balloons was about 1100 km and that between the Sanriku Balloon Center and the main balloon for the observation was about 1300 km. Author

A83-39817

PRESENT STATUS AND NEW TRENDS IN SCIENTIFIC BALLOONING IN INDIA

S. V DAMLE, G. S. GOKHALE, and R T. REDKAR (Tata Institute of Fundamental Research, Bombay, India) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p 101-104 refs

The efforts in scientific ballooning in India have always been focussed towards continuous upgrading of capabilities in all aspects of balloon flights - balloon material, balloon fabrication, launch techniques, heavy payload launch, telemetry, telecommand and other ground facilities - to meet the growing demands of the scientific community A brief account of recent progress in several of these aspects and future plans for further improvements in scientific ballooning capability is presented Author

A83-39818* Aerospace Corp , Los Angeles, Calif

ELECTRODYNAMICS OF THE STRATOSPHERE USING 5000 CU M SUPERPRESSURE BALLOONS

R H HOLZWORTH (Aerospace Corp., Space Sciences Laboratory, Los Angeles, CA) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p 107-114 NASA-supported research. refs

(Contract NSF ATM-80-17071)

The Electrodynamics of the Middle Atmosphere research project encompasses the design of a microprocessor-controlled payload and the launch of up to eight small superpressure balloons in the 1982-1984 period The primary payload instrument will measure the vector electric field from dc to 10 kHz, and the payloads will include instruments measuring local ionization, electrical conductivity, magnetic field, and temperature and pressure fluctuations In addition, optical lightning will be recorded The simultaneous measurement of these stratospheric parameters by several balloons, for periods extending over several solar rotations, will allow the study of electrical coupling between atmosphere and magnetosphere, of global current systems, and of global response to solar flares and magnetospheric storms O.C.

A83-40244

HYBRID COMPOSITE APPLICATION TO THE BOEING 767 WING/BODY FAIRING

H. NEMOTO (Fuji Heavy Industries, Ltd., Aircraft Engineering Div., Tochigi, Japan) IN Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 2 . Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p 1177-1184

The features of the composite doors and fairing panels on the 767 are described The parts were manufactured from Kevlar/graphite epoxy hybrid composite face sheets and Nomex honeycomb core sandwich panels, and represent a 30 percent weight savings over fiber glass materials It was found necessary to raise the resin content of the prepregs and use the self-adhesive resin of the Kevlar for the graphite face sheets in order to satisfy mechanical strength requirements A tedlar film co-cured on the inner surface of the panels provided a moisture barrier Ultrasonic inspection was selected for detecting internal delaminations and voids of the panels and were directed in a pulse echo mode when examining thicker sheets, like the main landing gear door, and in a low frequency mode for the thinner face sheets. M S K.

A83-40287

NEW INSIGHTS IN STRUCTURAL DESIGN OF COMPOSITE ROTOR BLADES FOR HELICOPTERS

F H IMMEN and R. L FOYE (U.S Army, Research and Technology Laboratories, Moffett Field, CA) IN· Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 2 Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p. 1673-1684

About 50 all-composite helicopter main rotor blades have been designed to date More than 15 of these have reached either limited or full production status Eight others are approaching production This paper reviews the different design concepts and materials that have been applied to many of these blades Various design solutions to the problems of root end and drag link attachments, spar and blade transition sections, and tip weight and tip cap attachments are described Blade fabrication methods are reviewed. Methods of analyzing the problem areas are described Finally, the service experience with US military blades made from composites is summarized with comments on present and future trends in the technology. Author

A83-40291

DESIGN, MANUFACTURE AND TEST OF GRAPHITE COMPOSITE WING BOX TEST STRUCTURE

K G WANGBERG (Saab-Scania AB, Aerospace Div , Linkoping, Sweden) IN: Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 2 Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p 1715-1722

Static and fatigue tests of a box structure designed to simulate the performance criteria of a high-performance lightweight fighter-aircraft wet wing are reported The box is constructed of five spars, an intermediate rib, and 20-ply laminate covers (all made of graphite-epoxy tape material) attached to steel end ribs Cover loads are transferred to steel fittings with steel bolts The optimization of design details and the manufacturing processes involved are described. The tests included static bending and torsion to the design limit load (DLL), simulation of 6000 flight hours of fatigue at 70 C and 60 kPa internal pressure, static bending and torsion to 1 8 DLL, 30-150-kPa pulsating pressure for 200,000 cycles at 70 C, static pressure loading to 200 kPa, and static loading in torsion to failure It was found that bending and torsional stiffness were unaffected by 60-kPa pressure at 70 C or by the fatigue testing, no damage was detected before failure, which began at 2 DLL and was final at 2.47 DLL These results are seen as justifying further development of graphite-composite wing designs. T K.

A83-40305#

VERTICAL SEEKING EJECTION SEAT BOOSTS PILOTS ODDS

B FRISCH and V. WIGOTSKY Astronautics and Aeronautics (ISSN 0004-6213), vol. 21, July-Aug 1983, p 28, 29.

Design and performance features of the maximum performance ejection seat (MPES) intended to reorient ejecting pilots down to 50 ft from the ground and fly them to a height where their parachute will open are presented The seat is equipped with a rocket motor controlled by a microwave vertical seeking antenna array and servocontrolled actuators The four planar spiral antennas measure the difference in microwave radiation temperature from the earth and sky at 15 GHz Departures from the vertical result in error signals that are processed and directed to pitch and roll actuator servos that steer the gimballed rocket beneath the seat. The seat equipment operates independently from the aircraft avionics, and includes a primary Ni-Cd battery with a thermal battery as back-up The addition of a yaw system would possibly avoid flail injuries to ejecting crewmembers M S K

A83-40621
F-16XL - GD HATCHES A NEW FALCON
B SWEETMAN Interavia (ISSN 0020-5168), vol 38, July 1983, p 747, 748

Design and performance features of the F-16XL fighter aircraft are explored, noting the performance improvements achieved with the same engine and few systems changes from the F-16 The fineness ratio has been upgraded and ground clearance has been increased by angling the longer fuselage upward 3 deg, thus putting the thrust line below the center of gravity The XL wing has a carbon fiber/polyamide skin with an aluminum substructure, and the entire aircraft can withstand g-forces up to 9. The XL wing has a sharply swept inner section and a less swept outer section, a thin profile, a sharp leading edge, two trailing edge surfaces, and extra ailerons The wing roots shed vortices and reduce drag and increase lift at high angles of attack M S K.

A83-40622
JVX - THE WORLD'S FIRST PRODUCTION TILT-ROTOR?
M LAMBERT Interavia (ISSN 0020-5168), vol 38, July 1983, p 755-757.

Performance, design, and mission objective for the JVX tilt-rotor aircraft are explored The aircraft is being designed and developed as a cooperative effort between Bell and Boeing under government contract Although mainly intended for use by the U S. Marines, all the military branches will have access to the aircraft, with operational status projected for 1991 Although the JVX has a shorter range and payload capability than comparably sized fixed wing aircraft, its ability to land vertically on shipboard compensates for other deficiencies. Using T64 engines, the JVX will have 9540 hp at sea level and a gross weight in short takeoffs of 25 t Forward speeds will be 100 mph in the horizontal mode All controls will be digitized and connected to five powered control actuators M S K.

A83-40665
US FIGHTER OPTIONS
G WARWICK Flight International (ISSN 0015-3710), vol 124, July 16, 1983, p 139, 140, 145, 146

Development programs underway to modify the USAF F-15 Eagle and F-16 Fighting Falcon aircraft in the 1990's (as an alternative or complement to a new advanced tactical fighter) are discussed. The beyond-visual-range defenses of both aircraft will be improved by installing the AIM-120 Amraam medium-range air-to-air missile and appropriate advanced radar systems, plus the Lantirn low-altitude navigation and targeting system (employing forward-looking IR sensors, laser rangefinder-designators, and terrain-following radar) on the F-16 Some aircraft will be fitted to perform both long-range air defense and all-weather air-to-ground attack missions. A larger version of the F-16, the F-16XL, is now being tested in one and two-seat configurations; it carries 82 percent more internal fuel and can deliver twice the payload to a 45-percent greater combat radius at 100-kt greater speed than the F-16A. Existing F-15 aircraft may also be upgraded by adding integrated flight and fire control, coupled in some cases with 2D thrust-vectoring nozzles for STOL capability T.K.

N83-27975* National Aeronautics and Space Administration. Hugh L Dryden Flight Research Center, Edwards, Calif
ADAPTER FOR MOUNTING A MICROPHONE FLUSH WITH THE EXTERNAL SURFACE OF THE SKIN OF A PRESSURIZED AIRCRAFT Patent
R B COHN, inventor (to NASA) 14 Jun. 1983 6 p Filed 14 Dec 1981 Supersedes N82-24474 (20 - 15, p 2086)
(NASA-CASE-FRC-11072-1, US-PATENT-4,388,502; US-PATENT-APPL-SN-230613; US-PATENT-CASE-179-179; US-PATENT-CASE-179-146-R, US-PATENT-CASE-367-906) Avail US Patent and Trademark Office CSCL 01C

A mounting device for securing a microphone pick up head flush with respect to the external surfaces of the skin of an aircraft for detecting shock waves passing thereover is described. The mount includes a sleeve mounted internally of the aircraft for capturing and supporting an electronics package having the microphone pick up head attached thereto in a manner such that the head is flush with the external surface of the aircraft skin and a pressure seal is established between the internal and external surfaces of the aircraft skin.
Official Gazette of the U S Patent and Trademark Office

N83-27976# Virginia Univ, Charlottesville School of Engineering and Applied Science.
OPTIMAL PASSIVE FREQUENCY RESPONSE CONTROL OF HELICOPTERS BY ADDED STRUCTURES
L. KITIS, W. D. PILKEY, and B. P WANG Jul 1982 25 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Aircraft in Sep 1983 Sponsored by ARO
Avail NTIS HC A02/MF A01

Two frequency response optimization methods for helicopters are developed by appending absorbers to the helicopter fuselage The methods are suitable for discrete models with a large number of degrees of freedom and are applied to obtain optimal broadband response Reanalysis and modal techniques are used in the structural dynamic analysis phase of the design algorithm and optimization is carried out by a feasible directions approach The optimal design algorithm is illustrated by several numerical examples using a 39 DOF helicopter model with discrete conventional absorbers and beam absorbers Author

N83-27977*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.
A CONCEPTUAL FRAMEWORK FOR USING DOPPLER RADAR ACQUIRED ATMOSPHERIC DATA FOR FLIGHT SIMULATION
W CAMPBELL Jun 1983 16 p refs
(NASA-TP-2192; NAS 1.60 2192) Avail NTIS HC A02/MF A01 CSCL 01C

A concept is presented which can permit turbulence simulation in the vicinity of microbursts The method involves a large data base, but should be fast enough for use with flight simulators The model permits any pilot to simulate any flight maneuver in any aircraft The model simulates a wind field with three-component mean winds and three-component turbulent gusts, and gust variation over the body of an aircraft so that all aerodynamic loads and moments can be calculated. The time and space variation of mean winds and turbulent intensities associated with a particular atmospheric phenomenon such as a microburst is used in the model In fact, Doppler radar data such as provided by JAWS is uniquely suited for use with the proposed model The concept is completely general and is not restricted to microburst studies. Reentry and flight in terrestrial or planetary atmospheres could be realistically simulated if supporting data of sufficient resolution were available Author

N83-27978*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
UNMANNED VEHICLE SYSTEMS EXPERIENCES AT THE DRYDEN FLIGHT RESEARCH FACILITY Final Report
T W REZEK Jun 1983 22 p refs Presented at the AUVS-83 Symp. Unmanned Systems: Confidence for the 80's, Salt Lake City, 28-30 Jun. 1983
(NASA-TM-84913, H-1192; NAS 1.15 84913) Avail NTIS HC A02/MF A01 CSCL 01C

An overview is presented of the remotely piloted research vehicle (RPRV) activities at the NASA Dryden Flight Research Facility from their beginning to the present The development of RPRV's as flight test tools is discussed, and system configuration is presented. Solutions derived from human factors experience related to flight activities and pilot responses have contributed to overall system capability. The development and use of visual displays, which are a critical feature of successful RPRV flights, are discussed as well as directions for future RPRV efforts
Author

N83-27979*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
FACTORS INFLUENCING AIRCRAFT GROUND HANDLING PERFORMANCE
T. J YAGER Jun 1983 32 p refs
(NASA-TM-85652; NAS 1 15 85652) Avail NTIS HC A03/MF A01 CSCL 01C

Problems associated with aircraft ground handling operations on wet runways are discussed and major factors which influence tire/runway braking and cornering traction capability are identified including runway characteristics, tire hydroplaning, brake system anomalies, and pilot inputs Research results from tests with instrumented ground vehicles and aircraft, and aircraft wet runway accident investigation are summarized to indicate the effects of different aircraft, tire, and runway parameters Several promising means are described for improving tire/runway water drainage capability, brake system efficiency, and pilot training to help optimize aircraft traction performance on wet runways S L.

N83-27980*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
STRUCTURAL RESPONSE OF TRANSPORT AIRPLANES IN CRASH SITUATIONS
R G. THOMSON and C CAIAFA (FAA Technical Center, Atlantic City) Jun 1983 99 p refs
(NASA-TM-85654; NAS 1 15 85654) Avail NTIS HC A05/MF A01 CSCL 01C

This report highlights the results of contractural studies of transport accident data undertaken in a joint research program sponsored by the FAA and NASA From these accident data studies it was concluded that the greatest potential for improved transport crashworthiness is in the reduction of fire related fatalities Accident data pertaining to fuselage integrity, main landing gear collapse, fuel tank rupture, wing breaks, tearing of tank lower surfaces, and engine pod scrubbing are discussed In those accidents where the energy absorbing protective capability of the fuselage structure is expended and the airplane experiences major structural damage, trauma caused fatalities are also discussed. The dynamic performance of current seat/restraint systems are examined but it is concluded that the accident data does not adequately define the relationship between occupant response and the dynamic interaction with the seat, floor and fuselage structure Author

N83-27981# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate
HELICOPTER PERFORMANCE COMPUTER PROGRAMS Final Report
D KOBUS and S. WOODS 30 Jan. 1982 115 p refs
(AD-A124603) Avail: NTIS HC A06/MF A01 CSCL 09B

Document describes helicopter performance computer programs which are capable of analyzing the flight performance of typical helicopter configurations Areas of flight performance include specific excess power, sustained and instantaneous turn rate, and maneuver capability Performance output can be displayed graphically as well as numerically These programs were written in FORTRAN and use three supporting subroutines This report describes the analytical development and logic development for the programs. In addition, it includes a user description and complete listing GRA

N83-27982# Dayton Univ, Ohio Research Inst
AUTOMATED DESIGN OF DAMAGE RESISTANT STRUCTURES. VOLUME 1: THEORY AND APPLICATION Final Report, 1 Jun. 1979 - 30 Apr. 1982
R F. TAYLOR Wright-Patterson AFB, Ohio AFWAL Oct. 1982 147 p refs
(Contract F33615-79-C-3209; AF PROJ. 2401)
(AD-A125731, AFWAL-TR-82-3087-VOL-1) Avail NTIS HC A07/MF A01 CSCL 01C

This report documents an effort to develop an optimality criterion approach to the design of damage tolerant structures subject to stress, deflection, and frequency requirements Damage conditions are treated in an integral manner in the resizing algorithm. An iterative reanalysis procedure is used to improve the efficiency of the static analyses that are needed as the optimization proceeds In this volume of the report, the theoretical development is given together with applications to representative structures Detailed applications include the development of designs for a metal and a composite A7D outer wing panel Volume 2 of the report gives user information on the computer program used in these applications. GRA

N83-27983# Dayton Univ, Ohio
AUTOMATED DESIGN OF DAMAGE RESISTANT STRUCTURES. VOLUME 2: PROGRAM USER'S MANUAL Final Report, 1 Jun. 1979 - 30 Apr. 1982
R F TAYLOR Wright-Patterson AFB, Ohio AFWAL Oct 1982 200 p refs
(Contract F33615-79-C-3209; AF PROJ 2401)
(AD-A125732, AFWAL-TR-82-3087-VOL-2) Avail NTIS HC A09/MF A01 CSCL 01C

This report documents an effort to develop an optimality criterion approach to the design of damage tolerant structures subject to stress, deflection, and frequency requirements Damage conditions are treated in an integral manner in the resizing algorithm An iterative reanalysis procedure is used to improve the efficiency of the static analyses that are needed as the optimization proceeds In this volume of the report, input instructions to the computer code ADDRESS (Automated Design of the Damage Resistant Structures) are detailed Further information is included which shows the required control card sequence, the program structures, and subroutine descriptions. The program is operational on the CDC CYBER system at Wright-Patterson Air Force Base. GRA

N83-27984# Naval Postgraduate School, Monterey, Calif
EFFECTS OF WIND ON THE AIRCRAFT OPTIMUM CRUISE PERFORMANCE AND FLIGHT PERFORMANCE ADVISORY SYSTEMS FOR F-4E AND F-5E AIRCRAFT M.S. Thesis
J. LEE Jun. 1982 232 p refs
(AD-A125587, NPS67-82-006) Avail NTIS HC A11/MF A01 CSCL 09B

One of several fuel-saving operational concepts being investigated is the application of state-of-the-art hand-held calculators to serve as Flight Performance Advisory Systems (FPAS). The principal function of a FPAS is to advise the pilot, based on the aircraft drag configuration, and gross weight, of the optimum flight performance parameters such as altitude and airspeed The research reported herein is the development of the mathematical relationships for the effects of the wind on the aircraft optimum cruise performance This thesis also describes the operating procedure of a Hewlett-Packard HP-41CV hand-held calculator programmed to serve as an F-4E and F-5E Flight Performance Advisory System The objective of the FPAS is to recommend optimal flight profiles to achieve maximum fuel conservation Because of the constraints imposed by HP-41CV memory size, the F-4E FPAS is comprised of three programs, and the F-5E is comprised of a single program. GRA

N83-27985# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
FUEL CONSERVATION EVALUATION OF US ARMY HELICOPTERS. PART 3: UH-1H FLIGHT TESTING Final Report, Feb. - Mar. 1981
F. STELLAR, D I. UNDERWOOD, and F DOMINICK Aug. 1982 84 p refs
(AD-A125667; USAAEFA-81-01-3) Avail NTIS HC A05/MF A01 CSCL 21D

The United States Army Aviation Engineering Flight Activity conducted level flight performance tests of the UH-1H helicopter to provide data to determine the most fuel efficient operating characteristics Hot and cold weather test sites were used to extend the advancing tip Mach number data range to supplement existing YUH-1H performance data. Based on preliminary analysis, range can be increased significantly at optimum altitude and rotor speed compared to sea level and normal rotor speed (324 RPM) Rotor compressibility effects were significant at all test conditions GRA

N83-27986# Georgia Inst of Tech, Atlanta Lab for Electromagnetics.
FLIGHT AND SIMULATION TEST ANALYSIS SYSTEM Final Report, 8 Feb. - 31 Aug. 1982
R. N SEITZ Jan. 1983 42 p refs
(Contract DAAH01-81-D-A003)
(AD-A125614, AD-E950357, DRSMI/RD-CR-83-7, GIT/EES-A-3167-001) Avail. NTIS HC A03/MF A01 CSCL 09B

The goal of this study was to propose an equipment configuration for the Flight and Simulation Test Analysis System based on potential users needs, and to conduct compatibility studies between various models of the proposed equipment. The Flight and Simulation Test Analysis System is intended to be a data analysis facility to improve engineering productivity by assimilating data from either flight tests or flight simulations and then analyzing and plotting the data for the engineering staff at interactive terminals. Author (GRA)

N83-27987# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
UH-60A LIGHT ICING ENVELOPE EVALUATION WITH THE BLADE DEICING KIT INSTALLED BUT INOPERATIVE Final Report, 29 Jan. - 1 Apr. 1982
R D. ROBBINS and V I DIEKMANN Jun 1982 59 p refs
(AD-A125630, USAAEFA-81-18) Avail NTIS HC A04/MF A01 CSCL 01C

Artificial and natural icing flight tests were conducted on the UH-60A Black Hawk helicopter to verify the existence of a light icing envelope. Testing consisted of 9 0 productive flight hours in the icing environment The aircraft handling qualities and vibration levels were acceptable throughout the limited artificial and natural icing conditions tested The UH-60A demonstrated safe operation in light icing conditions up to and including 0.3 gm/m3 LWC without operating the blade deice system However, the potential for aircraft damage exists in icing conditions greater than 0.3 gm/m3 Three deficiencies were identified including aircraft damage from rotor system ice sheds, improper droop stop positions during shutdown, and failure of the blade deice electrical protection system to protect the blades against a heater element short circuit. GRA

N83-29197*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
PIEZOELECTRIC DEICING DEVICE Patent Application
R C FINK and B A BANKS, inventors (to NASA) 25 Feb. 1983 10 p
(NASA-CASE-LEW-13773-1, US-PATENT-APPL-SN-469867) Avail· NTIS HC A02/MF A01 CSCL 01C

A fast voltage pulse is applied to a transducer which comprises a composite of multiple layers of alternately polarized piezoelectric material. These layers are bonded together and positioned over the curved leading edge of an aircraft wing structure Each layer is relatively thin and metallized on both sides. The strain produced in the transducer causes the composite to push forward resulting in detachment and breakup of ice on the leading edge of the aircraft wing. NASA

N83-29198*# McDonnell Aircraft Co, St Louis, Mo
SUBSONIC PANEL METHOD FOR DESIGNING WING SURFACES FROM PRESSURE DISTRIBUTION Final Report
D R BRISTOW and J. D. HAWK Washington NASA Jul 1983 56 p refs
(Contract NAS1-16156)
(NASA-CR-3713; NAS 1.26 3713) Avail· NTIS HC A04/MF A01 CSCL 01C

An iterative method has been developed for designing wing section contours corresponding to a prescribed subcritical distribution of pressure The calculations are initialized by using a surface panel method to analyze a baseline wing or wing-fuselage configuration. A first-order expansion to the baseline panel method equations is then used to calculate a matrix containing the partial derivative of potential at each control point with respect to each unknown geometry parameter In every iteration cycle, the matrix is used both to calculate the geometry perturbation and to analyze the perturbed geometry The distribution of potential on the perturbed gometry is established by simple linear extrapolation from the baseline solution. The extrapolated potential is converted to pressure by Bernoulli's equation Not only is the accuracy of the approach good for very large perturbations, but the computing cost of each complete iteration cycle is substantially less than one analysis solution by a conventional panel method. B.W

N83-29199# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
AIRWORTHINESS AND FLIGHT CHARACTERISTICS TEST (A&FC) OF AH-1S WITH AIRCRAFT GENERAL PURPOSE DISPENSER SYSTEM (AGPDS) Final Report, 12 May - 16 Jun. 1982
J. L. WEBRE and J. D. OTTOMEYER Aug. 1982 53 p
(AD-A125978, USAAEFA-82-01) Avail NTIS HC A04/MF A01 CSCL 01C

The United States Army Aviation Engineering Flight Activity conducted an Airworthiness and Flight Characteristics Tests (A&FC) of a production AH-1S equipped with an M130 Aircraft General Purpose Dispenser System (AGPDS) The A&FC consisted of limited performance and handling qualities tests and was conducted from 12 May through 16 June 1982 at Edwards AFB, California The tests were conducted to obtain performance and handling qualities data for inclusion in the operator's manual Installation of the M130 AGPDS on the AH-1S caused negligible effect on power required for level flight No significant changes in handling qualities were found as a result of the M130 AGPDS. GRA

N83-29200# McDonnell Aircraft Co, St Louis, Mo. Aerodynamics Dept
V/STOL FOUNTAIN FORCE COEFFICIENT Final Report
L. W GLAZE, D R. BRISTOW, and D. R. KOTANSKY Jan 1983 66 p refs
(Contract N62269-81-C-0717, WR02302000)
(AD-A126261, NADC-81106-60) Avail. NTIS HC A04/MF A01 CSCL 01C

The McDonnell Aircraft Company (MCAIR) V/STOL force and moment methodology was applied to a two-jet, a three-jet and four-jet V/STOL aircraft in hover in ground effect to determine the fraction (Lambda) of the impinging fountain momentum flux transferred to the airframe as a fountain impingement force The use of potential flow panel methods was verified for the calculation of suckdown forces on V/STOL aircraft in hover, provided the jet entrainment effects are accurately modeled In addition, an empirical two-jet fountain upwash momentum flux distribution was established for use in predicting the magnitude of the impinging fountain momentum flux Using the MCAIR methodology, the suckdown force and the total momentum flux incident upon the aircraft were calculated, and the results were compared with experimentally measured induced lift to determine lambda for each aircraft at several heights above ground. The mass entrainment rates associated with an axisymmetric free jet were quantified in an experimental program based upon a new, indirect technique of entrainment measurement In this new technique, the induced radial velocity field surrounding the free jet was measured using a hot film anemometer Inverse potential flow theory was then applied to convert the measured radial velocities to free jet mass entrainment rates. GRA

N83-29201# Army Aviation Engineering Flight Activity, Edwards AFB, Calif Development and Qualification Directorate

VALIDATION FLIGHT TEST OF UH-60A FOR ROTORCRAFT SYSTEMS INTEGRATION SIMULATOR (RSIS) Final Report, 28 Jul. - 6 May 1982

W Y ABBOTT, J O BENSCH, R G. OLIVER, and R A WILLIAMS Sep. 1982 28 p refs

(Contract DA PROJ 1L1-62209-AH-76)

(AD-A125428, USAAEFA-79-24) Avail NTIS HC A03/MF A01 CSCL 01C

The United States Army Aviation Engineering Flight Activity (USAAEFA) conducted flight tests of the UH-60A helicopter for the Aeromechanics Laboratory (AL) of the US Army Aviation Research and Technology Laboratories to obtain data for validation of a simulator. A test program of sixty-nine flights totaling 97 4 tests hours was flown to provide AL with extensive handling qualities data. In addition to standard handling qualities tests, special system identification maneuvers were flown. Summary results of those tests are contained in this report Author (GRA)

N83-29202# General Accounting Office, Washington, D. C Mission Analysis and Acquisition Div

ARMY HELICOPTER IMPROVEMENT PROGRAM'S FUTURE MAY DEPEND ON SUCCESS IN CONTROLLING COST Report to the Congress

26 Jan 1983 19 p

(PB83-168187, GAO/MASAD-83-2, B-209125) Avail NTIS HC A02/MF A01 CSCL 01C

In less than 3 years, costs of the program to improve the Army's scout helicopter have gone from an initial estimate of $1 3 billion to $2 7 billion The latest estimate would permit procuring only 578 helicopters instead of the original 720 Additional cost increases can be anticipated Since the helicopter's configuration was not fully defined when the initial cost estimate was prepared, Defense officials maintain that the initial estimate should not be given too much credence The Government Accounting Office considers the initial cost estimate, which prompted congressional approval, particularly significant given the repeated congressional objections to the high cost of earlier scout helicopter starts The Army's ability to contain further cost growth will likely determine the program's future. Author (GRA)

N83-29203# Intermountain Forest and Range Experiment Station, Ogden, Utah

MEASUREMENTS OF AIRTANKER DROP CONDITIONS DURING FIREFIGHTING OPERATIONS

C W GEORGE Dec. 1982 14 p

(PB83-157883; FSRP-INT-299) Avail NTIS HC A02/MF A01 CSCL 01C

Operational parameters for an S2F airtanker were monitored on a series of wildland fires to verify previous assumptions concerning typical flight envelopes Results confirmed the validity of the procedure and instrumentation used in obtaining real time aircraft drop height, speed, drop configuration, release sequence, and other related data In flight, measurements support general assumptions made during previous studies dealing with delivery systems, retardant properties, and in the development of guidelines derived therefrom Author (GRA)

06

AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments

A83-37061*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif

HIMAT ONBOARD FLIGHT COMPUTER SYSTEM ARCHITECTURE AND QUALIFICATION

A F. MYERS, M R. EARLS (NASA, Flight Research Center, Edwards, CA), and L A CALLIZO (Rockwell International Corp, Los Angeles, CA) (Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers, p 41-54) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol 6, July-Aug 1983, p 231-238

Previously cited in issue 01, p 12, Accession no. A82-10082

A83-37820

INTEGRATION PRODUCES SMALL KU-BAND ALTIMETER

L D CLOUGH, D E. LLOYD, J. C PARKER, and W RICHMOND (Royal Signals and Radar Establishment, Malvern, Worcs, England) Microwaves & RF (ISSN 0745-2993), vol 22, July 1983, p 79, 80

Thick film microstrip and hybrid techniques have been applied to the design of a small, lightweight radar altimeter, operating in the mid-Ku band, which provides altitude information down to a zero reading Because the component substrates all lie in a single plane, a one-piece device which measures only 300 x 90 x 60 mm and weighs less than 1 km has been achieved The two system antennas are mounted in line on the altimeter, and require beam widths of 30-40 deg in both the E and H planes to allow for the pitching and rolling of the system in which the altimeter is used O C

A83-37858#

ALPHA JET - FURTHER VERSION FOR THE INTERNATIONAL MARKET

Dornier-Post (English Edition) (ISSN 0012-5563), no 2, 1983, p 31-33

The MS 2 version of the French-German Alpha Jet military trainer aircraft is presented The MS 2 Alpha Jet is equipped with navigation and weapons control system almost identical to that of the Mirage F 1E, Mirage 50 and Mirage 2000 aircraft, enabling it to be used as both an advanced jet trainer and a combat aircraft The navigation and weapons control system is based in the Sagem ULISS 81 inertial navigation system, combining functions of an inertial navigation system with the computation of weapons delivery data Also included are a head-up display, options for six different types of weapons delivery in the air-to-ground mode, a laser rangefinder and a radar altimeter A.L W

A83-37959

DC-9 SUPER 80 DIGITAL FLIGHT GUIDANCE SYSTEM INTEGRATED SYSTEM TESTING

A M. BROWN (Douglas Aircraft Co, Long Beach, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 7 p

(SAE PAPER 821364)

The DC-9 Super 80 Digital Flight Guidance System incorporates continuous system monitoring, inflight failure logging, and extensive test capability both for troubleshooting problems and for verifying the system operational status after maintenance action This paper will discuss the evolution of Built In Test Equipment, its implementation and use in the DC-9 Super 80, some problems encountered in developing such a system, and speculation as to how system testing will be improved on future aircraft Author

A83-39807*

BALLOON FILM STRAIN MEASUREMENT

J L. RAND (Southwest Research Institute, San Antonio, TX) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol. 3, no. 6, 1983, p. 45-48
(Contract NAS6-3077)

A discussion is presented of the results of a flight test program in which scientific research balloon material strain was measured in order to determine stress levels Attention is given to material strain characteristics during the inflation, launch, ascent, and flight of a natural shape, zero-pressure scientific balloon Measurements were conducted with a simple thin film strain transducer Thermal, meridional and circumferential strain history data for the test flight are given O.C

A83-39809

AUTOMATIC CONTROL OF BALLOON ALTITUDE

M FUJII, Y. KOMA, Y OKABE, S. OHTA, J. NISHIMURA, and H HIROSAWA (Tokyo, University, Tokyo, Japan) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p. 53-56

An ascentmeter with a sensitivity of 1 cm/s was applied to the automatic control of balloon altitudes. In the flight tests made in 1980 and 1981, the automatic control system was successfully operated to keep a balloon altitude constant during sunset or to descend a balloon with a constant speed Author

A83-39822

A HARD X-RAY EXPERIMENT FOR LONG-DURATION BALLOON FLIGHTS

W N JOHNSON, J D KURFESS, M S. STRICKMAN, and D M. SAULNIER (U S. Navy, E O. Hulburt Center for Space Research, Washington, DC) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p 131-134

The Naval Research Lab has developed a balloon-borne hard X-ray experiment which is designed for 60- to 90-day flight durations soon to be available with around the world Sky Anchor or RACOON balloon flights. The experiment's scintillation detector is sensitive to the 15 - 250 keV X-ray energy range The experiment includes three microcomputer systems which control the data acquisition and provide the orientation and navigation information required for global balloon flights The data system supports global data communication utilizing the GOES satellite as well as high bit rate communications through L-band li line-of-site transmissions Author

A83-39823

GUIDANCE AND CONTROL OF A BALLOON-BORNE X-RAY TELESCOPE WITH ONBOARD AND GROUND BASED COMPUTERS

E KENDZIORRA and R. STAUBERT (Tuebingen, Universitaet, Tuebingen, West Germany) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol. 3, no. 6, 1983, p. 135-137.

The HEXE balloon payload for X-ray source observations in the 20-250 keV energy range employs Phoswich scintillator detectors with a total sensitive area of 2300 sq cm and a cooled Ge solid state detector with a 100 sq cm area Attention is presently given to the control of the instrument and the guidance of its telescope, as well as the data retrieval and real time analysis methods employed. These tasks are performed by data and command telemetry-linked onboard M 6800 microprocessors and an HP 1000 ground-based minicomputer. O.C.

N83-27988 Royal Aircraft Establishment, Farnborough (England)

THE DESIGN OF SHIELDED PITOT TUBES WITH SMALL SENSITIVITY TO INCIDENCE

A R G MUNDELL 29 Nov 1982 19 p refs
(RAE-TM-AERO-1863; BR86355) Avail Issuing Activity

The range of incidence over which a pitot-tube accurately indicates stagnation pressure in subsonic flow was increased by surrounding the pitot with a carefully designed shield The effect of some of the design variables of this shield are investigated experimentally, and a miniature probe design is described which enables an accurate indication of stagnation pressure to be obtained over an incidence range of 57 deg. Author (ESA)

N83-27989*# Old Dominion Univ, Norfolk, Va Dept of Mechanical Engineering and Mechanics

EXPERIMENTAL AND ANALYTICAL STUDIES OF A TRUE AIRSPEED SENSOR Final Report

G L. GOGLIA and J Y SHEN May 1983 173 p refs
(Contract NSG-1177)
(NASA-CR-165704, NAS 1 26:165704) Avail: NTIS HC A08/MF A01 CSCL 01D

A true airspeed sensor based on the precession of a vortex whistle for sensing airspeeds up to 321 9 km/hr (200 mph) In an attempt to model the complicated fluid mechanics of the vortex precession, three dimensional, inviscid, unsteady, incompressible fluid flow was studied by using the hydrodynamical linearized stability theory The temporal stability approach was used to derive the relationship between the true airspeed and frequency response. The results show that the frequency response is linearly proportional to the airspeed. A computer program was developed to obtain the numerical solution Computational results for various parameters were obtained The designed sensor basically consisted of a vortex tube, a swirler, and a transducer system A microphone converted the audible tone to an electronic frequency signal Measurements for both the closed conduit tests and wind tunnel tests were recorded For a specific flow rate or airspeed, larger exit swirler angles produced higher frequencies For a smaller cross sectional area in the precessional flow region, the frequency was higher It was observed that as the airspeed was increased the Strouhal number remained constant S.L

N83-27990# ITT Electro-Optical Products Div., Roanoke, Va.

A STUDY OF WAVELENGTH DIVISION MULTIPLEXING FOR AVIONICS APPLICATIONS Final Technical Report, 15 Jun. 1981 - 16 Aug. 1982

J. C WILLIAMS, D PORTER, T LEONARD, S GOODMAN, and D HUBER Wright-Patterson AFB, Ohio AFWAL Aug 1982 219 p refs
(Contract F33615-81-C-1481, AF PROJ 2003)
(AD-A125749, ITT-83-32-02, AFWAL-TR-82-1118) Avail: NTIS HC A10/MF A01 CSCL 09C

The performance of avionics wavelength division multiplexed (WDM) fiber optic systems was analyzed using an Optical Circuit Analysis Program (OCAP) developed during the study Design solutions were found for several sets of Air Force avionics information transfer specifications, and sensitivity analysis techniques using OCAP were used to show that the solutions were reliable Recommendations were made on key component developments which could result in major advancements in WDM system design. These developments would include diffraction grating WDM couplers, high speed-high power light emitting diodes, and pin-FET receivers Quantitative analysis of an avionics WDM system using these components indicates performance beyond that previously thought possible. Three specified Air Force WDM avionics systems were designed which could be fabricated using technology available in the 1983-1985 time frame. A design for a WDM demonstration system was developed which allows WDM systems to be demonstrated and WDM components to be tested. The WDM demonstration system was designed for laboratory bench applications and features a modular organization to provide for maximum user flexibility Examples are given of the use of the WDM demonstration system for measurements of system performance parameters such as bit error rate, link delay, optical dynamic range, and rise time, and recommendations are made on key future component developments which could enhance avionic WDM systems. Author (GRA)

N83-29204*# McDonnell Aircraft Co, St Louis, Mo
VARIABLE ACUITY REMOTE VIEWING SYSTEM FLIGHT DEMONSTRATION Final Report
R W. FISHER Jul 1983 67 p refs
(Contract NAS4-2619)
(NASA-CR-170404, NAS 1 26:170404, MDC-IRO296) Avail NTIS HC A04/MF A01 CSCL 01D

The Variable Acuity Remote Viewing System (VARVS), originally developed under contract to the Navy (ONR) as a laboratory brassboard, was modified for flight demonstration The VARVS system was originally conceived as a technique which could circumvent the acuity/field of view/bandwidth tradeoffs that exists in remote viewing to provide a nearly eye limited display in both field of view (160 deg) and resolution (2 min arc) while utilizing conventional TV sensing, transmission, and display equipment The modifications for flight demonstration consisted of modifying the sensor so it could be installed and flow in a Piper PA20 aircraft, equipped for remote control and modifying the display equipment so it could be integrated with the NASA Research RPB (RPRV) remote control cockpit. Author

N83-29205# Department of the Air Force, Washington, D C
USAF (UNITED STATES AIR FORCE) AVIONICS MASTER PLAN
Dec 1982 283 p
(AD-A125819) Avail NTIS HC A13/MF A01 CSCL 01C

This is the fourth annual USAF Avionics Master Plan (AMF) It is prepared by the Deputy for Avionics Control as directed in AFR 800-28, Air Force Policy on Avionics Acquisition and Support The purpose of the plan is to serve as a guide to the avionics community, to focus resources and energies on common goals, and promulgate strategies to move toward the resolution of common problems Strong emphasis continues in the avionics program areas of tactical and strategic C3, electronic combat and target acquisition/recognition from the standpoint of improved near/mid term capability. Programs supporting these areas are proceeding essentially as previously planned, with the exception of tactical C3 Significant changes are being planned in the approach to achieving jam resistant communications. The alternative architecture to be selected (scheduled for review and approval in the near future) could impact the JTIDS and Marx XV IFF programs as well as SFFK TALK GRA

N83-29206# Naval Air Test Center, Patuxent River, Md
THE 5TH ADVANCED AIRCREW DISPLAY SYMPOSIUM PROCEEDINGS
1981 281 p refs Symp held at Patuxent, Md, 15-16 Sep 1981
(AD-A126132) Avail. NTIS HC A13/MF A01 CSCL 05H

Historical cockpit development is reviewed in response to the expanding flight envelope and the need to improve operational effectiveness, and the impact of this on the number and type of cockpit displays and controls is shown The proposed extensions in capability for the next generation aircraft is discussed The difficulties these extensions cause and possible means such as reclined seats, electro-optical displays, digital data transmission, etc, which can be used to resolve them are also discussed Cockpit display techniques and their possible impacts on cockpit design are addressed S L.

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

A83-37092* Notre Dame Univ, Ind
NONLINEAR MULTIVARIABLE DESIGN BY TOTAL SYNTHESIS
M. K SAIN (Notre Dame, University, Notre Dame, IN) and J L PECZKOWSKI (Bendix Corp, Energy Controls Div, South Bend, IN) IN American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1982, p 252-260 refs
(Contract NSG-3048)

The Nominal Design Problem (NDP) is extended to nonlinear cases, and a new case study of robust feedback synthesis for gas turbine control design is presented. The discussion of NDP extends and builds on earlier Total Synthesis Problem theory and ideas Some mathematical preliminaries are given in which a bijection from a set S onto a set T is considered, with T admitting the structure of an F-vector space NDP is then discussed for a nonlinear plant, and nonlinear nominal design is defined and characterized The design of local controllers for a turbojet and the scheduling of these controls into a global control are addressed C D

A83-37219#
NUMERICAL SIMULATION OF COLD FLOW IN AN AXISYMMETRIC CENTERBODY COMBUSTOR
J N. SCOTT (Dayton, University, Dayton, OH) and W L HANKEY, JR (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 12 p refs
(Contract F33615-82-K-2252)
(AIAA PAPER 83-1741)

A centerbody combustor relies on the shedding of vortices behind a bluff body in order to effectively mix the fuel and air for stoichiometric burning This unsteady fluid dynamic process can only be predicted through the numerical integration of time-dependent Navier-Stokes equations The feasibility of modeling the self-excited oscillation evolved in vortex shedding by axisymmetric flows is presently demonstrated, and it is noted that while these numerical results are preliminary in nature, they illustrate the nature of the mixing process in association with experiments These computations have been performed with MacCormack's (1971) explicit finite difference scheme on a computational mesh of 2760 grid points O.C.

A83-37252
FINITE-ELEMENT MATHEMATICAL MODEL OF A GAS TURBINE ENGINE IN UNSTEADY FLOW [KONECHNO-ELEMENTNAIA MATEMATICHESKAIA MODEL' GAZOTURBINNOGO DVIGATELIA V NESTATSIONARNOM POTOKE]
IU A SKVORTSOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 1, 1982, p 21-29. In Russian refs

The finite-element method is used to construct a mathematical model of a gas turbine engine operating in a one-dimensional unsteady flow The basic modeling principles are examined using the example of a single-stage turbojet engine Results obtained with the finite-element method are compared with results obtained by Godunov's difference method for a channel of variable cross section Finite-element calculations of the unsteady gasdynamic process in an engine with a subsonic inlet channel are compared with experimental data. B J

A83-37274#
GAS TURBINE ENGINES
D E METZGER (Arizona State University, Tempe, AZ) and R E. MAYLE (Rensselaer Polytechnic Institute, Troy, NY) Mechanical Engineering (ISSN 0025-6501), vol. 105, June 1983, p 44-52 refs

A comprehensive discussion is presented concerning the thermodynamic characteristics of gas turbine engines, with respect both to the accurate and detailed prediction of engine component dimensions and relative positions, which are affected by differential thermal expansion, and the projection of engine service life The latter task involves the superposition on turbomachine centrifugal stresses of transient thermal stresses generated by temperature transients associated with power settings and operating environments Attention is given to turbine airfoil cooling airflow configurations, as well as blade tip clearance flows and the turbine blade endwall flow and heat transfer coefficient It is recommended that refined instrumentation and testing of engines be undertaken in order to obtain definitive data on hot gas flow characteristics. O.C.

A83-37956
SOME ASPECTS OF PROP-FAN PROPULSION SYSTEMS ANALYSIS
R E OWENS and W W. FERGUSON (United Technologies Corp., Pratt and Whitney Group, East Hartford, CT) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 15 p refs
(SAE PAPER 821358)

Optimization of a Prop-Fan propulsion system for a Mach 0 8, 120 passenger commercial transport has shown the need for relatively high levels of overall pressure ratio, combustor exit temperature, propeller tip speed and propeller disk loading to achieve lowest fuel burn and direct operating costs Comparison of this optimized Prop-Fan propulsion system with an equivalent technology turbofan showed it to have significant mission fuel burn and direct operating cost advantages Author

A83-37963
FULL AUTHORITY DIGITAL ELECTRONIC CONTROL (FADEC) - AUGMENTED FIGHTER ENGINE DEMONSTRATION
K L LINEBRINK (General Electric Co., Cincinnati, OH) and R W VIZZINI (U S Naval Air Propulsion Test Center, Trenton, NJ) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 11 p
(Contract N00019-76-C-0423)
(SAE PAPER 821371)

Attention is given to the results obtained in testing the Full Authority Digital Electronic Control (FADEC) which is being developed for the Navy. Testing was conducted on a qualification test vintage F404 engine fitted with a rear Variable Area Bypass Injector The engine mounted FADEC accumulated over 134 hours of engine operation during the tests. In addition to the control functions of standard F404 engines the FADEC control must also position the aft variable area bypass injector making possible changes in bypass ratio of the engine This FADEC application to an augmented fighter engine has been successful in demonstrating capabilities of providing both basic engine control needs and fault tolerant features over a wide range of flight conditions Operation has been demonstrated with engine sensor failures which would have required engine shutdown or large power loss with more conventional control systems G.R.

A83-37964
CLOSED-LOOP ENGINE FUEL SYSTEM SIMULATION
J E HORLING and R E HARRER (U.S Naval Air Propulsion Test Center, Trenton, NJ) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 9 p
(SAE PAPER 821374)

For the purpose of evaluating the fluid system components of contemporary and advanced air-breathing propulsion systems, personnel at the Naval Air Propulsion Center (NAPC) have implemented a hardware-in-the-loop simulation This system provides for closed-loop operation of the components and operationally stresses the components as if they were actually mounted on the engine The approach is currently being employed to perform a 2,000 hour life verification evaluation on the F404 engine fluid system components. Attention is given to the types and functions of engine fuel system components, an open-loop fuel control evaluation, closed-loop fuel control evaluations, a F404 engine fuel system component evaluation, and closed-loop operational characteristics G.R

A83-37966
DEVELOPMENT OF THRUST AUGMENTATION TECHNOLOGY FOR THE PEGASUS VECTORED THRUST ENGINE
A. SOTHERAN (Rolls-Royce, Ltd , London, England) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 11 p.
(SAE PAPER 821390)

Technological advances and experimentation to provide front nozzle thrust augmentation of lift/cruise engines such as the Pegasus on the VTOL Harrier aircraft are discussed The front nozzle gas temperature in the Pegasus is only one-third the level as the rear nozzle temperature, but has an equal thrust level Furthermore, the rear nozzle temperature ratio can be raised by a factor of two, while the front nozzle ratio can be increased by a factor of four-five The added thrust introduces problems in maintaining adequate control of the engine thrust level and the thrust center line, as well as ensuring equal power levels on both sides of the engine, even during engine intake distortions and storm water ingestion Augmentation will also increase the engine IR signature Computational methods with flow visualizations have served for analyzing the burner aerodynamics and programs are under way to verify and identify materials performance at the higher temperatures Tests on augmented engines thus far have shown thrust enhancements by up to 100 pct. M S K

A83-37972
FULL AUTHORITY FAULT TOLERANT ELECTRONIC ENGINE CONTROL SYSTEMS FOR ADVANCED HIGH PERFORMANCE ENGINES (FAFTEEC)
M E MCGLONE, R. J MILLER, W. J. DAVIES (United Technologies Corp , Pratt and Whitney Group, East Hartford, CT), and P T ADAMS (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 11 p
(SAE PAPER 821398)

It is pointed out that turbine engine controls technology is going through a period of rapid transition from hydromechanical based technology to digital computer based technology. Expected benefits in connection with a transition to digital eletronics are related to increased flexibility, and increased integration and coordination with other flight controls, inlet controls, and avionics systems The Full Authority Digital Electronic Control (FADEC) was to provide lighter weight, increased reliability, and improved maintainability The Full Authority Fault Tolerant Electronic Engine Control (FAFTEEC) program was sponsored by the Air Force to identify the basic redundancy requirements in the design architecture of control systems which provide very high levels of mission reliability Attention is given to engine control requirements, system architectures, reliability modeling, fault detection, system cost and weight, and a computer design analysis G R.

A83-37973
DEVELOPMENTS IN PERFORMANCE MONITORING AND DIAGNOSTICS IN AIRCRAFT TURBINE ENGINES
C SMITH, R DEHOFF (Systems Control Technology, Inc , West Palm Beach, FL), and M HUFFMAN (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 13 p
(Contract F33615-78-C-2062, F33615-80-C-2047; F41608-81-C-B231)
(SAE PAPER 821400)

Aspects of performance monitoring and diagnostics are considered in terms of data acquisition, data processing, and maintenance information management system integration It is pointed out that efficient methods for data collection and storage have been developed which should improve the accuracy and reliability of in-flight data. Processing techniques which reduce these data show promise for predicting engine health and correlating it with engine maintenance In connection with a Turbine Engine Fault Detection and Isolation Program, a Maintenance Information Management System (MIMS) was developed MIMS generated data include a daily base status summary, engine profile and diagnostic information, and detailed plots and tabulated displays for various types of data G R

A83-37974
DEVELOPMENT OF A COMPACT REAL-TIME TURBOFAN ENGINE DYNAMIC SIMULATION
M W FRENCH (General Electric Co , Aircraft Engine Group, Cincinnati, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 9 p
(Contract N00019-76-C-0423)
(SAE PAPER 821401)

Recent developments in the area of digital propulsion controls have precipitated requirements for compact real-time dynamic engine simulations This paper describes the analytical development and experimental validation of a full range, non-linear model of the F404-GE-400 after-burning turbofan engine Unique approaches were used to obtain a highly compact model which is capable of being operated in an engine mounted airborne digital computer. The model served as a signal source in a failure protection scheme, providing an unusual basis for model validation Highlights of the very successful broad ranging validation and use of this model are provided Author

A83-37975
MICROCOMPUTER BRINGS DIGITAL POWER TO THE SMALL AIRCRAFT GAS TURBINE
F C ZULIANI and G N KLINE (United Technologies Corp , Hamilton Standard Div., Windsor Locks, CT) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 10 p.
(SAE PAPER 821402)

A new small gas turbine engine control system suitable for the extremely cost sensitive small engine market is described The system concept, design details, development testing, and production initiation for the control system as applied to turbofan, turboprop, and turboshaft engines are reviewed The electronic control unit hardware and software are shown in block diagram and discussed In order to achieve a high degree of hardware commonality among all three applications, the electronics within the unit contains one digital board common to all applications and an analog board that changes with the application. The hydromechanical control unit accommodates the differing needs of the three applications with a common core fuel metering section for all versions and a core section interface with different application modules for specific engine requirements A block diagram of the unit is shown and the core section and application modules are described C D

A83-37980
UTILIZATION OF COMPUTER AIDED DESIGN FOR THE DEVELOPMENT OF ADVANCED TURBOMACHINERY COMPONENTS
P. S KUO and A. S. HOFFMANN (Avco Corp., Avco Lycoming Div , Stratford, CT) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 9 p.
(SAE PAPER 821423)

The present investigation is concerned with the uses and the achievements of the computer-aided design (CAD) system for the design of complex structural components, taking into account the efficient conduction of an economical and accurate structural analysis for the optimization of turbine designs In the computer-aided manufacturing (CAM) aspect, a controlled manufacturing procedure for a complete impeller geometry is also illustrated The structural analysis of stator assembly is considered, giving attention to the employment of the CAD procedure to analyze the stator vane stress distribution in a first stage compressor stator assembly of a gas turbine engine A coupled blade-disk vibration analysis is also discussed. It is found that accurate geometric definition of complex components generated using CAD/CAM systems for numerically controlled machining can be a cost-effective procedure to improve productivity G R

A83-37986
TRANSIENT BLADE RESPONSE DUE TO SURGE INDUCED STRUCTURAL LOADS
M D RUDY (Teledyne CAE, Toledo, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 16 p refs
(SAE PAPER 821438)

The aerodynamic aspects of surge events in gas turbine engines are discussed in relation to structural response and durability Analytical models for predicting load magnitudes and distributions as a function of time are presented along with transient response structural models Results of the analytical studies reported here highlight the effects of impulse time, load distribution and history, and model complexity on the dynamic behavior of the blade. The need for detailed high response experimental data from a control test vehicle for correlation of the proposed models is emphasized V.L.

A83-37987
A UNIFIED APPROACH TO TURBINE BLADE LIFE PREDICTION
B L LEWIS and L R. BECKWITH (Teledyne CAE, Toledo, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 19 p refs
(SAE PAPER 821439)

A computer based design analysis system for turbine blades has been implemented by assimilating state-of-the-art techniques in stress analysis, life prediction and material modeling, metal temperature prediction and probabilistic design philosophies State-of-the-art capabilities in each of these technologies are reviewed and compared to those of the described system with an emphasis on the technologies of structural analysis and life prediction Calibration of the constituents of the design system with extensive component and material characterization tests are described A statistical design approach was chosen to deal with blade-to-blade uncertainties in fundamental design parameters and provide increased decision making visibility in the design process. The design system described is considered applicable to all aspects of turbine engine design life analysis Author

A83-37994
THE APPLICATION OF A LIQUID-COOLED V-8 PISTON ENGINE TO GENERAL AVIATION AIRCRAFT
D L BLACKALLER and L MUIR Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 13 p refs
(SAE PAPER 821446)

A 522 kW (700 hp), liquid-cooled, turbocharged, V-8 piston aircraft engine is being developed for Federal Aviation

Administration certification with application directed toward repowering general aviation aircraft. Emphasis is on fuel-efficiency and altitude performance Installation of this engine has the potential to expand the performance envelope of agricultural and turboprop twin engine aircraft. Performance estimations of two representative twin engine aircraft capable of using 522 kW (700 hp) engines show significant increases in maximum true airspeed, climb performance, choice of cruise airspeed, and cruise performance. Installation in agricultural aircraft will increase performance and payload capability Author

A83-37995

AIRCRAFT SUPER INTEGRATED POWER UNIT

J. A WILLIAMS, A D LUCCI (Rockwell International Corp., Rocketdyne Div., Canoga Park, CA), and B. L. MCFADDEN (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 13 p.
(SAE PAPER 821461)

An SIPU is a single aircraft power unit capable of providing (1) electrical, pneumatic, and hydraulic power for ground maintenance and stand-by operations, (2) normal main engine start power, (3) emergency in-flight electrical and hydraulic power, and (4) in-flight emergency main engine restart power Power can be obtained from jet fuel combustion with air for the ground operations and normal engine starts, a gas generator system using on-board stored propelants for the emergency power and emergency engine restart functions, and the aircraft main engine compressor air as a second source for the emergency electrical and hydraulic power function. An SIPU concept demonstration program is currently near completion at Rockwell International's Rocketdyne Division, sponsored by the Aeropropulsion Laboratory at Wright-Patterson Air Force Base. The program is for design, fabrication, assembly, and test of a demonstrator SIPU capable of performing all four functions. Author

A83-37996

SUPER INTEGRATED POWER UNIT (SIPU) FOR THE F-16 ENGINE START SYSTEM

W. G. SMITH and R. J FANDEL (Sundstrand Corp., Rockford, IL) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 9 p
(SAE PAPER 821462)

The F-16 main engine inflight restart capability would be greatly enhanced by utilizing a Super Integrated Power Unit (SIPU) Because the available starter power remains constant at all altitudes, the engine can be motored at relatively high rotative speeds, providing for rapid acceleration to a self sustaining condition after relight This reduced start time plus a multiple start capability, reduces altitude loss and increases safety during combat. The SIPU concept expands the airstart window and allows the pilot to assume a 'best range' flight attitude which maximizes both time and range by up to 35 percent in the event the engine is not able to start Author

A83-37997

APPLICATION OF A HOT GAS HIGH PRESSURE ROTARY VANE MOTOR TO AIRCRAFT APU STARTING

L D GALBRAITH, W E JORGENSON, D. A PAHL (Rocket Research Co, Redmond, WA), and B. L MCFADDEN (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 14 p. refs
(Contract F33615-76-C-2148)
(SAE PAPER 821464)

Analyses and tests have been conducted on a hot gas rotary vane motor suitable for aircraft APU starting over the temperature range of - 65 to + 130 F (- 54 to + 54 C). Testing of the motor has been accomplished with gaseous nitrogen and hydrazine-based monopropellant hot gas decomposition products Revisions to the motor configuration reduced total gas consumption 52 percent compared to the original baseline and eliminated end clearance sensitivity Analytical studies, verified by test results, indicated the effect of friction coefficient, blade weight, and venting of the blade on overall internal friction Further studies evaluated linking pairs of blades to minimize centrifugal force effects Tests currently in progress are aimed at selecting the optimum blade material. Author

A83-38001* Avco Lycoming Div, Stratford, Conn

EXPERIMENTAL EVALUATION OF INLET TURBULENCE, WALL BOUNDARY LAYER, SURFACE FINISH, AND FILLET RADIUS ON SMALL AXIAL TURBINE STATE PERFORMANCE

A. A KOZAK, W D. BROCKETT (Avco Corp., Avco Lycoming Div, Stratford, CT), and J. E. HAAS (U S. Army, Research and Technology Laboratories, Cleveland, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 11 p. refs
(Contract NAS3-22109)
(SAE PAPER 821475)

The results of an experimental investigation are presented which establish the effects of surface finish, fillet radius, inlet boundary layer thickness, and free-stream inlet turbulence level on the aerodynamic performance of a small axial flow turbine stator The principal objective was to help understand why large turbine efficiency is not maintained when a large turbine is scaled to a smaller size and to provide the turbine designer with the performance compromises expected for a small scale design. A comprehensive test matrix was used to gain an understanding of the effects of each variable over the full range of all the other variables Author

A83-38006

REPAIRING GAS TURBINE HOT SECTION AIRFOILS TODAY

J. H. WILKENS Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 8 p. refs
(SAE PAPER 821487)

Product safety, conservation of critical materials, thermal protection, and operational cost control, are the goals presently addressed in a study of a teamwork-based approach to the development and application of gas turbine hot section airfoil repair techniques These techniques include hot isostatic pressing, diffusion bonding, controlled chamber tungsten inert gas welding, electrical discharge machining, laser drilling, electrochemical machining, abrasive flow machining, airfoil replacement, and blade tip sulfidation repair Attention is given to the protective coating methods of low pressure plasma spraying, vapor deposition, platinum aluminide pack coating, and overcoating. It is shown that repair engineering extends the useful life of hot section airfoils, without compromising safety or the desired reduction of critical materials usage and costs. O.C

A83-38007

MAJOR HOT SECTION COMPONENT SALVAGED THROUGH ADVANCED REPAIR METHODS

B. J GRANATEK (United Technologies Corp, Pratt and Whitney Group, East Hartford, CT) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 10 p.
(SAE PAPER 821489)

This paper describes Pratt and Whitney Aircraft's refurbishment method for upgrading in-service JT9D low pressure turbine cases with a redesigned front flange section of the case. Refurbishment was made possible by the development of electron beam welding techniques for the forged Incoloy 901 nickel-base alloy in the case The techniques developed minimize heat affected zone intergranular stress cracks which historically have been a deterent to structural welds in Incoloy 901. Author

A83-38008
EXPERIENCES IN REPAIR OF HOT SECTION GAS TURBINE COMPONENTS
M H HAAFKENS (Elbar, Lomm, Netherlands) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 18 p refs
(SAE PAPER 821490)

Because it is often necessary to repair heavily loaded turbine blades and buckets constructed from such nickel alloys as In738, U720 and In939, which possess poor welding characteristics, investigations have been conducted concerning the development of high operational reliability repair and recovery procedures These procedures encompass the welding of superalloys, superalloy powder metallurgy techniques (including hipping), superalloy bonding and repair brazing, and the development of such novel superalloy diffusion coatings as the one-step NiCrAlY, sulfidation resistant coatings, and new thermal barrier coatings Performance tests have established that repaired blades can out perform unused blades, due to the use of superior materials and coatings and modified heat treatment O C

A83-38022*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
DEVELOPMENT AND OPERATING CHARACTERISTICS OF AN ADVANCED TWO-STAGE COMBUSTOR
W GREENE, S TANRIKUT (United Technologies Corp, Pratt and Whitney Group, East Hartford, CT), and D E. SOKOLOWSKI (NASA, Lewis Research Center, Cleveland, OH; United Technologies Corp, Pratt and Whitney Group, East Hartford, CT) Journal of Energy (ISSN 0146-0412), vol. 7, July-Aug 1983, p 354-360 refs

Previously cited in issue 06, p 813, Accession no A82-17833

A83-38081#
PROPULSION SYSTEM INTEGRATION CONFIGURATIONS FOR FUTURE PROP-FAN POWERED AIRCRAFT
J GODSTON and C N REYNOLDS (United Technologies Corp, Pratt and Whitney Group, East Hartford, CT) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983. 14 p refs
(AIAA PAPER 83-1157)

Numerous propulsion system integration options involving novel gearbox, engine inlet, oil cooling, and engine mounting concepts, have been considered in the course of NASA's Advanced Prop-fan Engine Technology research program. Previous studies have indicated 20-30 percent reductions in fuel consumption for a prop-fan/advanced turboprop system relative to comparable technology turbofan propulsion The presently considered advanced technology turboprop engine can be combined with either single- or counter-rotation prop-fans, and installed in either a pusher or tractor configuration, on the wing or fuselage of aircraft The pros and cons of these configurational possibilities are discussed from the viewpoint of the engine designer. Technology availability considerations are also addressed O C

A83-38104
PROCEDURE FOR THE CALCULATION OF BASIC EMISSION PARAMETERS FOR AIRCRAFT TURBINE ENGINES
SAE Aerospace Information Report, AIR 1533, April 30, 1982, 39 p
(SAE AIR 1533)

A procedure for calculating basic emission parameters, including fuel-air ratio, emission index, and combustion efficiency for aircraft turbine engines is presented based on the measurement of carbon monoxide, carbon dioxide, total hydrocarbons, and oxides of nitrogen Information is provided for calculating the emissions parameters using the matrix method, including discussions of the combustion chemical equation, basic matrix solution, interferences, oxygen pressure broadening, NO(x) converter efficiency, sample drying, and comprehensive matrix solution Equations are provided for calculating the results by hand where a computer is not available The derivation of the previously presented equations is also shown C D

A83-38630#
JET-PROPULSION OF SUBSONIC BODIES WITH JET TOTAL-HEAD EQUAL TO FREE STREAM'S
F. R GOLDSCHMIED American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983 8 p refs
(Contract ARPA ORDER 4045-1, N00167-80-M-4800; N00167-81-C-0075)
(AIAA PAPER 83-1790)

Jet-propulsion of a subsonic axisymmetric 2 72 1 body has been achieved in a low-speed 8 x 10-ft windtunnel at a volume Reynolds Number of two millions with a stern jet total-head equal to free-stream's and therefore with 100 percent propulsive efficiency. The jet exit velocity was 33 percent lower than free-stream's and the jet exit static-pressure was over half the stagnation value. The aerodynamic basis for this milestone was provided by the integrated/body pressure-distribution/boundary-layer control/stern jet-propulsion/design concept Large excess thrusts have been also generated with higher jet flows, with an incremental propulsive efficiency up to 81 5 percent. A propulsion power reduction of 50 percent has been achieved with the integrated self-propelled wind-tunnel model, as compared to the best conventional streamlined bodies with wake stern propellers, at the same volume Reynolds Number Author

A83-38869
V/STOL FROM THE PROPULSION VIEWPOINT (7TH SIR SYDNEY CAMM MEMORIAL LECTURE)
G M LEWIS (Rolls-Royce, Ltd, London, England) Aerospace (UK) (ISSN 0305-0831), vol 10, June-July 1983, p 12-19

A discussion is presented of the propulsion requirements for high performance V/STOL combat aircraft. The advantages of vectored thrust include the high installed thrust, conventional cockpit controls, continuous thrust vectoring through transition from conventional flight to hover, exploitation of the ski jump launch, and thrust augmentation by burning fuel in the fan air nozzles It is argued that vertical landing is preferable to short landing in combat zones, due to the safety and accuracy with which the aircraft can return to land in a hostile environment. Possible future developments for V/STOL aircraft are examined, including ejector lift and tandem fan designs, a remote augmented lift system, and the use of auxiliary lift engines N.B.

A83-39101#
REGIONAL AIRLINE TURBOPROP ENGINE TECHNOLOGY
M D STOTEN (Pratt and Whitney Canada, Mississauga, Ontario, Canada) and R A. HARVEY AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p refs
(AIAA PAPER 83-1158)

It is pointed out that cruise fuel burn is not a good indicator of the best aircraft-engine combination on a short-range subsonic turboprop. Factors that enter into the design of the engine, namely engine weight, total engine maintenance, reliability, and specific fuel consumpton, are discussed. A description is then given of the one PW100 and of the decisions that were made in its design The improvements foreseen in the coming decades in materials, aerodynamic design, and mechanical design are discussed, with particular attention given to compressor, combustor, and turbine technology It is believed that the regional turboprop is here to stay C R.

A83-39169
LONGITUDINAL MODES OF GAS OSCILLATIONS IN THE MAIN COMBUSTION CHAMBER OF GAS-TURBINE ENGINES [PRODOL'NYE FORMY KOLEBANII GAZA V OSNOVOI KAMERE SGORANIIA GTD]
V M SILVERSTOV Fizika Goreniia i Vzryva (ISSN 0430-6228), vol 19, May-June 1983, p. 81-88. In Russian

An approximate method for calculating the acoustic characteristics of the main combustion chamber of a gas-turbine engine has been developed on the basis of the known equations describing sound propagation in a homogeneous moving medium

The method proposed here allows for the connectedness of the cavities of the annular duct and the flame tube, as well as for mean temperature and gas velocity distributions in these cavities The effects of various parameters on the acoustic field of the first longitudinal mode are investigated numerically, and the results are compared with experimental data V L

A83-39815
POWER SUPPLIES FOR LONG DURATION BALLOON FLIGHTS
E W LICHFIELD (National Center for Atmospheric Research, Boulder, CO) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p 87-96

With the advent of long duration superpressure balloon flights, and radio-controlled balloon techniques, electrical power supply performance and weight have become more important. Attention is presently given to design information regarding the selection of rechargeable batteries and their charging systems, with emphasis on solar panels and their power collection maximization through proper orientation While instrumented balloons with mission durations of as much as 44 days require batteries recharged by solar panels, it is recommended that designers consider the use of primary cells for flights lasting less than ten days. O.C.

A83-39993*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE FEASIBILITY OF WATER INJECTION INTO THE TURBINE COOLANT TO PERMIT GAS TURBINE CONTINGENCY POWER FOR HELICOPTER APPLICATION
G J. VAN FOSSEN (NASA, Lewis Research Center, Cleveland, OH) ASME, Transactions, Journal of Engineering for Power (ISSN 0022-0825), vol 105, July 1983, p 635-642 refs
(ASME PAPER 83-GT-66)

It is pointed out that in certain emergency situations it may be desirable to obtain power from a helicopter engine at levels greater than the maximum rating Yost (1976) has reported studies concerning methods of power augmentation in the one engine inoperative (OEI) case It was found that a combination of water/alcohol injection into the inlet and overtemperature/overspeed could provide adequate emergency power The present investigation is concerned with the results of a feasibility study which analytically investigated the maximum possible level of augmentation with constant gas generator turbine stress rupture life as a constraint In the proposed scheme, the increased engine output is obtained by turbine overtemperature, however, the temperature of the compressor bleed air used for hot section cooling is lowered by injecting and evaporating water G R

N83-27991*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
A SURVEY OF INLET/ENGINE DISTORTION COMPATIBILITY
D N. BOWDITCH and R. E. COLTRIN 1983 22 p refs Presented at the 19th Joint Propulsion Conf, Seattle, 27-29 Jun 1983; sponsored by AIAA, SAE and ASME
(NASA-TM-83421, E-1711, NAS 1.15 83421) Avail NTIS HC A02/MF A01 CSCL 21E

The history of distortion analysis is traced back to its origin in parallel compressor theory which was initially proposed in the late fifties The development of this theory is reviewed up to its inclusion in the complex computer codes of today. It is found to be a very useful tool to guide development but not quantitative enough to predict compatibility Dynamic or instantaneous distortion methodology is also reviewed from its origins in the sixties, to its current application in the eighties. Many of the requirements for interpreting instantaneous distortion are considered and illustrated. Statistical methods for predicting the peak distortion are described, and their limitations and advantages discussed Finally, some Reynolds number and scaling considerations for inlet testing are considered It is concluded that the deterministic instantaneous distortion methodology combined with distortion testing of engines with screens will remain the primary method of predicting compatibility for the near future. However, parallel compressor analysis and statistical peak distortion prediction will be important tools employed during the development of inlet/engine compatibility Author

N83-27992*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
LOW SPEED PERFORMANCE OF A SUPERSONIC AXISYMMETRIC MIXED COMPRESSION INLET WITH AUXILIARY INLETS
J F WASSERBAUER, R W CUBBISON, and C J TREFNY 1983 32 p refs Presented at the 19th Joint Propulsion Conf., Seattle, 27-29 Jun 1983, sponsored by AIAA, SAE and ASME
(NASA-TM-83435; E-1730, NAS 1.15 83435) Avail NTIS HC A03/MF A01 CSCL 21E

The aerodynamic performance of a representative supersonic cruise inlet was investigated using a fan simulator coupled to the inlet to provide characteristic noise signatures and to pump the inlet flow. Data were obtained at Mach numbers from 0 to 0 2 for the inlet equipped with an auxiliary inlet system that provided 20 to 40 percent of the fan flow Results show that inlet performance improved when the inlet bleed systems were sealed, when the freestream Mach number was increased, and when the auxiliary inlets were opened. The inlet flow could not be choked by either centerbody translation or by increasing the fan speed when the 40 percent auxiliary inlet was incorporated. A.R H

N83-27993*# Pratt and Whitney Aircraft Group, East Hartford, Conn Commercial Products Div
JT90 THERMAL BARRIER COATED VANES
K D SHEFFLER, R A GRAZIANI, and G C. SINKO Apr. 1982 171 p refs
(Contract NAS3-20630)
(NASA-CR-167964, NAS 1 26:167964; PWA-5515-176) Avail NTIS HC A08/MF A01 CSCL 21E

The technology of plasma sprayed thermal barrier coatings applied to turbine vane platforms in modern high temperature commercial engines was advanced to the point of demonstrated feasibility for application to commercial aircraft engines The three thermal barrier coatings refined under this program are zirconia stabilized with twenty-one percent magnesia (21% MSZ), six percent yttria (6% YSZ), and twenty percent yttria (20% YSZ) Improvement in thermal cyclic endurance by a factor of 40 times was demonstrated in rig tests. A cooling system evolved during the program which featured air impingement cooling for the vane platforms rather than film cooling The impingement cooling system, in combination with the thermal barrier coatings, reduced platform cooling air requirements by 44% relative to the current film cooling system Improved durability and reduced cooling air requirements were demonstrated in rig and engine endurance tests Two engine tests were conducted, one of 1000 cycles and the other of 1500 cycles All three coatings applied to vanes fabricated with the final cooling system configuration completed the final 1500 cycle engine endurance test. Results of this test clearly demonstrated the durability of the 6% YSZ coating which was in very good condition after the test. The 21% MSZ and 20% YSZ coatings had numerous occurrences of significant spalling in the test. Author

N83-27994*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANTAGE OF RESONANT POWER CONVERSION IN AEROSPACE APPLICATIONS
I. G HANSEN May 1983 8 p refs
(NASA-TM-83399, E-1676, NAS 1 15 83399) Avail NTIS HC A02/MF A01 CSCL 21E

An ultrasonic, sinusoidal aerospace power distribution system is shown to have many advantages over other candidate power systems These advantages include light weight, ease of fault clearing, versatility in handling many loads including motors, and the capability of production within the limits of present technology. References are cited that demonstrate the state of resonant converter technology and support these conclusions. Author

N83-27995*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
A VARIABLE-GEOMETRY COMBUSTOR USED TO STUDY PRIMARY AND SECONDARY ZONE STOICHIOMETRY
D BRIEHL, D F SCHULTZ, and R C. EHLERS 1983 15 p refs Proposed for presentation at the Joint Power Generation Conf, Indianapolis, 25-29 Sep 1983, sponsored by ASME
(NASA-TM-83372, E-1640; NAS 1 15 83372) Avail NTIS HC A02/MF A01 CSCL 21E

A combustion program is underway to evaluate fuel quality effects on gas turbine combustors A rich-lean variable geometry combustor design was chosen to evaluate fuel quality effects over a wide range of primary and secondary zone equivalence ratios at simulated engine operating conditions. The first task of this effort, was to evaluate the performance of the variable geometry combustor The combustor incorporates three stations of variable geometry to control primary and secondary zone equivalence ratio and overall pressure loss. Geometry changes could be made while a test was in progress through the use of remote control actuators The primary zone liner was water cooled to eliminate the concern of liner durability Emissions and performance data were obtained at simulated engine conditions of 80 percent and full power Inlet air temperature varied from 611 to 665K, inlet total pressure varied from 1 02 to 1 24 MPa, reference velocity was a constant 1400 K Author

N83-27996*# Detroit Diesel Allison, Indianapolis, Ind.
ROTORCRAFT CONVERTIBLE ENGINE STUDY Final Report, 11 Dec. 1980 - 31 Mar. 1982
J C GILL, R V EARLE, and H M MAR Sep 1982 114 p refs
(Contract NAS3-22742)
(NASA-CR-168161, NAS 1 26 168161; DDA-EDR-10978) Avail NTIS HC A06/MF A01 CSCL 21E

The objective of the Rotorcraft Convertible Engine Study was to define future research and technology effort required for commercial development by 1988 of convertible fan/shaft gas turbine engines for unconventional rotorcraft transports Two rotorcraft and their respective missions were defined a Fold Tilt Rotor aircraft and an Advancing Blade Concept (ABC) rotorcraft Sensitivity studies were conducted with these rotorcraft to determine parametrically the influence of propulsion characteristics on aircraft size, mission fuel requirements, and direct operating costs (DOC) The two rotorcraft were flown with conventional propulsion systems (separate lift/cruise engines) and with convertible propulsion systems to determine the benefits to be derived from convertible engines Trade-off studies were conducted to determine the optimum engine cycle and staging arrangement for a convertible engine Advanced technology options applicable to convertible engines were studied. Research and technology programs were identified which would ensure technology readiness for commercial development of convertible engines by 1988 Author

N83-29207# Library of Congress, Washington, D C Science Reference Section.
LC SCIENCE TRACER BULLET: JET ENGINES AND JET AIRCRAFT
G D HAVAS, comp Jun 1982 9 p
(TB-82-5, ISSN-0090-5232) Avail: NTIS HC A02/MF A01

Sources of information dealing with jet engines and jet aircraft are listed Technical aspects are emphasized, but historical background is included This guide is designed, as the name of the series implies, to put the reader on target. S L

N83-29208*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
COMBUSTION FUNDAMENTALS RESEARCH
Washington Mar 1983 252 p refs Proc of conf. held in Cleveland, 21-22 Oct 1982
(NASA-CP-2268, E-1525, NAS 1.55.2268) Avail. NTIS HC A12/MF A01 CSCL 21E

Increased emphasis is placed on fundamental and generic research at Lewis Research Center with less systems development efforts. This is especially true in combustion research, where the study of combustion fundamentals has grown significantly in order to better address the perceived long term technical needs of the aerospace industry The main thrusts for this combustion fundamentals program area are as follows analytical models of combustion processes, model verification experiments, fundamental combustion experiments, and advanced numeric techniques

N83-29209*# United Technologies Research Center, East Hartford, Conn
ANALYTICAL MODELING OF OPERATING CHARACTERISTICS OF PREMIXING-PREVAPORIZING FUEL-AIR MIXING PASSAGES
O L ANDERSON *In* NASA Lewis Research Center Combust Fundamentals Res. p 1-6 Mar 1983
Avail. NTIS HC A12/MF A01 CSCL 21E

A model for predicting the distribution of liquid fuel droplets and fuel vapor in premixing-prevaporizing fuel-air mixing passages of the direct injection type is described. This model consists of three computer programs a calculation of the two dimensional or axisymmetric air flow field neglecting the effects of fuel; a calculation of the three dimensional fuel droplet trajectories and evaporation rates in a known, moving air flow, and a calculation of fuel vapor diffusing into a moving three dimensional air flow with source terms dependent on the droplet evaporation rates The air flow calculation can treat compressible swirling flows in arbitrary ducts with arbitrary distributions of temperature and velocity as initial conditions The fuel droplets are treated as initial conditions The fuel droplets are treated as individual particle classes each satisfying Newton's law, a heat transfer, and a mass transfer equation. The vapor diffusion calculation treats three dimensional, gas phase, turbulent diffusion processes with the turbulence level determined by the air flow calculations and the source terms determined by the droplet evaporation rates Author

N83-29210*# Naval Research Lab, Washington, D C Lab. for Computational Physics
NUMERICAL SIMULATION FOR DROPLET COMBUSTION USING LAGRANGIAN HYDRODYNAMICS
M J FRITTS, D E. FYFE, and E S ORAN *In* NASA. Lewis Research Center Combust Fundamentals Res p 7-12 Mar. 1983 refs
Avail· NTIS HC A12/MF A01 CSCL 21E

A predictive model of spray combustion must incorporate models for the wide variety of physical environments in a practical combustor In regions where droplets are closely spaced, combustion resembles a diffusion flame, where they are well separated, an envelope or wake flame results The relative velocity field between the fuel droplets and oxidizer in influences boundary layer development about the droplet, recirculating flow patterns, and droplet shape and stability. A model must encompass these interacting temporal and spatial effects as well as complicated combustor boundaries The objective of the current work is to develop the triangular gridding method for describing the individual and collective properties of vaporizing and burning fuel droplets Author

N83-29211*# Pennsylvania State Univ, University Park Dept. of Mechanical Engineering
STRUCTURE OF EVAPORATING AND COMBUSTING SPRAYS: MEASUREMENTS AND PREDICTIONS
J S SHUEN, A. S. P. SOLOMON, and G. M. FAETH *In* NASA Lewis Research Center Combust. Fundamentals Res p 13-28 Mar 1983 refs
(Contract NAG3-190)
Avail· NTIS HC A12/MF A01 CSCL 21E

Complete measurements of the structure of nonevaporating, evaporating and combusting sprays for sufficiently well defined boundary conditions to allow evaluation of models of these processes were obtained. The development of rational design methods for aircraft combustion chambers and other devices involving spray combustion were investigated Three methods for treating the discrete phase are being considered a locally homogeneous flow (LHF) model, a deterministic separated flow (DSF) model, and a stochastic separated flow (SSF) model The main properties of these models are summarized Author

N83-29212*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
FUEL SPRAY DIAGNOSTICS
F. M HUMENIK and M. A BOSQUE *In its* Combust Fundamentals Res. p 29-38 Mar 1983 refs
Avail NTIS HC A12/MF A01 CSCL 21E

Fundamental experimental data base for turbulent flow mixing models is provided and better prediction of the more complex turbulent chemical reacting flows Analytical application to combustor design is provided and a better fundamental understanding of the combustion process Author

N83-29213*# Drexel Univ., Philadelphia, Pa Dept of Mechanical Engineering
POLLUTANT FORMATION IN MONODISPERSE FUEL SPRAY COMBUSTION
N. P. CERNANSKY and H SARV *In* NASA Lewis Research Center Combust. Fundamentals Res. p 39-47 Mar. 1983
Avail NTIS HC A12/MF A01 CSCL 21E

The combustion of liquid sprays represents an extremely important class of combustion processes. In the transition region, encompassing droplet sizes in the range of 25-80 micron diameter, the mixing and evaporation processes are both incomplete at the flame front and burning occurs in a combined diffusive and premixed fashion. Under these conditions, the relative importance of heterogeneous and homogeneous effects in dominating the combustion process is switched and gives rise to a number of interesting phenomena NO (sub x) formation in monodisperse spray combustion was investigated with the following specific objectives: (1) to quantitatively determine the effect of droplet size, number density, etc. on NO sub x formation in monodisperse fuel spray combustion; and (2) to isolate the important physical and chemical phenomena in NO sub x formation in these combustion systems Author

N83-29218*# Case Western Reserve Univ, Cleveland, Ohio. Dept of Mechanical and Aerospace Engineering
DILUTION JET EXPERIMENTS IN COMPACT COMBUSTOR CONFIGURATIONS
I GREBER and J. ZIZELMAN *In* NASA. Lewis Research Center Combust. Fundamentals Res. p 85-92 Mar 1983 refs
Avail NTIS HC A12/MF A01 CSCL 21E

The effects of cooling jets on the velocity and temperature fields in a compact reverse flow combustion are discussed The work is motivated by the need to limit the temperature of past-combustion gases in jet engines to values within the endurance capabilities of turbine blades The application requires not only that the temperature be kept sufficiently low but also that a suitably tailored temperature profile be provided at the combustor exit, with higher temperatures generally permissible at the blade tip than at the blade root because of higher centrifugal loads at the root. A single jet. As spacing is reduced, jet penetration is also reduced, and the cooling jets tend to remain close to the wall from which they are injected Results suggest that cooling and temperature distribution tailoring can be accomplished without injecting cooling jets upstream of the turn, and thus it appears that combustors can be made smaller than current designs R J.F

N83-29219*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
ANALYTICAL CALCULATION OF A SINGLE JET IN CROSS-FLOW AND COMPARISON WITH EXPERIMENT
R. W. CLAUS *In its* Combust Fundamentals Res. p 93-100 Mar 1983 refs
Avail· NTIS HC A12/MF A01 CSCL 21E

A series of progressively finer grid systems to calculate the single jet in cross-flow experimentally measured were employed The experimental measurements provide a collection of velocities, turbulence intensities, and jet concentration profiles with measurements of the inlet field The use of a series of progressively finer grid systems allows a differentiation between numerical errors and the hydrodynamic modeling assumptions embodied in the 3D combustor code E A K.

N83-29220*# Oklahoma State Univ., Stillwater. Dept. of Mechanical and Aerospace Engineering
TURBULENT COMBUSTOR FLOWFIELD INVESTIGATION
D. G LILLEY *In* NASA. Lewis Research Center Combust. Fundamentals Res p 101-118 Mar. 1983 refs
Avail NTIS HC A12/MF A01 CSCL 21E

The 2-D axisymmetric geometries under low speed, nonreacting, turbulent, swirling flow conditions were investigated. The effect of the parameters on isothermal flowfield patterns, time mean velocities and turbulence quantities is determined and an improved simulation in the form of a computer prediction code equipped with a suitable turbulence model is established This is a prerequisite to the prediction of more complex turbulent reacting flows E A.K.

N83-29221*# Detroit Diesel Allison, Indianapolis, Ind.
SMALL GAS TURBINE COMBUSTOR PRIMARY ZONE STUDY
R E SULLIVAN and R D. SUTTON *In* NASA. Lewis Research Center Combust. Fundamentals Res p 119-130 Mar. 1983
(Contract NAS3-22762)
Avail. NTIS HC A12/MF A01 CSCL 21E

The combustion research program, small gas turbine combustor primary zone study is summarized The basic elements of a design methodology program to obtain the maximum performance potential of small reverse-flow annular combustors is described Three preferred combustion design approaches for internal flame stabilization patterns were selected Design features are incorporated in the combustors to address the performance limiting problem areas associated with smaller annular combustors Performance is predicted by using a 3-D aerodynamic/chemical kinetic elliptic flow analysis, initially developed by Garrett Corporation for the USARTL. It is shown that the analytical flow field predictive models provide a useful design tool for understanding the combustion performance of a small reverse flow annular combustor. E A K.

N83-29226*# Garrett Turbine Engine Co., Phoenix, Ariz.
COMPUTATIONS OF EMISSIONS USING A 3-D COMBUSTOR PROGRAM
S. K SRIVATSA *In* NASA. Lewis Research Center Combust. Fundamentals Res p 171-182 Mar 1983
Avail NTIS HC A12/MF A01 CSCL 21E

A general 3-D combustor performance program developed by Garrett was extended to predict soot and NOx emissions. The soot formation and oxidation rates were computed by quasi-global models, taking into account the influence of turbulence. Radiation heat transfer was computed by the six-flux radiation mode The radiation properties include the influence of CO2 and H2O in addition to soot NOx emissions were computed from a global four-step hydrocarbon oxidation scheme and a set of rate-controlled reactions involving radicals and nitrogen oxides Author

N83-29234*# Naval Air Propulsion Test Center, Trenton, N.J
ROTOR FRAGMENT PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN US COMMERCIAL AVIATION DURING 1979 Final Report
R. A. DELUCIA and J T SALVINO Oct 1982 29 p
(Contract NASA ORDER C-41581-B)
(NASA-CR-168163, NAS 1.26 168163, NAPC-PE-80) Avail NTIS HC A03/MF A01 CSCL 21E

Statistical information relating to the number of gas turbine engine rotor failures which occurred during 1979 in commercial aviation service use is provided The predominant failure mode involved blade fragments, 84 percent of which were contained. No uncontained disk failures occurred and although fewer rotor rim and seal failures occurred, 100 percent and 50 percent, respectively, were uncontained Sixty-eight percent of the 157 rotor failures occurred during the take-off and climb stages of flight
Author

N83-29235*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
MULTI-FUEL ROTARY ENGINE FOR GENERAL AVIATION AIRCRAFT
C JONES (Curtiss-Wright Corp., Woodridge, N J), D R ELLIS (Cessna Aircraft Co , Wichita, Kans), and P. R MENG 1983 47 p refs Presented at the 19th Joint Propulsion Conf., Seattle, 27-29 Jun 1983, sponsored by AIAA, SAE, and ASME
(NASA-TM-83429; E-1718; NAS 1 15.83429, AIAA-83-1340) Avail NTIS HC A03/MF A01 CSCL 21E

Design studies of advanced multifuel general aviation and commuter aircraft rotary stratified charge engines are summarized Conceptual design studies were performed at two levels of technology, on advanced general aviation engines sized to provide 186/250 shaft kW/hp under cruise conditions at 7620 (25000 m/ft) altitude A follow on study extended the results to larger (2500 hp max.) engine sizes suitable for applications such as commuter transports and helicopters. The study engine designs were derived from relevant engine development background including both prior and recent engine test results using direct injected unthrottled rotary engine technology. Aircraft studies, using these resultant growth engines, define anticipated system effects of the performance and power density improvements for both single engine and twin engine airplanes The calculated results indicate superior system performance and 27 to 33 percent fuel economy improvement for the rotary engine airplanes as compared to equivalent airframe concept designs with current baseline engines The research and technology activities required to attain the projected engine performance levels are also discussed S L

N83-29236*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
THE NASA BROAD-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM: AN ASSESSMENT OF PHASE 1 TEST RESULTS
J. S FEAR 1983 13 p refs Presented at the Joint Power Generation Conf , Indianapolis, 25-29 Sep 1983; sponsored by ASME
(NASA-TM-83447; E-1753, NAS 1 15:83447) Avail NTIS HC A02/MF A01 CSCL 21E

An assessment is made of the results of Phase 1 screening testing of current and advanced combustion system concepts using several broadened-properties fuels The severity of each of several fuels-properties effects on combustor performance or liner life is discussed, as well as design techniques with the potential to offset these adverse effects The selection of concepts to be pursued in Phase 2 refinement testing is described. This selection takes into account the relative costs and complexities of the concepts, the current outlook on pollutant emissions control, and practical operational problems
Author

N83-29237*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
PARAMETRIC STUDY OF FLAME RADIATION CHARACTERISTICS OF A TUBULAR-CAN COMBUSTOR
F M. HUMENIK, R W. CLAUS, and G. M. NEELY 1983 13 p refs Proposed for presentation at the Joint Power Generation Conf , Indianapolis, 25-29 Sep 1983, sponsored by ASME
(NASA-TM-83436, E-1731, NAS 1.15 83436) Avail NTIS HC A02/MF A01 CSCL 21E

A series of combustor tests were conducted with a tubular-can combustor to study flame radiation characteristics and effects with parametric variations in combustor operating conditions Two alternate combustor assemblies using a different fuel nozzle were compared Spectral and total radiation detectors were positioned at three stations along the length of the combustor can Data were obtained for a range of pressures from 0 34 to 2 07 MPa (50 to 300 psia), inlet temperatures from 533 to 700K (500 to 800 F), for Jet A (13.9 deg hydrogen) and ERBS (12 9% hydrogen) fuels, and with fuel-air ratios nominally from 0 008 to 0 021 Spectral radiation data, total radiant heat flux data, and liner temperature data are presented to illustrate the flame radiation characteristics and effects in the primary, secondary, and tertiary combustion zones.
Author

N83-29238# Naval Academy, Annapolis, Md Hydromechanics Lab.
AN EXPERIMENTAL STUDY OF A HIGH ROTATIONAL SPEED PROPULSOR
A. F LEHMAN (Lehman (A. F) Associates, Inc , Centerport, N Y) and J HILL Jan 1983 69 p refs
(AD-A126060, USNA-EW-01-83) Avail: NTIS HC A04/MF A01 CSCL 21E

A study of an ultra-high rotational speed propulsor, including experimental results, is detailed. The propulsor consists of a helix vane system encapsulated by a thin shell, with a fixed shroud at the exit to convert the radial and rotational velocity components into an axial velocity The necessity of including the velocity wake deficit of the propulsor (itself) in the design considerations is described
Author (GRA)

N83-29239# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div
GAS TURBINES FOR THE PRODUCTION OF ELECTRICAL AND THERMAL ENERGY
V. POTOCNIK 28 Jan. 1983 30 p refs Transl into ENGLISH from Energija (Yugoslavia), no 11-2, 1973 p 375-384
(AD-A126182; FTD-ID(RS)T-1611-82) Avail NTIS HC A03/MF A01 CSCL 21E

Basic types of gas turbines are described. A review is presented of the application of gas turbines to the production of electrical and thermal energy. Trends in potential development are discussed
R J F

N83-29240# Deutsche Gold- und Silber-Scheideanstalt, Frankfurt am Main (West Germany) Fertigungstechnik Metall.
GAS TURBINE PARTS MADE OF INJECTION MOLDED SILICON NITRIDE Final Report, Sep. 1981
E. LANGE and N MUELLER Bonn Bundesministerium fuer Forschung und Technologie Mar 1983 39 p In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-83-021, ISSN-0340-7608) Avail NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 8

The improvement of the injection molding process for the production of gas turbine parts made of silicon nitride is dealt with Different turbine parts were fabricated in series of 100 to 1000 parts, and were tested. The quality of smaller parts such as turbine blades and vanes is considerably improved An average 4-point bending strength of 350 N/sqmm with Weibull values near 20 is achieved In spin tests rotor blades achieve the specified value of 65 000 1/min without damage Turbine parts with large volumes, such as rotor hubs can not be fabricated without any failure.
Author (ESA)

N83-29241# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
ENGINE HANDLING
Feb. 1983 419 p refs Symp held at Marathon, Greece, 11-14 Oct 1982
(AGARD-CP-324, ISBN-92-835-0327-9) Avail NTIS HC A18/MF A01

Several areas of engine handling were addressed including design analysis, military aircraft engines, thermal transient effects, aerothermodynamic interactions, compressor systems, and control system concepts.

N83-29242# Motoren- und Turbinen-Union Muenchen G m b H (West Germany)
SOME GENERAL TOPICS IN THE FIELD OF ENGINE HANDLING
K BAUERFEIND *In* AGARD Eng. Handling 14 p Feb 1983 refs
Avail· NTIS HC A18/MF A01

A general definition of engine handling can probably be given as achieving a desired state with a minimum of manual effort in the shortest possible time without any undue safety risks. The desired state may comprise such general items as combat readiness or a more specific item like a certain performance level Engine transient operations as a response to throttle changes represent one of the most critical handling aspects with respect to a potential danger of stalling a compressor under adverse conditions and/or wearing out components These detrimental effects may have a large influence on the life cycle costs of a weapon system as well as on its effectiveness. Based on good engine/afterburner thermodynamic models for both steady state and transient performance the use of advanced control concepts in conjunction with digital controls will lead towards optimized transients and a more even distribution of safety margins With the modern digital control boxes there is also a trend and a potential available to include and integrate more and more functions and features directed at fault diagnosis and/or component life accounting Author

N83-29243# Pratt and Whitney Aircraft, West Palm Beach, Fla Government Products Div
DESIGNING FOR FIGHTER ENGINE TRANSIENTS
B L. KOFF *In* AGARD Eng Handling 15 p Feb 1983
Avail: NTIS HC A18/MF A01

Operational experience with high performance fighter engines has highlighted the effects of thermal transients on performance, durability, weight and cost as an increasingly important consideration in engine design. Transient thermals within the engine, resulting from rapid throttle movements, cause changes in radial and axial clearances, variable stator vane position, rotor balance, hot part stresses and aerodynamic matching of components The effect of these transients causing differential thermal expansion and aerodynamic mismatching of components must be accounted for in the design to avoid maintenance action resulting from abnormal engine operation such as stall, high fuel usage and excessive vibration The component design involving configuration, materials selection, structural analysis and producibility is strongly influenced by the thermal response of rotors, cases, seals, sensors and hot section parts. Author

N83-29244# Aeroplane and Armament Experimental Establishment, Boscombe Down (England) Performance and Trials Management Div
THE CRITERIA USED FOR ASSESSING ACCEPTABLE ENGINE HANDLING ON UK MILITARY AIRCRAFT
E J. BULL *In* AGARD Eng. Handling 11 p Feb. 1983 refs
Avail: NTIS HC A18/MF A01

The criteria used to assess the acceptability of engine handling qualities and operating procedures for Service use is reviewed. Criteria discussed include those used to assess engine behavior and response during starting, relighting, throttle movement (in both dry power and reheat range), changes in flight condition, and changes in intake conditions caused by gunfire and weapon delivery. The factors to be considered in establishing these criteria are multifarious and it is not possible to generalize because of the differences posed by different engine installations and operational roles The qualities that were found necessary during recent trials to meet the required levels of safety and operational effectiveness were discussed The application of these criteria in the definition of engine operating limits and procedures for Service user were discussed. Author

N83-29245# Messerschmitt-Boelkow-Blohm G m b H., Munich (West Germany).
A LOOK AT ENGINE HANDLING ASPECTS FROM AIRCRAFT FLIGHT TEST EXPERIENCE; WITH AN OUTLOOK FOR FUTURE REQUIREMENTS
H FICHTER and E HIENZ *In* AGARD Eng. Handling 18 p Feb 1983 refs
Avail NTIS HC A18/MF A01

The question of airframe/engine compatibility with regard to engine handling under high incidence and various power off-takes assumed special significance as the engine (RB 199 in Tornado) was gradually approaching its production configuration The effort at localizing and quantifying the somewhat lower than predicted compatibility between airframe and engine involves two separate approaches: full-scale (development aircraft) trials, model tests During the course of flight testing, various palliatives designed to improve engine handling were successfully implemented These modifications were developed by means of model trials and later verified in flight tests, ascertaining safe and full handling capability even at the corner points of operational conditions. Further requirements, as viewed for advanced projects, will cover an extended handling envelope. High maneuverability may put some additional strains on aircraft engine integration Author

N83-29246# Technische Hochschule, Aachen (West Germany). Inst. for Jet Propulsion and Turbomachinery.
OPERATIONAL ENGINE USAGE
W. KOSCHEL *In* AGARD Eng Handling 17 p Feb. 1983 refs
Avail NTIS HC A18/MF A01

The flight data recording system LEADS 200 was introduced into a F104G wing of the German Air Force for aircraft and engine maintenance purposes some years ago. The LEADS 200 airborne system components and ground based central flight data processor are described in short below The main evaluation routines for the engine data used by the maintenance personnel refer to the engine condition monitoring and fault diagnosis Only for test purposes an engine cycle counting program which registers the variations of selected engine parameters of each flight, was added in order to obtain information on the operational engine usage. The records of these engine cycle counts were evaluated for 1450 flights with 12 different aircrafts and set into relation to the LCF damage of the engine transients Some results of this analysis and the impacts of the aircraft configuration of the mission type and of the pilot's handling upon the engine usage are discussed Author

N83-29247# French Air Force, Paris.
HANDLING COMBAT ENGINES: THE PILOTS VIEWPOINT [PILOTABILITE DES MOTEURS DE COMBAT: LE POINT DE VUE DU PILOTE]
M. ROUGEVIN-BAVILLE *In* AGARD Eng Handling 8 p Feb 1983 In FRENCH
Avail NTIS HC A18/MF A01

To permit the combat pilot to devote himself to his mission, engine management must be made easier suppression or simplification or briefings, improvement of the throttle level and control instruments; and operation of supplemental devices such as automatic throttle levers or computers for optimizing fuel consumption. These improvements come about by more powerful integration of the engine in the aircraft. The Mirage 2000 aircraft suggests simple and effective solution to the problem of thrust control Transl by A R H

N83-29248# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
FLIGHT TEST EXPERIENCE ON MILITARY AIRCRAFT ENGINE HANDLING
G GOTHAN (BWB - LG) and H SIEVERS (BWB - LG) *In its* Eng Handling 9 p Feb. 1983
Avail NTIS HC A18/MF A01

With the overall testing of a weapon system the assessment of the engine handling characteristics represents a specific and very important field, since engine handling affects the value of the weapon system considerably Starting to prepare a test program for the assessment of engine handling characteristics, the following three essential aspects which determined the scope of testing are considered the fact that it is an official test, the mission of the weapon system, and the specific technical characteristics of the engine. Author

N83-29249# National Defence Headquarters, Ottawa (Ontario) Directorate of Aircraft Engineering and Maintenance
THROTTLE HANDLING RELATED TO J85 ENGINE PERFORMANCE AND DURABILITY: CANADIAN FORCES EXPERIENCE
R. HASTINGS and W. L MACMILLAN *In* AGARD Eng Handling 19 p Feb 1983 refs
Avail NTIS HC A18/MF A01

Because engine handling can impact two critical areas of engine operation - compressor stall margin and engine durability - the Canadian Forces undertook a flight test program with CF-5 aircraft, employed as an advanced jet trainer and close air support fighter, and Tutor aircraft, employed as primary jet trainers and as a flight demonstration team aircraft. Both aircraft types use versions of the J85 engine. Throttle handling data obtained over a wide variety of missions, from normal training to ground attack, ACM, and demonstration team flying are presented The methods used to relate mission profile data to mission severity factors are described The resulting low cycle fatigue life predictions are compared with actual component overhaul rejection data In connection with CF-5 aircraft compressor stall investigations, the flight test program was successful in identifying throttle techniques involving the use of engine antiice, which improved compressor stall margin under certain conditions Author

N83-29251# KHD Luftfahrttechnik G.m.b.H , Oberursel (West Germany).
EXPERIENCE WITH THE KHD APU T312 FOR A MODERN FIGHTER TYPE
K. PIEL *In* AGARD Eng Handling 15 p Feb 1983 refs
Avail: NTIS HC A18/MF A01

A short description is given of the APU T 312 as a lightweight single spool gas turbine. The installation into the aircraft compartment requires a very short overall length The solution as to an optimized air inlet is shown. A survey is given on in service experience of the deterioration of compressor efficiency due to air contamination and eventual corrective actions. Cold start capability associated with modern aircraft lubricants is discussed as well as a proposed inflight restart procedure. Author

N83-29252# Rolls-Royce Ltd , Derby (England). Technical Design Group
MECHANICAL AND THERMAL EFFECTS ON THE TRANSIENT AND STEADY STATE COMPONENT PERFORMANCE OF GAS TURBINES
P. F NEAL *In* AGARD Eng. Handling 10 p Feb. 1983 refs
Avail. NTIS HC A18/MF A01

Gas turbines in a flight installation are subjected to varying mechanical and thermal loading which produces relative deflections between rotating and stationary components The relative movement usually occurs during transient operation of the engine and results in varying tip clearances, annulus spoiling and increased/decreased seal mass flows If rubbing and wear occurs during the transient phase, steady state performance of the compressor and turbines may be impaired usually leading to higher fuel consumption, loss of surge margin and higher flame temperatures. The mechanical design of components to minimize transient performance loss can be severely inhibited by cyclic life, weight, mechanical integrity, operational requirements and production testing considerations It follows that the optimized mechanical design of components to achieve the best overall performance of gas turbines is usually a compromise based on a trade-off between these conflicting requirements. The origin and magnitude of the transient variation in radial and axial deflections during engine operation in flight together with an assessment of the losses produced during transient and steady state engine operation are discussed Author

N83-29253# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France)
THE MATRIX OF AXIAL AND RADIAL PLAYS: THE PRESENT SITUATION AND PERSPECTIVES [MAITRISE DES JEUX AXIAUX ET RADIAUX SITUATION ACTUELLE ET PERSPECTIVES]
J. P. LAGRANGE *In* AGARD Eng Handling 19 p Feb 1983 refs In FRENCH
Avail NTIS HC A18/MF A01

The prediction and calculation of axial and radial play of turbojets has increasing importance because of their direct effect on performance and maneuverability The different criteria that each type of play should fill, whether for civil or military engines, are presented by specifying the computation methods usually employed Several typical examples of problems encountered are described as well as the corrective actions to be taken, which should result from compromised performances/mass cost. Perspectives for the short and medium term improvement of prediction models and control techniques are addressed Transl. by A.R H

N83-29254# Motoren- und Turbinen-Union Muenchen G m b H. (West Germany)
TURBINE TIP CLEARANCE CONTROL IN GAS TURBINE ENGINES
D K HENNECKE and K TRAPPMANN *In* AGARD Eng Handling 12 p Feb 1983 refs
Avail: NTIS HC A18/MF A01

High aerodynamic efficiencies of the turbomachinery of modern aero-engines are only possible if tight tip clearances are achieved by proper thermal matching of rotor and casing This paper describes various possibilities of passive and active tip clearance control systems that are designed to avoid large rub-ins as well as excessively large gaps during transient operation whilst maintaining very tight clearances during steady-state operation. The impact of these systems on the mechanical design is discussed Advanced clearance control configurations are described for two actual examples, i.e., the gas generator turbine of a shaft power engine for helicopters and the low-pressure turbine of a large turbofan engine for transport aircraft The results of the analytical and mechanical designs are presented and the benefits are demonstrated Author

N83-29255# Glasgow Univ. (Scotland) Dept of Mechanical Engineering
MODELS FOR PREDICTING TIP CLEARANCE CHANGES IN GAS TURBINES
P. PILIDIS and N. R L. MACCALLUM *In* AGARD Eng. Handling 10 p Feb 1983 refs
Avail: NTIS HC A18/MF A01

Clearances at compressor and turbine blade tips and seals alter during and following transients These changes affect the performance of the components of the engine A model was developed to predict these clearance changes The model divides the stage into casing, blade and disc sections, the disc being split into three elements. A simplified version was produced for inclusion in engine transient performance programs As an illustration the models were applied to the H P Compressor of a two-spool by-pass engine, and to two seals controlling bleed and cooling flows The results indicate that the effect of compressor blade tip clearance is small More significant are the effects of the seal clearance changes. Author

N83-29256# National Aerospace Lab, Amsterdam (Netherlands)

DETERIORATION IN SERVICE OF ENGINE TRANSIENT BEHAVIOUR

J. P. K VLEGHERT *In* AGARD Eng. Handling 13 p Feb. 1983 refs

Avail· NTIS HC A18/MF A01

A qualitative survey is given of conditions that may lead to stall and the measures that are designed to prevent it, provided the controls are rigged properly A distinction is made between low corrected speed stall which is often rotating and stable, and rear stage stall which results in surge. Finally two case histories are given which describes some modifications of the standard diagnostic procedures to track down the reason for stall, as well as modified tolerances to improve stall margin Author

N83-29257# Rolls-Royce Ltd, Bristol (England) Installation Aerodynamics Group

EFFECTS OF INTAKE FLOW DISTORTION ON ENGINE STABILITY

R G. HERCOCK *In* AGARD Eng. Handling 20 p Feb. 1983 refs

Avail. NTIS HC A18/MF A01

Topics covered encompass inlet/engine flow-field interactions and synthesis of time-variant total-pressure distortion using limited high-response pitot instrumentation with turbulent flow modelling Fundamental aspects of the spool-coupling process are addressed using theoretical methods and extended semi-empirical mathematical models of the developed parallel-compressor type. Problems that need to be resolved in the area of compressor dynamic response are discussed Future requirements for assessing the distabilizing influence of temperature distortion are outlined Author

N83-29258# Office National d'Etudes et de Recherches Aeronautiques, Paris (France)

TEST FACILITY FOR BASIC RESEARCH ON DISTORTION

J. HUARD *In* AGARD Eng Handling 17 p Feb 1983 refs In FRENCH; ENGLISH summary

Avail NTIS HC A18/MF A01

An experimental test facility designed for basic research on the transmission of an inlet distorsion through a single stage axial flow compressor was realized The following conditions had to be met with no distorsion imposed at the inlet, the flow has to be as uniform as possible; the inlet channel must be as long as possible in order to insure a well defined distorsion pattern when a distorsion screen is used, any change in compressor configuration must be easy; and the test instrumentation must give a detailed analysis of the flow in three dimensions. The test facility that was realized with these requirements is described. Results obtained with a stationary and a non-stationary distorsion are presented. Author

N83-29259# Glasgow Univ. (Scotland). Dept. of Mechanical Engineering.

AXIAL COMPRESSOR CHARACTERISTICS DURING TRANSIENTS

N. R L. MACCALLUM *In* AGARD Eng Handling 13 p Feb. 1983 refs

Avail NTIS HC A18/MF A01

The anticipated effects of heat transfer on the characteristics of an axial-flow air compressor were estimated using two different prediction methods. The second method, which incorporates end-wall boundary layers, predicted somewhat smaller changes of characteristics than those indicated by the earlier method. As the second method uses a model of the flow which is probably more realistic, for the present it is considered that its predictions on heat transfer effects on characteristics are more accurate In an altitude deceleration of a typical 12-stage compressor it is therefore estimated that surge margins might be reduced by about 20 or 25% In a sea-level acceleration there are similar increases in surge margins, as compared to adiabatic characteristics. Decreasing the stagger angle increases slightly the susceptibility to characteristics being altered due to heat transfer effects in transients Author

N83-29260# Detroit Diesel Allison, Indianapolis, Ind.

APPLICATIONS OF A COMPRESSION SYSTEM STABILITY MODEL

S. BAGHDADI *In* AGARD Eng. Handling 15 p Feb 1983 refs

Avail: NTIS HC A18/MF A01

A mathematical model for compression system aerodynamic stability is presented and discussed. The model is applied to simulate several situations in which the operational stability of aircraft gas turbine engines is compromised, including radial and circumferential inlet pressure and/or temperature distortion, planar inlet pressure pulsations, hot gas ingestion resulting from armament firing, sudden variable geometry resets, and compressor stalling behavior The theoretical results are validated by comparison with relevant test data Author

N83-29261# General Electric Co, Evendale, Ohio. Aircraft Engine Business Group.

MODELLING COMPRESSION COMPONENT STABILITY CHARACTERISTICS: EFFECTS OF INLET DISTORTION AND FAN BYPASS DUCT DISTURBANCES

W G STEENKEN *In* AGARD Eng. Handling 15 p Feb 1983 refs

Avail NTIS HC A18/MF A01

Two extensions to quasi-one dimensional, time dependent aerodynamic stability, digital computer model are presented. These extensions permit studying turbofan compression systems where, in one case, radial variations are important and, in the other, where circumferential variations are important The basic equations used in the radial flow redistribution model and in the circumferential flow redistribution model are presented The features of this computer model which lead to inherent numerical stability are discussed. The turbofan system which is being modeled in each case is described, and the manner in which a solution is obtained is presented. The capabilities of the radial flow redistribution model are illustrated by examining the propagation characteristics of a pulse such as might be initiated by augmentor hard lights. Also, the effect of splitter location on pulse propagation is illustrated The capabilities of the circumferential flow redistribution model are illustrated by coupling it with a parallel compressor model of a fan component to obtain an estimate of the loss in surge pressure ratio due to a 180 deg inlet total pressure distortion The estimates obtained using both a parallel compressor model and the circumferential flow redistribution parallel compressor model are compared with test data. Author

N83-29262# Carleton Univ, Ottawa (Ontario) Dept. of Mechanical and Aeronautical Engineering

AN OVERVIEW OF ENGINE DYNAMIC RESPONSE AND MATHEMATICAL MODELING CONCEPTS

H. I H. SARAVANAMUTTOO (GasTOPS Ltd) and B D. MACISAAC (GasTOPS Ltd) *In* AGARD Eng Handling 13 p Feb. 1983 refs

Avail. NTIS HC A18/MF A01

The problem of the dynamic response of gas turbines based on fundamental concepts of aerothermodynamic matching of components, leading to a physical understanding of engine behavior and the resulting control requirements is introduced Although the basic principles are straightforward, implementation requires the use of mathematical models of varying degrees of sophistication. The development of advanced fighter aircraft requires careful integration of engine, control systems and aircraft installation and there must be free exchange of information between the various participants The various approaches to modelling of engine response, the evolution of computing facilities and the differing requirements of manufacturers and users are discussed. Author

N83-29263# Technische Universitaet, Munich (West Germany).
GENERALIZED DIGITAL SIMULATION TECHNIQUE WITH VARIABLE ENGINE PARAMETER INPUT FOR STEADY STATE AND TRANSIENT BEHAVIOUR OF AERO GAS TURBINES
H RICK and W MUGGLI *In* AGARD Eng Handling 20 p Feb 1983 refs
Avail NTIS HC A18/MF A01

Computerized simulation of aircraft gas turbine engines was used to investigate powerplant and aircraft systems A generalized digital simulation technique with variable engine parameter input for steady state and transient behavior of typical turbine engines as turbojet, turboprop and especially helicopter engines with and without heat exchanger and variable turbine is presented. Examples are shown of helicopter flights close to the ground at low speeds in complex flow environment as a result of different interaction effects. E.A.K

N83-29264# National Gas Turbine Establishment, Pyestock (England)
IMPROVEMENTS IN THE DYNAMIC SIMULATION OF GAS TURBINES
R. A ONIONS and A M FOSS *In* AGARD Eng. Handling 16 p Feb. 1983 refs
Avail NTIS HC A18/MF A01

Thermodynamic simulations which were used to predict both steady state and dynamic engine performance, important for engine and control system designers to make predictions without recourse to expensive engine running The current status of these models and the extent to which they are capable of reproducing engine performance is reviewed Simulations based on steady state component characteristics, known inertias and air volumes have not necessarily been capable of predicting the transient response of real engines under all circumstances. While it is possible to alter the assumed inertias of the rotors to tailor the response of the simulation to that of the real engine, this is not physically justified Alternative approaches aimed at more accurate prediction of the fastest transients are outlined It is shown that the critical period of an acceleration is during the first fraction of a second. Current models could give misleading results and a stage by stage representation of the compressor should give a more accurate representation. The concepts and techniques of the model together with a comparison of accelerations are presented E.A K

N83-29265# ARO, Inc , Arnold Air Force Station, Tenn.
TECHNIQUES FOR DETERMINING ENGINE STALL RECOVERY CHARACTERISTICS
G. T PATTERSON *In* AGARD Eng Handling 14 p Feb. 1983 refs
Avail· NTIS HC A18/MF A01

Stall of a compression system component in a gas turbine engine results in engine surge followed by rapid and violent poststall behavior The poststall behavior is characterized by the response of one component or the interaction between engine components Experimental investigations of engine stall propagation and recovery require techniques which will characterize component transient and dynamic performance and component interactions during the stall and poststall event. Test, instrumentation, data processing, and analysis techniques were employed in the systematic evaluation of engine stall characteristics The application of these techniques to the evaluation of stall characteristics of mixed flow augmented turbofan engines is discussed This includes: (1) an overview of stall inducing test techniques necessary for producing engine stall in a simulated test environment; (2) instrumentation necessary in both response and extent for determining dynamics of the engine flow path and engine control response; and (3) digital and analog data acquisition, data processing digital form, and analysis which primarily utilizes digital techniques and graphics display E A K.

N83-29266# Pratt and Whitney Aircraft, West Palm Beach, Fla Government Products Div
DESIGNING FOR STABILITY IN ADVANCED TURBINE ENGINES
H. D STETSON *In* AGARD Eng Handling 11 p Feb. 1983 refs
Avail NTIS HC A18/MF A01

One of the most critical functional problems which are encountered by a high technology turbine engine is nonrecoverable stall The only effective means of clearing the nonrecoverable stall is engine shutdown and subsequent airstart, potentially impacting the effectiveness of the weapon system. The design improvements required to make the system more tolerant to the operational environment are addressed The establishment of design criteria to be applied in the preliminary engine design phase to ensure resistance/avoidance of nonrecoverable stalls while ensuring adequate engine operability in the form of airstart capability and engine throttle response are discussed The mechanisms of rotating stall, the design improvements to resist/avoid rotating stall, their projected effectiveness in reducing operational problems, and engine test results of some of these design improvements are identified. E A K

N83-29267# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France) Centre d'Etudes et de Recherches
THE MODERN CONCEPT OF ACCELERATION CONTROL: INTRODUCTION TO OPTIMAL COMMAND IN A HANDLING BY OBJECTIVE STRUCTURE [CONCEPT MODERN DE CONTROLE DE L'ACCELERATION: INTRODUCTION DE COMMANDE OPTIMALE DANS UNE STRUCTURE DE PILOTAGE PAR OBJECTIF]
C. BARROUIL and J. DELMAS *In* AGARD Eng Handling 9 p Feb. 1983 In FRENCH
Avail NTIS HC A18/MF A01

Theoretical studies carried out on an aircraft engine usually employ a linear representation of the system studied. This approach is perfectly justified for computing the regulation gain at a stabilized operating point. To study the change of regime, a nonlinear representation is more precise but the mathematical tools of investigation are more delicate to use. Results are presented of a study undertaken at by DRET and conducted in collaboration with SNECMA during which the results of a nonlinear study of transition were integrated with a linear study of regulation in the same regulator Transl by A.R H

N83-29268# National Gas Turbine Establishment, Pyestock (England)
A NEW APPROACH TO REHEAT CONTROL
M. J. PORTER *In* AGARD Eng. Handling 11 p Feb 1983 refs
Avail NTIS HC A18/MF A01

The task of the reheat (afterburner) control system is to provide as rapid a thrust response as possible without exceeding reheat stability limits or engine limits As there is at least one reheat fuel flow to control and also a variable nozzle area to control, a variety of control strategies are considered. A closed loop controller, incorporating automatic buzz-avoidance is described and the results of an engine test bed evaluation are presented. E.A.K.

N83-29269# Grumman Aerospace Corp , Bethpage, N.Y
POTENTIAL BENEFITS OF A FULL AUTHORITY DIGITAL ELECTRONIC CONTROL (FADEC) INSTALLED ON A TF30 ENGINE IN AN F14 FLIGHT TEST DEMONSTRATOR AIRCRAFT
C A. HOELZER, W. H NUFER, R H. TINDELL, and R W. VIZZINI (NAPC) *In* AGARD Eng. Handling 17 p Feb. 1983 refs
Avail: NTIS HC A18/MF A01

A systems analysis, preliminary installation design, and flight test definition for an integrated F-14/TF30/FADEC demonstrator aircraft flight test configuration was completed The modifications, tests, and installation support to incorporate FADEC's on the TF30, were defined. An overall plan for the F14 design and modifications, procurement, fabrication, ground test and flight test program was developed The program includes a 22 flight development demonstration of F-14/TF30/FADEC fuel controls technology and inlet control on an F14 aircraft. The major tasks include design and development of the FADEC on the TF30, and the planning and performance of systems, sea level and altitude chamber tests Many potential areas of F14 and TF30 generic or general aircraft and propulsion system benefits which could be accrued through the use of integrated aircraft/engine FADEC technology are identified These include improved air inlet engine compatibility, improved propulsion system reliability and maintainability, increased loiter time, mission fuel savings, reduction in weight, and incorporation of some F14 propulsion system independent features into FADEC. E A.K.

08

AIRCRAFT STABILITY AND CONTROL

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

A83-37065*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif.

SPACE SHUTTLE STABILITY AND CONTROL DERIVATIVES ESTIMATED FROM THE FIRST ENTRY

K. W ILIFF, R. E MAINE (NASA, Flight Research Center, Edwards, CA), and D. R. COOKE (NASA, Johnson Space Center, Houston, TX) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 6, July-Aug 1983, p 264-271. refs

Previously cited in issue 03, p 333, Accession no A82-13880

A83-37066#

STABILITY OF AIRCRAFT MOTION IN CRITICAL CASES

J E. COCHRAN, JR and C.-S HO (Auburn University, Auburn, AL) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol 6, July-Aug 1983, p 272-279. Research supported by the Auburn University. refs

Previously cited in issue 21, p. 3626, Accession no A81-44577

A83-37067#

ANGULAR MOTION OF A SPINNING PROJECTILE WITH A VISCOUS LIQUID PAYLOAD

C. H MURPHY (U S. Army, Ballistics Research Laboratories, Aberdeen Proving Ground, MD) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol 6, July-Aug 1983, p 280-286. refs

Previously cited in issue 19, p. 2983, Accession no A82-39116

A83-37080

BIFURCATION AND LIMIT CYCLE ANALYSIS OF NONLINEAR SYSTEMS WITH AN APPLICATION TO AIRCRAFT AT HIGH ANGLES OF ATTACK

J. V CARROLL and R K. MEHRA (Scientific Systems, Inc., Cambridge, MA) IN American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1982, p. 23-27. refs

A new approach is presented for analyzing nonlinear and high angle of attack dynamic behavior and stability of aircraft This approach involves the application of bifurcation analysis and catastrophe theory methodology to specific phenomena such as stall, departure, spin entry, flat and steep spin, nose slice, and wing rock. Quantitative results of a global nature are generated using numerical techniques based on parametric continuation. The methodology's provision of a complete representation of the aircraft equilibrium and bifurcation surfaces in the state-control space, using a rigid body model with aerodynamic controls is discussed. Also presented is a particularly useful extension of continuation methods to the detection and stability analysis of stable attracting orbits (limit cycles) The use of this methodology for understanding high angle of attack phenomena, especially spin-related behavior, is discussed Author

A83-37145* Drexel Univ., Philadelphia, Pa.

A VARIABLE STRUCTURE APPROACH TO ROBUST CONTROL OF VTOL AIRCRAFT

A. J CALISE and F. KRAMER (Drexel University, Philadelphia, PA) IN. American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 1046-1052 refs
(Contract N00019-81-C-0178, NAG2-8)

This paper examines the application of variable structure control theory to the design of a flight control system for the AV-8A Harrier in a hover mode The objective in variable structure design is to confine the motion to a subspace of the total state space The motion in this subspace is insensitive to system parameter variations and external disturbances that lie in the range space of the control A switching type of control law results from the design procedure The control system was designed to track a vector velocity command defined in the body frame For comparison purposes, a proportional controller was designed using optimal linear regulator theory Both control designs were first evaluated for transient response performance using a linearized model, then a nonlinear simulation study of a hovering approach to landing was conducted Wind turbulence was modeled using a 1052 destroyer class air wake model. Author

A83-38000

FLIGHT AT SUPERNORMAL ATTITUDES

T. H STROM and W. J. ALFORD, JR. (Dynamic Engineering, Inc , Newport News, VA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 19 p. refs
(SAE PAPER 821469)

In Supernormal Flight (SNF), the aircraft's wing is either partially or completely stalled, while the longitudinal stabilizing and control surfaces are deflected to approximately the same magnitude, but of opposite sign, as the aircraft's angle of attack so that they remain effective through large ranges (approaching 90 deg) of angles of attack, pitch, and flight path. Some potential advantages of SNF include: improved safety through prevention of spins, rapid recovery from undesirable stalls and spins, steep descents and approaches to landings; precise, steep, survivable recoveries of remotely piloted vehicles (RPVs); and enhanced maneuverability and agility Free-flight, wind tunnel, and analytic results are presented on example aircraft models to illustrate and substantiate the proposed applications and advantages. Author

A83-38666*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HIGH ANGLE-OF-ATTACK FLIGHT DYNAMICS OF A FORWARD-SWEPT WING FIGHTER CONFIGURATION

D G MURRI, M. A CROOM, and L. T NGUYEN (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 13 p refs
(AIAA PAPER 83-1837)

As part of a forward-swept wing technology development effort, the Defense Advanced Research Projects Agency (DARPA), and the NASA Langley Research Center are conducting a cooperative research program to investigate the high angle-of-attack, stall and spin characteristics associated with the forward-swept wing concept. The studies are centered around the X-29A configuration which is being built to flight demonstrate the application of forward-swept wing technology to a fighter class airplane The program includes static and dynamic wind-tunnel force tests, free-flight model tests, drop-model tests, spin-tunnel tests, and piloted simulation studies. Selected results are presented from the Langley research program on the X-29A configuration with emphasis on the high-alpha aerodynamics and the vehicle component contributions to these characteristics The effects of

these aerodynamic characteristics on the overall high-alpha flying qualities of the configuration are discussed in terms of results of the wind-tunnel free-flight tests and the piloted simulation study
Author

A83-38668#
AERODYNAMICS CHARACTERISTICS OF A CANARD CONTROLLED HIGH FINENESS RATIO MISSILE
D. W EASTMAN (Boeing Aerospace Co , Seattle, WA) American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 7 p.
(AIAA PAPER 83-1839)

Wind tunnel tests were conducted on a canard controlled missile having a body fineness ratio of 21.8 at Mach numbers from 0.6 to 2 2. The canards were located in the horizontal plane only and were small compared to the body size Tests of the body alone indicated that its center of pressure at transonic speeds was significantly ahead of the location predicted by viscous crossflow theory. There was no extreme loss in canard roll control effectiveness due to adverse interference effects on the tails As angle of attack increased, adverse roll control interference decreased and eventually favorable interference occurred Best roll control was achieved with the canards in the pitch plane
Author

A83-38669*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
THE EVALUATION OF THE ROLLING MOMENTS INDUCED BY WRAPAROUND FINS
A SEGINER (NASA, Ames Research Center, Moffett Field, CA, Technion Israel Institute of Technology, Haifa, Israel) and B BAR-HAIM American Institute of Aeronautics and Astronautics, Applied Aerodynamics Conference, Danvers, MA, July 13-15, 1983. 11 p refs
(AIAA PAPER 83-1840)

A possible reason is suggested for the induced rolling moments occurring on wraparound-fin configurations in subsonic flight at zero angle of attack. The subsonic potential flow over the configuration at zero incidence is solved numerically The body is simulated by a distribution of sources along its axis, and the fins are described by a vortex-lattice method. It is shown that rolling moments can be induced on the antisymmetric fins by the radial flow generated at the base of the configuration, either over the converging separated wake, or over the diverging plume of rocket motor
Author

A83-38916#
DYNAMICS OF THE STARS AEROSTAT
S. P. JONES, J A KRAUSMAN, and B. D SUNKARA (TCOM Corp , Columbia, MD) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 124-131 refs
(AIAA PAPER 83-1990)

The STARS is a small tethered aerostat with inverted-Y fins and a large windscreen An aerodynamic model of this aerostat was derived from wind tunnel data and applied to the study of its dynamic characteristics by non-linear simulations and stability analysis Hull and fin efficiency factors, cross-flow drag coefficients, lateral fin interference factors and other aerodynamic parameters computed from wind tunnel data and the geometry of the vehicle were used to derive a segmented mathematical model Stability analysis based on the analytical model shows all modes to be stable and similar to those reported for other tethered aerostats The response to turbulence obtained by non-linear simulations is reported in terms of rms linear and angular displacements and tether tensions.
Author

A83-39103#
WIND TUNNEL EVALUATION OF TACTICAL AIRCRAFT STABILITY AND CONTROL AS AFFECTED BY NOZZLE THRUST REVERSER PARAMETER VARIATIONS
C CHIARELLI (Northrop Corp , Aircraft Div., Hawthorne, CA) and M. COMPTON (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983. 14 p. refs
(AIAA PAPER 83-1228)

In-flight thrust reversal has been investigated on full-scale tactical aircraft since the early 1950s The Air Force Flight Dynamic Laboratory is currently sponsoring a program entitled 'Generic Thrust Reverser Technology for Near Term Application' The main objective of the program is related to the development of design criteria for the proper placement of thrust reversers and tail surfaces of tactical aircraft so as to avoid stability and control problems during approach and landing The program was started in September 1981 under a contract awarded to an American aerospace company Program completion is scheduled for January 1984 Attention is given to a brief outline of the Air Force Program and the key data obtained for approach conditions on one of the aircraft configurations which were tested. It is concluded that the reverser-induced effects on the directional characteristics are produced by the jet efflux blockage on the vertical tails The rudder effectiveness increases approximately 40 percent for efflux angles of 45 and 60 degrees in the baseline location
G.R

A83-39220
THE EMPLOYMENT OF A MINIATURE CALCULATING DEVICE FOR THE DETERMINATION OF THE CENTER OF GRAVITY [EINSATZ EINES KLEINSTRECHNERS ZUR SCHWERPUNKTBERECHNUNG]
M CASPARI and B GLOECKNER (Interflug Gesellschaft fuer internationalen Flugverkehr mbH, Berlin, East Germany) Technisch-oekonomische Information der zivilen Luftfahrt (ISSN 0232-5012), vol 18, no 6, 1982, p 212-214 In German

Small electronic calculators are increasingly used in many areas of the national economy because they provide a convenient approach for obtaining rapidly accurate solutions in the case of many computational problems A description is presented of an example for such an employment of a calculator, taking into account the use of a programmable calculator for the determination of optimal loading conditions and the calculation of the center of gravity in the case of the aircraft IL-62/IL-62M The position of the center of gravity of the loaded aircraft has an effect on fuel consumption The use of the programmable calculator makes it possible to determine conveniently optimal loading conditions with respect to fuel consumption Magnetic cards are used for introducing programming data and for recording data It has been found that, after a brief introduction, a pilot can work very reliably with the calculator and the program.
G.R

N83-27997 Princeton Univ., N J
LONGITUDINAL FLYING QUALITIES CRITERIA FOR SINGLE PILOT INSTRUMENT FLIGHT OPERATIONS Ph.D. Thesis
A BAR-GILL 1982 253 p
Avail Univ. Microfilms Order No DA8228170

This research used modern estimation and control theory flight testing, and statistical analysis to deduce flying qualities criteria for General Aviation (GA) Single Pilot Instrument Flight Rule (SPIFR) operations Unsatisfactory aircraft dynamic response combined with high navigation/communication workload can produce problems of safety and efficiency First, the relative importance of these factors was determined by flying SPIFR tasks with different aircraft dynamic configurations and assessing the effects of such variations The experimental results yielded quantitative indicators of pilot's performance and workload, and for each of them, multivariate regression was applied to evaluate several candidate flying qualities criteria Aircraft configurations that are representative of the low frequency dynamic and trim related airframe response, and whose ranges of variation cover both the existing light aircraft fleet and recent trends in GA design, were tested Dissert Abstr.

N83-27998*# Hydraulic Research Textron, Valencia, Calif.
APPLICATION OF ACTIVE CONTROL LANDING GEAR TECHNOLOGY TO THE A-10 AIRCRAFT Final Report
I ROSS and R EDSON Jun 1983 130 p refs
(Contract NAS1-17068, NAS1-14459, NAS1-16420)
(NASA-CR-166104; NAS 1 26:166104) Avail. NTIS HC A07/MF A01 CSCL 01C

Two concepts which reduce the A-10 aircraft's wing/gear interface forces as a result of applying active control technology to the main landing gear are described In the first concept, referred to as the alternate concept a servovalve in a closed pressure control loop configuration effectively varies the size of the third stage spool valve orifice which is embedded in the strut. This action allows the internal energy in the strut to shunt hydraulic flow around the metering orifice. The command signal to the loop is reference strut pressure which is compared to the measured strut pressure, the difference being the loop error Thus, the loop effectively varies the spool valve orifice size to maintain the strut pressure, and therefore minimizes the wing/gear interface force referenced S L.

N83-27999# Naval Test Pilot School, Patuxent River, Md
FIXED WING STABILITY AND CONTROL THEORY AND FLIGHT TEST TECHNIQUES. REVISION
1 Nov. 1981 669 p
(AD-A124610; USNTPS-FTM-103-REV) Avail NTIS HC A99/MF A01 CSCL 01B

This manual is primarily a guide for pilots and engineers attending the U.S Naval Test Pilot School The text presents basic fixed wing stability and control theory, qualitative and quantitative test and evaluation techniques, and data presentation methods In most sections, more than one technique is described for each test. Generally, the best technique for a particular investigation will depend on the purpose of the investigation, the amount of instrumentation available and the personal preference of the individual test pilot. The approach of the qualitative stability and control testing presented herein is an attempt to associate all flying qualities tests with particular pilot tasks required in the performance of the total mission of the airplane. The pilot's opinion of a particular flying quality will consequently depend primarily on the pilot workload while performing the desired task. Quantitative evaluation techniques presented may be used to substantiate pilot opinion or gather data for documentation of airplane characteristics. The performance of both qualitative testing and quantitative evaluation is considered essential for any successful flying qualities investigation GRA

N83-28000# Naval Postgraduate School, Monterey, Calif.
CALCULATION OF THE LONGITUDINAL STABILITY DERIVATIVES AND MODES OF MOTION FOR HELICOPTER AIRCRAFT M.S. Thesis
H J ONEILL Oct. 1982 114 p refs
(AD-A125593) Avail: NTIS HC A06/MF A01 CSCL 01C

This thesis presents an analysis of the longitudinal stability derivatives for helicopter aircraft and is intended to be used as a resource document for a helicopter stability and control course at the Naval Postgraduate School. Emphasis is given to the evolution of forces and moments on the helicopter, calculation of the stability derivatives at high advance ratios, derivation of the stability determinant and solution of the characteristic equation to yield the modes of motion of the helicopter Author (GRA)

N83-28001# European Space Agency, Paris (France).
AN OBSERVER APPROACH TO THE IDENTIFICATION AND ISOLATION OF SENSOR FAILURES IN FLIGHT CONTROL SYSTEMS
N. STUCKENBERG Dec 1982 164 p refs Transl. into ENGLISH of "Ein Beitrag zur Erkennung und Isolation von Sensorfehlern in Flugregelsystemen unter Verwendung von Beobachtern" rept. DFVLR-FB-81-26 DFVLR, Brunswick, Jul. 1981
(ESA-TT-738; DFVLR-FB-81-26) Avail NTIS HC A08/MF A01; original German version available from DFVLR, Cologne DM 32

A reliability concept for flight control sensors which provides a duplex sensor configuration with fail-operational capabilities by using analytical redundancy with deterministic observers is presented. Without disregarding disturbances and plant parameter variations, the detection performance was evaluated with respect to the failure signal properties. The concept was applied to a command and stability augmentation system for the lateral motion of the HFB 320 aircraft Author (ESA)

N83-28002# Technische Hogeschool, Delft (Netherlands). Dept of Aerospace Engineering.
OUTPUT FEEDBACK REGULATORS FOR AIRCRAFT AUTOMATIC CONTROL SYSTEMS
P WILBERS and J. A. HOOGSTRATEN Apr 1983 51 p refs
(VTH-LR-339) Avail· NTIS HC A04/MF A01

A design method for linear proportional and linear dynamic output feedback regulators for discrete time systems is presented The system to be controlled is represented by a linear model. The performance criterion is given in the form of a quadratic cost function, weighing the deviations from their reference values of the control input signals, and of the controlled variables (represented as linear combinations of state and input variables) which define the control task. It is shown that the necessary conditions for minimization of the chosen cost function, when employing an output feedback gain matrix, are given by a set of three recurrent relations. Solution of this set of equations yields the elements of the feedback gain matrix. This result is extended to encompass the design of a dynamic output feedback regulator Design of a transport aircraft altitude regulator is outlined Author (ESA)

N83-28003# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering
IDENTIFICATION OF PRIMARY FLIGHT CONTROL SYSTEM CHARACTERISTICS FROM DYNAMIC MEASUREMENTS
J. G DENHOLLANDER Nov. 1982 79 p refs
(VTH-LR-348) Avail· NTIS HC A05/MF A01

A method which formulates an a priori mathematical model of the primary flight control system is presented The model is formulated in a format directly applicable to the analysis of in flight measurements of the motion of the control system relative to the moving aircraft. The model parameters relating the linear and nonlinear model characteristics are extracted from the measurements using multiple regression analysis. Since not all required time varying data can be measured equally well in flight, a separate state reconstruction is performed prior to the regression analysis, by an extended Kalman filtering and smoothing algorithm Data analysis consists of reconstruction of the state of the aircraft, reconstruction of the state of the control system relative to the aircraft and parameter identification by regression analysis. Author (ESA)

N83-29270*# Information and Control Systems, Inc , Hampton, Va

DESIGN, IMPLEMENTATION AND FLIGHT TESTING OF PIF AUTOPILOTS FOR GENERAL AVIATION AIRCRAFT

J R. BROUSSARD Washington NASA Jul. 1983 177 p refs

(Contract NAS1-16303)

(NASA-CR-3709, NAS 1 26.3709, TR-681102) Avail· NTIS HC A09/MF A01 CSCL 01C

The designs of Proportional-Integrated-Filter (PIF) auto-pilots for a General Aviation (NAVION) aircraft are presented The PIF autopilot uses the sampled-data regulator and command generator tracking to determine roll select, pitch select, heading select, altitude select and localizer/glideslope capture and hold autopilot modes. The PIF control law uses typical General Aviation sensors for state feedback, command error integration for command tracking, digital complementary filtering and analog prefiltering for sensor noise suppression, a control filter for computation delay accommodation and the incremental form to eliminate trim values in implementation Theoretical developments described in detail, were needed to combine the sampled-data regulator with command generator tracking for use as a digital flight control system The digital PIF autopilots are evaluated using closed-loop eigenvalues and linear simulations The implementation of the PIF autopilots in a digital flight computer using a high order language (FORTRAN) is briefly described The successful flight test results for each PIF autopilot mode is presented. Author

N83-29271*# Virginia Polytechnic Inst. and State Univ, Blacksburg

STUDY OF AN AUTOMATIC TRAJECTORY FOLLOWING CONTROL SYSTEM Final Report

H. F. VANLANDINGHAM, R L MOOSE, P E ZWICKE, W H. LUCAS, and J D BRINKLEY Hampton, Va NASA Langley Research Center Jul 1983 86 p refs

(Contract NSG-1354)

(NASA-CR-166121, NAS 1 26 166121) Avail NTIS HC A05/MF A01 CSCL 01C

It is shown that the estimator part of the Modified Partitioned Adaptive Controller, (MPAC) developed for nonlinear aircraft dynamics of a small jet transport can adapt to sensor failures In addition, an investigation is made into the potential usefulness of the configuration detection technique used in the MPAC and the failure detection filter is developed that determines how a noise plant output is associated with a line or plane characteristic of a failure It is shown by computer simulation that the estimator part and the configuration detection part of the MPAC can readily adapt to actuator and sensor failures and that the failure detection filter technique cannot detect actuator or sensor failures accurately for this type of system because of the plant modeling errors In addition, it is shown that the decision technique, developed for the failure detection filter, can accurately determine that the plant output is related to the characteristic line or plane in the presence of sensor noise Author

09

RESEARCH AND SUPPORT FACILITIES (AIR)

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

A83-38103

TRANSFILLING AND MAINTENANCE OF OXYGEN CYLINDERS

SAE Aerospace Information Report, AIR 1059A, Oct. 15, 1982, 11 p

(SAE AIR 1059A)

Attention is given to the formulation of a standardized procedure for charging high pressure oxygen cylinders in aviation maintenance facilities that are required by circumstances to perform this task, rather than sending the cylinders to a commercial gas supplier. The suggested filling procedure emphasizes points to be followed in transferring oxygen from one container to another while minimizing the risk of accident, and is primarily concerned with pressure levels,container valves and regulators, sources of supply, and supply manifold precautions O.C

A83-38105

THE COANDA/REFRACTION CONCEPT FOR GAS TURBINE ENGINE TEST CELL NOISE SUPPRESSION

SAE Aerospace Information Report, AIR 1813, June 30, 1982, 22 p. refs

(SAE AIR 1813)

A Coanda/refraction system for suppressing gas turbine engine exhaust noise in ground run-up test cells systems is described. The overall noise characteristics of test cells were determined to be dependent on the contributions from the engine inlet, chamber walls, and the exhaust section. The Coanda effect was exploited in terms of placing walls of a channel a short distance downstream from the exitting jet. The step encouraged formation of trapped vortices between the jet and the walls, and the presence of the walls caused a lowered pressure gradient which caused the jet to move toward the walls in the absence of access to the full ambient atmosphere Steel was selected as the structural material, with inner and outer walls isolated by neoprene. The exhaust was directed upward, and an outside hush-house enclosure ensured that fracted noise in the channel was damped within the room M.S.K

A83-39104*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif

DETERMINING COMPRESSOR-INLET AIRFLOW IN THE COMPACT MULTIMISSION AIRCRAFT PROPULSION SIMULATORS IN WIND-TUNNEL APPLICATIONS

S C. SMITH (NASA, Ames Research Center, Moffett Field, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 15 p. refs

(AIAA PAPER 83-1231)

Test techniques are being developed to use the Compact Multimission Aircraft Propulsion Simulator (CMAPS) in wind-tunnel tests. The CMAPS allows simultaneous simulation of inlet and exhaust flow fields. Static tests have been conducted to acquire CMAPS performance data and to evaluate four methods of determining compressor inlet airflow during wind-tunnel tests The first method measures airflow at the compressor face, the second measures airflow in the compressor discharge duct, the third deduces the compressor airflow from the calibrated nozzle, turbine supply, and turbine bleed airflows, and the fourth correlates compressor airflow with the mixer pressure Test results and the advantages, disadvantages, and expected accuracy of each method are discussed. Author

A83-39816
A NEW STATIC-LAUNCH METHOD FOR PLASTIC BALLOONS
H AKIYAMA, J. NISHIMURA, M NAMIKI, Y OKABE, Y MATSUZAKA, and H. HIROSAWA (Tokyo, University, Tokyo, Japan) (COSPAR, Workshop on Scientific Ballooning - III, Ottawa, Canada, May 16-June 2, 1982) Advances in Space Research (ISSN 0273-1177), vol 3, no 6, 1983, p 97-100.

A new static-launch method that we have developed as an improvement of our former method is described The key procedure is to extend a whole balloon vertically upon the launcher before release, with squeezing the top bubble of the balloon by a soft collar. The new method improved the capability for heavier payload significantly. In 1981, 15 balloons, ranging from 5000-50,000 cu m in volume with a total lift from 150-650 kg, were launched successfully by this new method Author

A83-40619
SIMULATION WHICH SIMULATES LESS
D BOYLE Interavia (ISSN 0020-5168), vol. 38, July 1983, p 736-738.

The capabilities of various simulators used for pilot training and their use in flight schools are discussed Modern simulators are equipped with a range of features, from a simple instrument panel mock-up to computer-generated displays and control and instrument response The simulator may be used in conjuction, prior to, or after initial flight training, and also serves to familiarize pilots with new aircraft and updated avionics displays. Attention can be given to difficult flight situations and instrument failure compensatory procedures The simulators can also be used to train maintenance personnel in fault location, including verifying that indicated malfunctions are not part of the electronics that sense faults. M.S K.

A83-40620
AIR-TO-AIR COMBAT IN A PLASTIC DOME
D. BOYLE Interavia (ISSN 0020-5168), vol 38, July 1983, p 742-744

Physical features and performance capabilities of a fighter aircraft pilot training simulator facility being constructed for the RAF are described. The pilot sits within a realistic cockpit inside a dome on whose surface various air combat scenes are projected Various potentially hostile aircraft, their flight characteristics, and their armaments can be simulated for the student pilot's view. The scene changes in response to the student's actions, or in response to the opposing pilot's actions, which are controlled by a pilot in another dome. Work is progressing on adding third and fourth domes The seat is equipped with hydraulic devices and sliding parts to furnish a semblance of g-forces encountered by a pilot during air combat. The entire system, depending on the total capabilities, can cost as much as $20 million M S.K.

N83-28004# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France) Aerothermodynamics Dept
STUDIES ON THE CRYOGENIC INDUCTION DRIVEN WIND-TUNNEL T2
J. L. GOBERT and A. MIGNOSI 1982 19 p refs Presented at the ETW Cryogenic Technol Rev Meeting, Amsterdam, 15-17 Sep 1982
Avail: NTIS HC A02/MF A01

The transonic induction driven wind-tunnel T2, with a testing section of 38 x 40 square cm pressurized up to 6 bars was transformed into a cryogenic system in 1981 The airflow cooling is provided by a parietal injection of liquid nitrogen in the wind-tunnel An internal insulation preserves most of the tunnel elements and works with runs which last until one minute. The method used for the run starting and the automatic control of the airflow parameters is described A simplified process model allows a mini-computer centralizing all useful data to generate in real time the commands to initate and stabilize the desired temperature and pressure values. The results defining the installation performances and airflow qualities are presented. B.G

N83-28005# Federal Aviation Administration, Washington, D C
ADVISORY CIRCULAR. AIRPORT DESIGN STANDARDS: TRANSPORT AIRPORTS
28 Feb 1983 85 p
(FAA-AC-150/5300-12) Avail: NTIS HC A05/MF A01

Airport geometry, runway design, taxiway design, surface gradient and line-of-sight, the effects of treatment of jet blast, runway and taxiway bridges, taxiway design rationale, and taxiway fillet design are discussed Author

N83-28006*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
MAN-VEHICLE SYSTEMS RESEARCH FACILITY: DESIGN AND OPERATING CHARACTERISTICS
May 1983 17 p
(NASA-TM-84372; A-9371; NAS 1 15:84372) Avail: NTIS HC A02/MF A01 CSCL 14B

The Man-Vehicle Systems Research Facility (MVSRF) provides the capability of simulating aircraft (two with full crews), en route and terminal air traffic control and aircrew interactions, and advanced cockpit (1995) display representative of future generations of aircraft, all within the full mission context. The characteristics of this facility derive from research, addressing critical human factors issues that pertain to: (1) information requirements for the utilization and integration of advanced electronic display systems, (2) the interaction and distribution of responsibilities between aircrews and ground controllers, and (3) the automation of aircrew functions. This research has emphasized the need for high fidelity in simulations and for the capability to conduct full mission simulations of relevant aircraft operations. This report briefly describes the MVSRF design and operating characteristics. S L.

N83-28007# Materials Research Labs., Ascot Vale (Australia)
ELECTRICAL RESISTANCE TESTING OF ANTISTATIC BENCH AND FLOOR SURFACE MATERIAL AFTER LAYING
M G WOLFSON and K. J LEE Aug. 1982 56 p refs
(AD-A125423, MRL-TN-466, AR-003047) Avail· NTIS HC A04/MF A01 CSCL 14B

Large areas of floors and benchtops in the laboratories of the Explosives and Ammunition Composite at Materials Research Laboratories are covered with an antistatic material. Electrical resistance testing of this material afer laying is reported Testing was carried out in accordance with BS 2050 1961 and BS 3398·1961. Author (GRA)

N83-28008# New Mexico Univ, Albuquerque Engineering Research Inst
SOFT AIRFIELD TEST WITH F-4 AIRCRAFT Final Report, May - Sep. 1981
V CASSINO Tyndall AFB, Fla. Air Force Energy and Service Center Dec 1981 99 p
(Contract F29601-81-C-0013; AF PROJ. 2621)
(AD-A125393; NMERI-TA5-4, AFFSC/ESL-TR-82-18) Avail: NTIS HC A05/MF A01 CSCL 08M

Tests were conducted to investigate the interaction of soil surfaces with the landing gear of F-4E aircraft to validate computer prediction routines. Site selection and soil tests are described. In-place soil tests were conducted, and aircraft ground performance was measured during towed and powered taxi operations Soil strength was adequate to support the aircraft for the two loadings used. Laboratory tests were performed to further identify the soil strength parameters Aircraft location while operating on the test area was determined by a ground survey system and a laser tracking system. Author (GRA)

N83-28009# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering.
DESIGN AND EVALUATION OF CASCADE TEST FACILITY M.S. Thesis
D M ALLISON Jun 1982 67 p refs
(AD-A125622; AFIT/GAE/AA/81D-2) Avail NTIS HC A04/MF A01 CSCL 20D

A cascade test facility was designed and built The facility delivers 4 0 lbm/sec of air to the test section with turbulence intensities of 2 1 percent The maximum Reynolds number attainable is 3.24 x 10 to the 6th power per foot. The velocity and turbulence intensity profiles in the flow stream behind the blades were investigated with a hot film anemometer. The fluid turning angle was 30 degrees. The profiles were obtained at 5, 2, and 4 chord lengths downstream from the trailing edges of Reynolds numbers of 2.34, 2 83, and 2 97 million per foot The profiles behind the three center blades of the five blade cascade were very closely matched in all tests cases One major problem in the design, a flow tuning adjustment in the test section, requires redesign, otherwise, the facility is adequate for the testing of compressor and turbine cascades Author (GRA)

N83-28010# Franklin Research Center, Philadelphia, Pa.
COMPUTER CONTROL AND ACTIVATION OF SIX-DEGREE-OF-FREEDOM SIMULATOR Final Report
E G. DAVIES, R CHOU, J STONE, K TSUI, and M Z DARWISH Jan 1983 417 p
(Contract DAAF03-73-C-0142)
(AD-A126126, AD-E400962, ARTSD-SP-81001) Avail NTIS HC A18/MF A01 CSCL 17G

Following the acquisition of a passive multi-degree-of-freedom simulator by the Ware Simulation Section, Rock Island Arsenal, Rock Island, IL, the Franklin Research Center was contracted to design and to make the necessary modifications for conversion from a passive to an activated simulator. This report outlines and details the design philosophy used for providing programmable motions, vibrations, and spring rates required for activating the passive simulator This report also documents the changes required in the hydraulic power supply, the mechanical changes to the yaw and pitch gimbals, and the electronic changes to the spring rate controller GRA

N83-29272*# United Technologies Corp, Stratford, Conn
DEVELOPMENT OF MONOFILAR ROTOR HUB VIBRATION ABSORBER
J DUH and W. MIAO May 1983 91 p refs
(Contract NAS1-16700)
(NASA-CR-166088; NAS 1 26:166088) Avail: NTIS HC A05/MF A01 CSCL 14B

A design and ground test program was conducted to study the performance of the monofilar absorber for vibration reduction on a four-bladed helicopter. A monofilar is a centrifugal tuned two degree-of-freedom rotor hub absorber that provides force attenuation at two frequencies using the same dynamic mass Linear and non-linear analyses of the coupled monofilar/airframe system were developed to study tuning and attenuation characteristics. Based on the analysis, a design was fabricated and impact bench tests verified the calculated non-rotating natural frequencies and mode shapes. Performance characteristics were measured using a rotating absorber test facility These tests showed significant attenuation of fixed-system 4P hub motions due to 3P inplane rotating-system hub forces In addition, detuning effects of the 3P monofilar modal response were small due to the nonlinearities and tuning pin slippage However, attenuation of 4P hub motions due to 5P inplane hub forces was poor The performance of the 5P monofilar modal response was degraded by torsional motion of the dynamic mass relative to the support arm which resulted in binding of the dynamic components Analytical design studies were performed to evaluate this torsional motion problem An alternative design is proposed which may alleviate the torsional motion of the dynamic mass Author

N83-29273*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
MAGNETIC SUSPENSION AND BALANCE SYSTEMS, A SELECTED, ANNOTATED BIBLIOGRAPHY
M H TUTTLE, R A KILGORE, and R P BOYDEN Jul 1983 50 p Revised
(NASA-TM-84661; L-15626, NAS 1 15:84661) Avail NTIS HC A03/MF A01 CSCL 14B

This publication, containing 206 entries, supersedes an earlier bibliography, NASA TM-80225 (April 1980) Citations for 18 documents have been added in this updated version Most of the additions report results of recent studies aimed at increasing the research capabilities of magnetic suspension and balance systems, e g, increasing force and torque capability, increasing angle of attack capability, and increasing overall system reliability. Some of the additions address the problem of scaling from the relatively small size of existing systems to much larger sizes The purpose of this bibliography is to provide an up-to-date list of publications that might be helpful to persons interested in magnetic suspension and balance systems for use in wind tunnels The arrangement is generally chronological by date of publication. However, papers presented at conferences or meetings are placed under dates of presentation The numbers assigned to many of the citations have been changed from those used in the previous bibliography. This has been done in order to allow outdated citations to be removed and some recently discovered older works to be included in their proper chronological order Author

N83-29274# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab
EXPERIMENTAL AERODYNAMIC FACILITIES OF THE AERODYNAMICS RESEARCH AND CONCEPTS ASSISTANCE SECTION
M C MILLER Feb 1983 26 p
(Contract DA PROJ. 1L1-61102-A-71A)
(AD-A126272; ARCSL-SP-83007) Avail NTIS HC A03/MF A01 CSCL 14B

The primary mission involves research and development support related to the aerodynamic and aeroballistic aspects of advanced chemical delivery vehicles. This includes the evaluation and optimization of advanced aerodynamic chemical munition configurations as well as the analysis of the effects of chemical type payloads on their flight performance Secondly, because of the technical expertise of the ARCAS personnel and their special aerodynamic laboratory facilities, the mission also includes providing assistance to ARRADCOM and DOD in demonstrating the feasibility of advanced aerodynamic weapons concepts To support this mission, the ARCAS possesses an aerodynamic laboratory with a unique array of experimental aerodynamic facilities including four wind tunnels and a special projectile flight simulator. The wind tunnels cover the subsonic, transonic, and supersonic speed regimes and also include a special vertical wind tunnel facility The flight simulator allows full sized artillery payloads to undergo the simultaneous spinning and coning motion of the projectile in flight GRA

N83-29275# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio. Structural Vibration Branch
VIBRATION AND AEROELASTIC FACILITY Final Report, Jan. 1977 - Dec. 1981
P G. BOLDS Dec 1982 100 p refs
(Contract AF PROJ 2401)
(AD-A126317, AFWAL-TR-82-3054) Avail NTIS HC A05/MF A01 CSCL 14B

The Vibration and Aeroelastic Facility of the Air Force Wright Aeronautical Laboratories is used for recording and analyzing dynamics data New instrumentation systems have made possible a significant increase in the quantity of measurements which can be acquired to define the dynamics environment in various aircraft, missile, and ground support equipment To reduce the large quantities of data to a usable form, processing techniques based upon the use of spectrum analyzers and minicomputers are employed These techniques are described and methods are illustrated for presenting statistical quantities defining the spectral composition of dynamics environments. GRA

N83-29276# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
SURVEY OF MISSILE SIMULATION AND FLIGHT MECHANICS FACILITIES IN NATO
W. M HOLMES (Army Missile Command, Redstone Arsenal, Ala.) 1982 103 p
(AGARD-AG-279, ISBN-92-835-1448-3) Avail. NTIS HC A06/MF A01

A survey of missile system simulation facilities was conducted Information from this task addresses missile system and subsystem simulation capabilities, methodology of simulation development, simulation model verification and validation In addition, approaches and procedures were recommended that would enhance cooperative development of missile system simulation, test and evaluation as related to missile system flight mechanics. S L.

N83-29277# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
PROCEEDINGS OF THE AGARD FLUID DYNAMICS SPECIALISTS MEETING ON WALL INTERFERENCE IN WIND TUNNELS
T W BINION, JR (Calspan Field Services, Inc., Arnold AFS, Tenn) 1982 12 p refs Proc. held in London, 19-20 May 1982 Submitted for publication
(AGARD-AR-190, AGARD-CP-335, ISBN-92-835-1447-5) Avail: NTIS HC A02/MF A01

The effects of wind tunnel wall interference are studied. Endeavors were undertaken to learn how to correct wind tunnel data or to reduce the wall induced interference Successful efforts are largely limited to solid wall, low speed situations. The invention of ventilated wall tunnels did much to reduce the tunnel boundary induced interferences, and the adaptive wall concept promises to finally provide a test environment with neglibible wall interference. GRA

11

CHEMISTRY AND MATERIALS

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

A83-37836
INVESTIGATION OF THE FATIGUE AND CRACK PROPAGATION PROPERTIES OF X7091-T7E69 EXTRUSION
S. L LANGENBECK (Lockhed-California, Co., Materials and Processes Dept., Burbank, CA) IN: High-strength powder metallurgy aluminum alloys, Proceedings of the Symposium, Dallas, TX, January 17, 18, 1982 Warrendale, PA, Metallurgical Society of AIME, 1982, p 87-105 Research supported by the Lockheed-California Independent Research and Development Program refs
(Contract N62269-78-C-0446)

Fatigue and fatigue crack growth data are presented on rectangular X7091-T7E69 extruded bar Various test conditions were used in this evaluation of X7091-T7E69. The data were compared to 7075-T76510 as well as earlier results obtained on a Navy funded program on extruded shapes of X7091-T7E69. Constant amplitude fatigue life of X7091-T7E69 was greater than 7075-T76 for K(t) = 2 7 and 4 0 specimens. In addition, the P-3 spectrum fatigue results for X7091-T7E69 were better than previous results obtained for 7075-T6510 and 7050-T7E73 extrusions; however, a high scatter factor was evident for the X7091-T7E69 material The fatigue crack growth rates above 1 x 10 to the -6th inches/cycle of X7091-T7E69 extrusions were higher than those of the 7075-T76 extrusions The combination of properties for X7091-T7E69 extrusion makes the material attractive for continued development Author

A83-37954
ADVANCED ALUMINUM ALLOY FOR TRANSPORT AIRCRAFT - WHY AND WHAT ARE THE BENEFITS
I F SAKATA (Lockheed-California Co , Burbank, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 18 p.
(SAE PAPER 821345)

In airframe structures applications, high strength wrought aluminum alloys have been widely used by the air transport industry for several decades In connection with demands for improved performance and better structural reliability in advanced aircraft structures, there is now a need for alloys which combine high strength, low density, and high modulus of elasticity with improved toughness, corrosion, and fatigue properties. Attention is given to the results of a study conducted by an American aerospace company for NASA. The study had the objective to quantify the potential benefits of utilizing advanced aluminum alloys in commercial transport aircraft and to define the effort necessary to fully develop the alloys to a viable commercial production capability. The application of the advanced aluminum alloys to the airframe resulted in structural weight savings of 16, 15, and 10 percent for a long-range, short-medium range, and supercommuter aircraft, respectively For the introduction of a new aircraft in 1990, the production program must be initiated in the mid-1980s. G R

A83-38004
TESTING OF ANTIMISTING KEROSENE IN THE DC-10/KC-10 FUEL SYSTEM SIMULATOR
A. T. PEACOCK and F. Y. CHING (Douglas Aircraft Co , Long Beach, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982 11 p
(SAE PAPER 821485)

The compatibility of antimisting kerosene (AMK) with a contemporary fuel system was evaluated AMK made with the FM-9 additive to the base fuel was used throughout the program. Tests were conducted to determine the effects AMK had on the components and system performance, and the effects components and the system had on the fuel. Some DC-10/KC-10 systems are incompatible with the AMK fuel Systems and/or procedural revisions to accommodate the AMK do not appear to present technically insurmountable problems AMK reduces the performance of some systems below normally accepted levels Additional studies and testing would be required to certify the aircraft fuel system for use with the FM-9 AMK. Author

A83-38077#
OPERATIONAL EFFECTS OF INCREASED FREEZE POINT FUELS IN MILITARY AIRPLANES
P. M MCCONNELL, L. A. DESMARAIS, F. F TOLLE (Boeing Military Airplane Co., Seattle, WA), and C L. DELANEY (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p refs
(Contract F33615-78-C-2001)
(AIAA PAPER 83-1139)

The high freeze point fuels currently being evaluated by the U.S Air Force for use in its aircraft would permit refiners to increase the final boiling point of distillation and increase the fraction of crude oil that may be used as jet fuel. The tendency of jet fuel to form frozen layers on aircraft structures has been evaluated for the cases of the C-141, KC-135 and B-52 aircraft during simulated long duration flights over cold regions. The simulation availed itself of worst case in-flight thermal exposure data for a 10-year period along each route studied, and calculated the time-varying boundary temperatures to which the wing surface was exposed, together with fuel temperature profiles computed as a function of tank depth at various times during the flights, and the percentage of nonflowing fuel in each mission Results indicate that the fuel freeze point of JP-4 could be increased by 12 C for the study aircraft without adverse operational effect O.C

A83-38875

ECONOMIC EVALUATION OF A STANDARD PRODUCT OF FIBER-REINFORCED COMPOSITE MATERIAL IN COMPARISON WITH STEEL [WIRTSCHAFTLICHKEITSBETRACHTUNG FUER EIN STANDARDPRODUKT AUS FASERVERBUNDWERKSTOFF IM VERGLEICH ZU STAHL]

H FLECKENSTEIN (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) VDI-Z (ISSN 0042-1766), vol 125, Feb. 1983, p 123-131. In German refs

The total-lifetime energy cost of a standard product made of steel (density 7.8 g/cu cm) is compared with that of the same product made with a reinforced composite material (42 pct glass fiber, 18 pct carbon fiber, 40 pct resin, density 2 0 g/cu cm) Tables and figures illustrate the properties, composition, manufacture, and application of different reinforced composites. The energy-equivalence calculations are based on four phases in the life of the standard product. (A) production of the semifinished stock from the raw materials, (B) manufacture of the product, (C) use of the product (carburetor-engine-powered operation at 20,000 km/year for a life of 10 years), and (D) recovery/recycling of the material after use The step-by-step results of the analysis are presented in tables for each material The net energy costs (A + B - D) of the product (which weighted 1000 kg in steel and 600 kg in composite) were 33,100 kW for steel and 1,366 kW for composite; the costs of use (C) were 210,000 kW for steel and 126,000 kW for composite, reflecting the weight difference T K

A83-38913#

MEASUREMENT OF HELIUM GAS TRANSMISSION THROUGH AEROSTAT MATERIAL

R. L ASHFORD, B. T. BATA, and E. D WALSH (TCOM Corp., Aerostat Systems Dept., Columbia, MD) IN Lighter-Than-Air Systems Conference, Anaheim, CA, July 25-27, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p. 101-107
(AIAA PAPER 83-1986)

Attention is given to the refinement of test methods for the determination of aerostat structural material helium gas transmission and permeation These materials are often Tedlar and Mylar films and sheets, with varying permeability and transmission in response to gas temperature, pressure, and container size and wall thickness The features and capabilities of a permeability test cell and instrumentation console acquired to introduce uniformity into test procedures are noted O C

A83-39075

INFLUENCE OF OVERLOADS AND BLOCK LOADING SEQUENCES ON MODE III FATIGUE CRACK PROPAGATION IN A469 ROTOR STEEL

H NAYEB-HASHEMI, F A. MCCLINTOCK (MIT, Cambridge, MA), and R O RITCHIE (California, University, Berkeley, CA) Engineering Fracture Mechanics (ISSN 0013-7944), vol. 18, no 4, 1983, p 763-783 refs
(Contract W-7405-ENG-26, DE-AC03-76SF-00098)

A83-39509

DETERMINATION OF ZONES OF CRACK DISTRIBUTION IN FLEXIBLE SPECIMENS [OPREDELENIE ZON RASPOLOZHENIIA TRESHCHIN V GIBKIKH OBRAZTSAKH]

O T. SIDOROV, A. F. RAKSHIN, and M. I FENIUK Problemy Prochnosti (ISSN 0556-171X), June 1983, p 101-103 In Russian.

Tests were performed on D16T alloy specimens to evaluate the possibility of determining zones of crack distribution by comparing the damping increments of a specimen for various vibration modes The results support the possibility of determining crack-distribution zones in structures in which higher vibration modes can be excited (e.g., such structures as wings, tail assemblies, and fuselages) Frequency-test data can be used to choose the vibration modes which make it possible to assess the presence of cracks in given parts of the structure B J

A83-40129* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

HIGH-TEMPERATURE COMPOSITES - STATUS AND FUTURE DIRECTIONS

R. A. SIGNORELLI (NASA, Lewis Research Center, Materials Div , Cleveland, OH) IN. Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 1 . Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p 37-48 refs

A summary of research investigations of manufacturing methods, fabrication methods, and testing of high temperature composites for use in gas turbine engines is presented Ceramic/ceramic, ceramic/metal, and metal/metal composites are considered Directional solidification of superalloys and eutectic alloys, fiber reinforced metal and ceramic composites, ceramic fibers and whiskers, refractory coatings, metal fiber/metal composites, matrix metal selection, and the preparation of test specimens are discussed Previously announced in STAR as N82-30336 J D.

A83-40130

COMPOSITE MATERIALS IN AIRCRAFT STRUCTURES

N J. HOFF IN Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 1 . Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p 49-61. refs

In aircraft structures glassfiber has been used increasingly since 1955 in sailplanes and in helicopter rotorblades Advanced composites, among them carbonfiber-epoxy, were introduced in the early 1960s. In spite of their superior mechanical properties these new materials are being accepted only reluctantly in the construction of military and particularly of civilian transport aircraft because of the financial risk posed by recent interpretations of the concept of product liability Author

A83-40131

ADHESIVE BONDING AND COMPOSITES

R. J SCHLIEKELMANN (Fokker Technological Centre, Schiphol, Netherlands) IN. Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 1 Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p 63-78 refs

The experience gained with structural adhesive bonding of metals is seen as offering important lessons applicable to the introduction of composite primary structures. For successful adhesive bonding of composites, it is important to attain well defined adherend surfaces To obviate problems with stress concentrations at the edges of bonded joints, it is advised that the stress/strain characteristics of both the adhesive and the composite matrix resins be carefully investigated. C R

A83-40215

EFFECT OF DEFECT ON THE BEHAVIOUR OF COMPOSITES

K. K STELLBRINK and R M. AOKI (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Bauweisen- und Konstruktionsforschung, Stuttgart, West Germany) IN: Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 1 Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p. 853-860. refs

An experimental investigation was conducted to study the effect of defect on impact-damaged CFRP specimens Several laminates of different ply orientations and ply thicknesses (1-2.7 mm) were impact-damaged by simulated dropped tools and then tension-compression (R = -1) or tension-tension (R = 0.1) loaded. Results suggest a practicable damage tolerance with nearly invisible defects. Author

A83-40286
KEVLAR ARAMID AS A FIBER REINFORCEMENT WITH EMPHASIS ON AIRCRAFT
P. R LANGSTON (DuPont de Nemours and Co , Wilmington, DE) IN. Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982. Volume 2 Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p 1639-1672

The applications of Kevlar in the aircraft industry are reviewed and future uses are discussed Kevlar has half the density of fiberglass, is 10-20 percent lighter than carbon fibers, and has the highest strength/weight ratio of any existing material Additionally, the fiber does not melt or burn, does not exhibit embrittlement or degradation at cryogenic temperatures, has a slightly negative thermal expansion coefficient, has an excellent cycle tension-tension fatigue life, and displays good damping characteristics. It has been used as structural and chassis components in cars, and for ropes, gloves, flak jackets, and as boat hulls The Trident missile motor cases, middle stage, the 747 escape slides, the ESA apogee kick motor, the second stage of the French M-4 missile, and a large number of exterior parts of the L-1011 are made of Kevlar. Structural parts and antennas for satellites are increasingly being fabricated with Kevlar strands.
M S.K.

A83-40342
ADVANCED COMPOSITES FOR ADVANCED AIRCRAFT
R. HADCOCK and S DASTIN (Grumman Aerospace Corp , Bethpage, NY) Grumman Aerospace Horizons (ISSN 0095-7615), vol 19, no. 2, 1983, p. 19-24

The progress toward incorporation of lightweight, advanced composites in aircraft is traced and their applications are reviewed After the Wright brothers' use of wood, wire, and fabric in 1906, metal was used as the structural material in 1912 Materials, costs, and availability dictated what was used until after WW II, when stainless steel and then titanium were employed in jet aircraft A boron fiber composite was introduced on the Tomcat horizontal stabilizer in the late 1960s Vertical and horizontal stabilizers and rudders on the F-16, F-15, and F-18 fighters have been made of advanced composites, and the AV-8B Harrier is 26 percent composite material High modulus fibers, i e , boron, graphite, and Kevlar are used for the parts in an resin, organic matrix M.S K.

N83-28084 ERA Ltd., Leatherhead (England) Electromagnetic Interference Dept
INVESTIGATION OF THE RF PROPERTIES OF CARBON FIBER COMPOSITE MATERIALS Final Report
D. A BULL, G A JACKSON, A MCHALE, and B W SMITHERS Jul. 1981 278 p refs
(Contract A57B/566; PROJ-34-03-3320)
(ERA-81-109) Avail: Issuing Activity

The resistivity of small carbon fiber composite (CFC) samples at frequencies up to 300 MHz was measured using Q-meter techniques Changes in resistance resulting from prolonged exposure to various liquids were investigated. Electromagnetic shielding (0.15 to 1000 MHz) was measured for panels incorporated as one face of a cubic enclosure or as one surface panel of a helicopter tail cone and for a CFC cylinder The performances of vhf and uhf aerials when mounted on metallic and CFC ground planes were compared The implications of the results on the electromagnetic comptability of CFC aircraft are discussed.

N83-28088 ERA Ltd , Leatherhead (England)
FURTHER MEASUREMENTS OF THE SCREENING EFFECTIVENESS OF CARBON FIBER COMPOSITE MATERIALS
A. MCHALE *In its* Investigation of the RF Properties of Carbon Fiber Composite Mater 20 p Jul 1982
Avail Issuing Activity

Shielding effectiveness to magnetic fields in the range 0.15 to 30 MHz and to electric fields in the range 30 to 1000 MHz was measured for 6 square carbon fiber composite panels Magnetic effectiveness rises linearly with increasing frequency, reaching values of 50 to 60 dB at 30 MHz Electric shielding effectiveness rises slightly over the frequency range 30 to 1000 MHz; depending on the quality of the electrical contact at the edges of the sheets, values can range from 50 to 90 dB Results show that shielding integrity, particularly in the high frequency band, is poor unless good electrical contact between panel sections or to the surrounding structure is achieved The use of insulated bucket fasteners and nonconductive adhesive to attach the panels to metal structures reduces shielding. Author (ESA)

N83-28090 ERA Ltd., Leatherhead (England).
THE ELECTROMAGNETIC ENVIRONMENT OF AN AIRFRAME PARTLY CONSTRUCTED FROM CARBON FIBER COMPOSITE MATERIAL
A. MCHALE *In its* Investigation of the RF Properties of Carbon Fiber Composite Mater 37 p Jul. 1982
Avail Issuing Activity

One original panel section of a helicopter tail cone was replaced in turn with demountable carbon fiber composite (CFC) panels Changes in the electromagnetic environment within the tail cone were investigated. Magnetic shielding effectiveness, field strength and induced current measurements indicate that where electrical contact is maintained, by riveting and bolting, the shielding effectiveness of 4 ply and 16 ply panels is comparable with or greater than the effectiveness of the original metallic structure Where CFC panels were mounted using adhesive bonding techniques, the shielding is significantly less than for the original structure Electric field shielding results for CFC and aluminum are comparable above 200 MHz Between 30 and 200 MHz the adhesively bonded 4 ply CFC panel gives up to 10 dB less shielding than aluminum Results are limited by the overall shielding integrity of the fuselage. Author (ESA)

N83-28093 ERA Ltd , Leatherhead (England).
EMC IMPLICATIONS OF USING CFC MATERIALS IN AIRCRAFT MANUFACTURE Final Report
A. MCHALE *In its* Investigation of the RF Properties of Carbon Fiber Composite Mater. 7 p Jul 1982
Avail Issuing Activity

The radio frequency (RF) properties of CFC are summarized and the implications of these properties for the EMC of CFC aircraft are discussed Problems include the high resistivity of CFC and the difficulty of ensuring sufficient electrical continuity across joints (due to the insulating properties of the resin systems). This results in lower screening, at hf and below, than is expected for metallic aircraft, and greater penetration of RF energy into the aircraft from on board HF transmitters and from external sources such as EMP and lightning More severe EMC susceptibility requirements for avionic systems for CFC aircraft particularly in the HF band are advocated Positioning, shielding and bonding of system installations is seen as more important for CFC aircraft EMC design than for metallic aircraft. Author (ESA)

N83-28098*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FABRICATION AND EVALUATION OF BRAZED TITANIUM-CLAD BORSIC/ALUMINUM SKIN-STRINGER PANELS
T T. BALES, D. M ROYSTER, and R. R. MCWITHEY Jul. 1980 41 p refs
(NASA-TP-1674, L-13413; NAS 1.60 1674) Avail NTIS HC A03/MF A01 CSCL 11D

A successful brazing process was developed and evaluated for fabricating full-scale titanium-clad Borsic/aluminum skin-stringer panels A panel design was developed consisting of a hybrid composite skin reinforced with capped honeycomb-core stringers Six panels were fabricated for inclusion in the program which included laboratory testing of panels at ambient temperatures and 533 K (500 F) and flight service evaluation on the NASA Mach 3 YF-12 airplane. All panels tested met or exceeded stringent design requirements and no deleterious effects on panel properties were

detected followng flight service evaluation on the YF-12 airplane
Author

N83-28118# Royal Aircraft Establishment, Farnborough (England)
THE TOXIC NATURE OF GASES FROM THE THERMAL DECOMPOSITION OF COMBUSTIBLE MATERIALS
P E PICART, J. P DELCROIX, and M. GUERBET Feb 1982 21 p refs Transl into ENGLISH from the proceedings of the AGARD Conf. No 309(B8) Toxic Hazards in Aviation (Canada), 1980 p 1-10 Conf held in Toronto, 1980
(RAE-TRANS-2082, BR84017) Avail NTIS HC A02/MF A01
When fire breaks out in the passenger cabin of an aircraft, escape is not immediately possible and it is necessary, first, to return to land. In this case toxic gases cause the major problem. For this reason it is necessary to select materials which will cause minimal toxicity in case of fire on board. A test chamber giving sufficient control over the thermal decompositions of materials to reproduce real life atmospheres as accurately as possible was designed. This prototype must have the following specific characteristics a relatively small enclosed volume, rapid renewal of the air (a total change in three minutes) and the possibility of almost a total stoppage of ventilation, in order that it should be capable of simulating those situations encountered in flight. The prototype test chamber is described and the first results obtained with it are given The aim is to be able, ultimately, and depending upon the danger criteria chosen, to supply bases against which selection of materials for the furnishing of aircraft cabins can be made
S L

N83-28211# Systems Research Labs, Inc, Dayton, Ohio Research Applications Div.
ACCELERATED CORROSION TESTING Final Report, 1 Jun. 1979 - 31 May 1982
M KHOBAIB Wright-Patterson AFB, Ohio AFWAL Sep. 1982 148 p refs
(Contract F33615-79-C-5109, AF PROJ 2418)
(AD-A125639, SRL-6507, AFWAL-TR-82-4186) Avail NTIS HC A07/MF A01 CSCL 11F
Available methods for accelerated testing of corrosion behavior yield results which are not sufficiently accurate or reliable for predicting the service life of aircraft components and materials which degrade or fail due to environmental attack Research has been conducted in controlled atmospheres on the localized environmental enhancement of crack-growth rates of aerospace alloys in order to provide the basis for development of realistic accelerated corrosion tests Slow-strain-rate, corrosion-fatigue, and rising-load experiments have been conducted on high-strength 4340 steel and 7075-T6 aluminum alloy using accelerating pollutants such as sulfur dioxide, nitrogen dioxide, surface salt, and ambient to 100%-relative-humidity (RH) air in a specially designed atmospheric chamber
Author (GRA)

N83-28212# Columbia Univ, New York. School of Mines
THE EFFECTS OF SMALL DEFORMATION ON CREEP AND STRESS RUPTURE OF ODS SUPERALLOYS Final Technical Report, 1 Jun. 1978 - 30 Sep. 1982
V C NARDONE, D. E MATEJCZYK, and J K. TIEN 7 Jan 1983 58 p refs
(Contract AF-AFOSR-3637-78, AF PROJ 2306)
(AD-A125640, AFOSR-83-0095TR) Avail NTIS HC A04/MF A01 CSCL 11F
This Air Force sponsored research program studied the effects of predeformation including periodic load cycling on the creep and stress rupture of oxide dispersion strengthened (ODS) high temperature alloys The alloys most studied in this program are Inconel MA 754, a Ni-Cr alloy strengthened by oxide dispersoids, and MA 6000, strengthened by both the oxide dispersoids and gamma prime precipitates. At temperatures above 1093 degrees C, these alloys have better creep resistance than any current high temperature alloy The MA 754 alloy is now used as stator components in the hot sections of jet engines and MA 6000 is the only candidates turbine blade ODS alloy
Author (GRA)

N83-28255*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
RESEARCH ON AVIATION FUEL INSTABILITY
C. E BAKER, D A BITTKER, S M COHEN, and G T SENG 1983 20 p refs Proposed for presentation at the AGARD Propulsion and Energetics Panel Symp on Combust Probl. in Turbine Eng, Cesme, Turkey, 3-7 Oct. 1983
(NASA-TM-83420, E-1710, NAS 1.15 83420) Avail NTIS HC A02/MF A01 CSCL 21D
The underlying causes of fuel thermal degradation are discussed Topics covered include nature of fuel instability and its temperature dependence, methods of measuring the instability, chemical mechanisms involved in deposit formation, and instrumental methods for characterizing fuel deposits Finally, some preliminary thoughts on design approaches for minimizing the effects of lowered thermal stability are briefly discussed
Author

N83-28273# Teledyne CAE, Toledo, Ohio Turbine Engines
GAS TURBINE DEMONSTRATION OF PYROLYSIS: DERIVED FUELS Technical Progress Report, 1 Jul. 1979 - 31 Dec. 1981
G JASAS and J KASPER 1982 42 p refs
(Contract DE-AC03-78ET-13333)
(DE82-007193; DOE/ET-13333/T1, TPR-3) Avail NTIS HC A03/MF A01
The objective of this program is to demonstrate the feasibility of utilizing pyrolytic oil and char as a fuel for a combustion turbine engine This is the first phase of an extended program with the ultimate goal of commercializing a gas turbine engine and electrical generating system which is independent of petroleum-based fuels Maximum use of existing technology and current production engine hardware is being incorporated for a sequence of test evaluations rating from isolated combustor component tests to full scale engine demonstration tests The technical goals to be achieved during the course of this project are: pyrolytic fuel characterization in terms of its properties and constituents, pyrolytic fuel combustion technology in gas turbine application in terms of pyrolytic oil atomization, quantity of char burned, emissions, performance and associated combustion system aerothermodynamics, pyrolytic fuel (oil and char slurry) handling, mixing, and storage technology; and engine materials compatibility with the pyrolytic fuel and its combustion products
DOE

N83-28620# General Electric Co, Philadelphia, Pa Space Systems Div
COMPOSITE HYBRID FLYWHEEL ROTOR DESIGN OPTIMIZATION AND FABRICATION
A P COPPA *In* Courtesy Assoc, Inc. Proc of the DOE Phys. and Chem Storage Ann Contractors' Rev Meeting p 255-262 Dec 1982 refs
Avail NTIS HC A25/MF A01
Further development of the composite hybrid flywheel rotor is reported A prototype design having an operational energy capacity of 0.25 kWh and a projected lifetime of 105 acceleration/deceleration cycles was developed. Rotors based on this design were fabricated and delivered for spin test evaluation at designated flywheel test centers
Author

N83-29214*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
FUEL VAPORIZATION EFFECTS
M A BOSQUE *In its* Combust Fundamentals Res. p 49-54 Mar. 1983
Avail: NTIS HC A12/MF A01 CSCL 21D
A study of the effects of fuel-air preparation characteristics on combustor performance and emissions at temperature and pressure ranges representative of actual gas turbine combustors is discussed The effect of flameholding devices on the vaporization process and NOx formation is discussed Flameholder blockage and geometry are some of the elements that affect the recirculation zone characteristics and subsequently alter combustion stability, emissions and performance. A water cooled combustor is used as the test rig Preheated air and Jet A fuel are mixed at the entrance of the apparatus. A vaporization probe is used to

determine percentage of vaporization and a gas sample probe to determine concentration of emissions in the exhaust gases The experimental design is presented and experimental expected results are discussed. R.J F.

N83-29231*# Purdue Univ., Lafayette, Ind.
SPONTANEOUS IGNITION CHARACTERISTICS OF HYDROCARBON FUEL-AIR MIXTURES
A H LEFEBVRE and G. W. FREEMAN *In* NASA Lewis Research Center Combust Fundamentals Res p 235-238 Mar. 1983 refs
Avail: NTIS HC A12/MF A01 CSCL 21B

Although the subject of spontaneous ignition of liquid fuels has received considerable attention in the past, the role of fuel evaporation in the overall spontaneous ignition process is still unclear. A main purpose of this research is to carry out measurements of ignition delay times, using fuels of current and anticipated future aeronautical interest, at test conditions that are representative of those encountered in modern gas turbine engines Attention is focused on the fuel injection process, in particlar the measurement and control of man fuel drop size and fuel-air spatial distribution The experiments are designed to provide accurate information on the role of fuel evaporation processes in determining the overall ignition delay time The second objective is to examine in detail the theoretical aspects of spontaneous ignition in order to improve upon current knowledge and understanding of the basic processes involved, so that the results of the investigation can find general and widespead application. L.F M.

N83-29322# *Rolls-Royce Ltd, Derby (England)*
USE OF COMPOSITES IN AERO-ENGINES
I J. SHELLARD 19 Nov 1981 21 p refs Presented at Inst. of Phys, Mater and Testing Group Meeting on Adv. Composites Appl, Econ, and Develop., London
(PNR-90149; REPRINT-840) Avail NTIS HC A02/MF A01

Problems, in the performance of the materials and in the processing and manufacturing procedures, which limit the use of composites in aero-engines are discussed. The high manufacturing costs of composite components prevent the materials from being fully exploited in aero engines The basis for these high costs is outlined, and changes in material types, material processing routes, component design and manufacturing methods which may lead to composite components which are cost competitive with the best metal alternatives are considered. One major limitation as compared with metals is the temperature capability of the resin matrix. Research on polymides and thermoplastic materials such as polyethersulphones is examined The use of injection molding, and the advantages of higher fiber elongation and improved fiber transverse properties are discussed Author (ESA)

N83-29358*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REACTIONS OF NACL WITH GASEOUS SO3, SO2, AND O2
W. L. FIELDER, C. A STEARNS, and F J KOHL Washington 1983 19 p refs Presented at the 163d Meeting of the Electrochem. Soc, San Francisco, 9-13 May 1983
(NASA-TM-83423, E-1712; NAS 1 15 83423) Avail: NTIS HC A02/MF A01 CSCL 11F

Hot corrosion of gas turbine engine components involves deposits of Na_2SO_4 which are produced by reactions between NaCl and oxides of sulfur. For the present investigation, NaCl single crystals were exposed at 100 to 850 C to gaseous mixtures of SO_3, SO_2, and O_2. The products formed during this exposure depend, primarily, on the temperatures The four product films were NaCl-SO_3; $Na_2S_2O_7$, Na_2SO_4; and NaCl-Na_2SO_4 The kinetics of the reactions were measured Author

N83-29360*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
CONSIDERATIONS OF TECHNOLOGY TRANSFER BARRIERS IN THE MODIFICATION OF STRATEGIC SUPERALLOYS FOR AIRCRAFT TURBINE ENGINES
J R STEPHENS and J K. TIEN (Columbia Univ., New York) 1983 25 p refs Presented at the 112th Ann. Meeting of the Am. Inst. of Mining, Metall and Petroleum Engr, Atlanta, 7-10 May 1983
(NASA-TM-83395; E-1672, NAS 1 15 83395) Avail NTIS HC A02/MF A01 CSCL 11F

A typical innovation-to-commercialization process for the development of a new hot section gas turbine material requires one to two decades with attendant costs in the tens of millions of dollars This transfer process is examined to determine the potential rate-controlling steps for introduction of future low strategic metal content alloys or processes. Case studies are used to highlight the barriers to commercialization as well as to identify the means by which these barriers can be surmounted The opportunities for *continuing joint government-university-industry partnerships in planning and conducting strategic materials R&D programs are* also discussed Author

N83-29377# Deutsche Gold- und Silber-Scheideanstalt, Frankfurt am Main (West Germany). Fertigungstechnik Metall.
GAS TURBINE PARTS MADE OF INJECTION MOLDED SILICON NITRIDE AND BRAZING OF SILICON NITRIDE WITH METAL Final Report, Feb. 1980
E. LANGE and N MUELLER Bonn Bundesministerium fuer Forschung und Technologie Mar 1983 36 p In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-83-028, ISSN-0340-7608) Avail NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 7,50

The fabrication of turbine blades and turbine vanes, the fabrication of turbine parts with larger volumes and the brazing of silicon nitride and metal are considered Densities up to 2 g/cucm, bending strength values up to 330 MN/sqm, and Weibull values between m = 10 and 20 are reached with silicon nitride parts Spin tests confirm expectations The injection molding technique of turbine parts with larger volume was studied. Recommendations are given for brazing alloys and brazing components for joining silicon nitride with metal Author (ESA)

N83-29407# Volkswagen A.G, Wolfsburg (West Germany) Forschung Antriebstechnik.
DEVELOPMENT OF CERAMIC AUTOMOBILE TURBINE ENGINE COMPONENTS Final Report, Apr. 1981
M LANGER and J SIEBELS Bonn Bundesministerium fuer Forschung und Technologie Mar 1983 126 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-83-025, ISSN-0340-7608) Avail NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 26,50

The development of ceramic components for an experimental gas turbine of 100 kW output is discussed Satisfactory application of statically loaded ceramic parts, e g, hot testing of a turbine stator ring, is described Monolithic axial turbine rotors made from reaction bonded silicon nitride (RBSN) were cold tested successfully up to circumferential speeds in excess of 400 m/sec. Results for monolithic sintered silicon carbide radial turbine rotors under normal operating conditions are good. Individual RBSN turbine blades mounted in metal disks satisfy qualification tests. Author (ESA)

N83-29408# Rosenthal-Stemag, Technische Keramik A.G , Selb (West Germany)
DEVELOPMENT OF HIGH-TEMPERATURE RESISTANT, NONCORROSIBLE, NONMETALLIC CERAMIC MATERIALS, ESPECIALLY SILICON NITRIDE, FOR HEAT EXCHANGERS IN GAS TURBINE APPLICATION Final Report, Feb. 1980
S SCHINDLER and A KRAUTH Bonn Bundesministerium fuer Forschung und Technologie Mar. 1983 106 p refs In GERMAN, ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-83-026; ISSN-0340-7608) Avail· NTIS HC A06/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 22

The improvement of silicon nitride concerning oxidation resistance and strength, suitable production techniques such as foil casting, injection molding, extrusion and isostatic pressing, as well as the manufacturing of structural components with improved material data (heat exchanger, single stator blades and 4-blade-segments) for test purposes are examined. A close relationship between production techniques, construction and testing in simulated application conditions is found In spite of the change of production technique - from extrusion to foil casting - the progress in heat exchanger development is promising
Author (ESA)

N83-29414# Cranfield Inst. of Tech , Bedfordshire (England) Management Library
ALTERNATIVE FUEL TECHNOLOGY SERIES. VOLUME 1: ALTERNATIVE FUELS FOR TRANSPORT
E M GOODGER 1982 38 p refs
(ISBN-0-902937-63-4) Avail NTIS HC A03/MF A01

The fuels that are proposed as candidates for conventional fuel extenders or substitutes in the three main branches of transport surface, marine and air are reviewed Summaries of short courses that were held on this subject together with lists of references to student research theses and dissertations, and related publications are presented
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

A83-37189*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FINITE-DIFFERENCE SIMULATION OF TRANSONIC SEPARATED FLOW USING A FULL POTENTIAL BOUNDARY LAYER INTERACTION APPROACH
W R VAN DALSEM (NASA, Ames Research Center, Moffett Field, CA) and J. L. STEGER (Stanford University, Stanford, CA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 15 p refs
(AIAA PAPER 83-1689)

A new, fast, direct-inverse, finite-difference boundary-layer code has been developed and coupled with a full-potential transonic airfoil analysis code via new inviscid-viscous interaction algorithms The resulting code has been used to calculate transonic separated flows The results are in good agreement with Navier-Stokes calculations and experimental data. Solutions are obtained in considerably less computer time than Navier-Stokes solutions of equal resolution. Because efficient inviscid and viscous algorithms are used, it is expected this code will also compare favorably with other codes of its type as they become available
Author

A83-37210*# Complere, Inc., Palo Alto, Calif
AN ASSESSMENT OF FLOW-FIELD SIMULATION AND MEASUREMENT
F. K. OWEN (Complere, Inc., Palo Alto, CA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983. 26 p refs
(Contract NAS2-11080, NAS1-16643)
(AIAA PAPER 83-1721)

The effectiveness of the instrumentation, techniques, and wind tunnel flow characterizations in the U.S. large scale wind tunnels for accuracy in making increasingly finer drag measurements on airfoils is assessed The more reliable measurement is necessary due to refined designs of airfoils and the need to continue to improve the economic performance of commercial aircraft. Consequently, the effects of flows in wind tunnels, compared with those in the freestream environment, have become a critical factor. Dynamic flow properties in individual wind tunnels have to be documented in order to assure reproducible results Laser velocimetry is a suitable tool for nonintrusive measurement of the mean velocity, turbulence intensity, and the shear stress in wind tunnel flowfields It is suggested that future wind tunnel studies be designed to remain within the diagnostic capabilities available at the site
M.S K

A83-37232*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
STABILITY EXPERIMENTS IN ROTATING-DISK FLOW
S P. WILKINSON (NASA, Langley Research Center, High Speed Aerodynamics Div , Hampton, VA) and M. R MALIK (NASA, Langley Research Center, High Technology Corp., Hampton, VA) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 19 p refs
(AIAA PAPER 83-1760)

An experimental study of the transitional flow on a flat disk, rotating in still air, has been conducted Using digitized hot-wire data, the axes of the stationary spiral vortices, which are the primary instability mechanism for the disk flow, have been mapped-out in terms of both spatial coordinates and velocity fluctuations Data are presented for a clean disk and for a disk with a single, isolated roughness element. The data show that the disk vortices are generated at discrete roughness disturbance sites on the disk and that they propagate and grow as wave packets. The familiar vortex pattern of 30 or so vortices results only when these wave packets have merged and filled the entire circumference The appearance of stationary, secondary vortices prior to turbulent breakdown has also been observed Comparisons with linear stability theory show reasonable agreement with measured growth rate data
Author

A83-37234*# National Academy of Sciences - National Research Council, Washington, D C.
THE IMPACT OF CFD ON DEVELOPMENT TEST FACILITIES - A NATIONAL RESEARCH COUNCIL PROJECTION
R. H KORKEGI (National Research Council, Washington, DC) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 16th, Danvers, MA, July 12-14, 1983 7 p NASA-USAF-supported research
(AIAA PAPER 83-1764)

The results of a National Research Council study on the effect that advances in computational fluid dynamics (CFD) will have on conventional aeronautical ground testing are reported Current CFD capabilities include the depiction of linearized inviscid flows and a boundary layer, initial use of Euler coordinates using supercomputers to automatically generate a grid, research and development on Reynolds-averaged Navier-Stokes (N-S) equations, and preliminary research on solutions to the full N-S equations Improvements in the range of CFD usage is dependent on the development of more powerful supercomputers, exceeding even the projected abilities of the NASA Numerical Aerodynamic Simulator (1 BFLOP/sec) Full representation of the Re-averaged N-S equations will require over one million grid points, a computing level predicted to be available in 15 yr. Present capabilities allow identification of data anomalies, confirmation of data accuracy, and adequateness of model design in wind tunnel trials Account can be taken of the wall effects and the Re in any flight regime during simulation CFD can actually be more accurate than instrumented tests, since all points in a flow can be modeled with CFD, while they cannot all be monitored with instrumentation in a wind tunnel. M S.K.

A83-37268

GENERALIZATION OF THE RESULTS OF CALCULATIONS OF THE STRESSED STATE OF STRUCTURES WITH CUTOUTS [OBOBSHCHENIE REZUL'TATOV RASCHETNYKH ISSLEDOVANII NAPRIAZHENNOGO SOSTOIANIIA KONSTRUKTSII S VYREZAMI]

V I GOLOVAN TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 1, 1982, p 124-129 In Russian

Results of finite-element calculations of the stressed state of fuselage and wing structures with rectangular cutouts are generalized This stressed state was determined in the elastic region for various types of loading: pure bending, torsion, and transverse bending. The dimensions of the cutouts and the stiffness parameters of the structures were varied in the course of the analyses. It is noted that the present results can lead to recommendations on ways to compensate for the cutouts B J.

A83-37289

RELIABILITY ANALYSIS OF A DUAL-REDUNDANT ENGINE CONTROLLER

E. GAI, J V. HARRISON, and R H LUPPOLD (Charles Stark Draper Laboratory, Inc, Cambridge, MA) IEEE Transactions on Reliability (ISSN 0018-9529), vol R-32, April 1983, p. 14-20. refs

A Markov model is developed to predict the reliability of a full-authority, dual-redundant aircraft engine controller The effects of failures of any of the controllers sensors, electronic interface modules, processors and actuators, as well as the consequences of redundancy management decisions are modeled The model issued to study parameter sensitivity and to develop quantitative data in support of design tradeoffs The effects of scheduled maintenance of the inflight shutdown rate of the engine are determined. Author

A83-37497#

EXPERIMENTAL RESEARCH ON CAVITATION EROSION FOR AN OSCILLATING WING PROFILE [EXPERIMENTELLE KAVITATIONSEROSIONSUNTERSUCHUNGEN AN EINEM SCHWINGENDEN TRAGFLUEGELPROFIL]

G SASSE Berlin, Technische Universitaet, Fachbereich fuer Verkehrswesen, Dr-Ing Dissertation, 1982, 60 p. In German. refs

The influence of reduced frequency on the erosion behavior of a two-dimensional oscillating wing profile under cavitation conditions is experimentally investigated A soft surface technique was used to cause erosion, and a special optical measurement apparatus was used for quantitative determination of the erosion rate Cavitation erosion began at a seven degree angle of incidence at a flow speed of 6 m/s and a 30-min test period. The rate of erosion increased with increasing oscillation amplitude at a given reduced frequency, and reduced frequency had a marked influence on that rate For a zero degree angle of incidence, the maximum erosion rate occurred between 0.3-0 5 reduced frequency, this range shifted to higher reduced frequencies with increased average angle of incidence C D.

A83-37513

DISTRIBUTION OF THE LOAD-CARRYING MATERIAL IN A MINIMUM-WEIGHT WING IN THE CASE OF CONSTRAINTS ON STRENGTH AND LOAD-CARRYING CAPACITY [RASPREDELENIE SILOVOGO MATERIALA V KRYLE MINIMAL'NOGO VESA PRI OGRANICHENIIAKH PO PROCHNOSTI I NESUSHCHEI SPOSOBNOSTI]

A V. ALBUL, N. V BANICHUK, V. I. BIRIUK, and I I KOANDE TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p 69-75 In Russian. refs

The paper examines the problem of the minimization of a swept wing of high aspect ratio in the case of constraints on the strength and load-carrying capacity of the wing The variable function is the function of stiffness distribution along the wing. Necessary conditions of optimality are obtained, and an analysis is presented of the depedence of the optimal solution on values of permissible stresses and losses in lift force, determined by aeroelastic deformations B J

A83-37514

DECOMPOSITION METHOD FOR MINIMIZING THE WEIGHT OF THE LOAD-CARRYING STRUCTURE OF A SWEPT WING WITH ALLOWANCE FOR THE CONDITIONS OF STATIC STRENGTH AND PRESCRIBED AILERON EFFICIENCY [DEKOMPOZITSIONNAIA METODIKA MINIMIZATSII VESA SILOVOI KONSTRUKTSII STRELOVIDNOGO KRYLA S UCHETOM USLOVII STATICHESKOI PROCHNOSTI I ZADANNOI EFFEKTIVNOSTI ELERONOV]

S V SELIUGIN TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 3, 1982, p 76-87 In Russian refs

A solution is obtained to the problem of minimizing the weight of the load-carrying structure of a swept wing when the conditions of static strength and prescribed aileron efficiency are satisfied The variables of the problem are the thickness of the load-carrying assembly and the relative thickness of the wing profile The method of solution, developed in a general form for a definite class of structural optimization problems, consists in the decomposition of the nonlinear programming problem into successively solvable subproblems of substantially lesser dimensionality. Numerical results are presented B J

A83-37515

ON THE FORMULATION OF THE FINITE-ELEMENT METHOD IN HEAT-CONDUCTION PROBLEMS FOR AIRCRAFT STRUCTURES [O FORMULIROVKE METODA KONECHNYKH ELEMENTOV V ZADACHAKH TEPLOPROVODNOSTI AVIAKONSTRUKTSII]

G. N ZAMULA, S N IVANOV, and S F TESLENKO TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p 88-98. In Russian

The paper examines aspects of the formulation of the finite-element method in problems of calculating temperature fields of aircraft structures with allowance for thermal radiation, contact resistances, and the presence of elements of different dimensionality A general approach is taken based on the analogy between problems of heat conduction and problems of elasticity, as well as on variational principles of heat-transfer theory. B.J.

A83-37516

THE EFFECT OF STRINGERS ON THE STRESS-STRAIN STATE NEAR A HOLE OR CRACK IN AN ANISOTROPIC PLATE [VLIIANIE REBER ZHESTKOSTI NA NAPRIAZHENNO-DEFORMIROVANNOE SOSTOIANIE OKOLO OTVERSTIIA ILI TRESHCHINY V ANIZOTROPNOI PLASTINE]

V N. MAKSIMENKO and IU. N. KHAN TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p 99-107 In Russian

An analysis is presented of the distribution of stresses in an elastic anisotropic plate (e g, the composite panel of an aircraft or rocket) reinforced by a finite number of stringers and weakened by an elliptical hole or crack. It is assumed that the plate is subjected at infinity to uniform tension at an arbitrary angle to the Ox axis The Green-function method is used to obtain a resolvent system of singular integral equations An algorithm for the numerical solution of these equations is proposed, and results of calculations are presented. B J

A83-37517

INTERACTION OF A SUNK BOLT WITH PARTS OF A SINGLE-SHEAR JOINT IN CONDITIONS OF RADIAL TENSION [VZAIMODEISTVIE POTAINOGO BOLTA S DETALIAMI ODNOSREZNOGO SOEDINENIIA V USLOVIIAKH RADIAL'NOGO NATIAGA]

P P BARANOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 3, 1982, p 108-117. In Russian refs

A method commonly used to analyze beams on elastic foundations is applied to the interaction of a sunk bolt with parts of a single-shear joint in conditions of radial tension. Formulas are derived for determining bending moments, transverse forces, and forces along the axis of the bolt. The role of the structural and elastic parameters of the joint is investigated, and ways to structurally improve such joints are indicated B J

A83-37638

A MODEL FOR DETERMINING THE RELIABILITY OF AN AIRCRAFT WING STRUCTURE [MODEL' OPREDELENIIA NADEZHNOSTI KONSTRUKTSII KRYLA SAMOLETA]

E L ZIMONT and V. IA SENIK TsAGI, Uchennye Zapiski (ISSN 0321-3429), vol 13, no 5, 1982, p. 118-124 In Russian

The objective of the study was to determine the critical states for an aircraft wing and to obtain formulas for calculating the probabilities of the occurrence of these states within a specified operating time The problem of the probability of the occurrence of critical states is formulated in terms of the reliability theory Calculations are presented for the case of the fatigue fracture of a wing structure consisting of eight panels, with each panel reinforced by four stringers. V.L

A83-37642

A VERSION OF A SINGLE-BEAM LASER TIME-OF-FLIGHT METHOD FOR MEASURING FLIGHT VELOCITY [OB ODNOM VARIANTE LAZERNOGO ODNOLUCHEVOGO VREMIAPROLETNOGO METODA IZMERENIIA SKOROSTI POLETA]

S V ZHIGULEV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 5, 1982, p 142-147 In Russian. refs

A procedure is presented for measuring local mean flight velocity by means of a time-of-flight laser anemometer. In accordance with this method, the light of a single laser beam scattered by natural dust particles moving with the flow across the beam are detected by a photoelectron multiplier, and the resulting series of signals are processed digitally Based on wind tunnel tests in the flow-velocity range 8-95 m/s, the method proposed here is found to be accurate to within 3 percent V L

A83-37644

ANALYTICAL CONTROL OF THE SHAPE OF THE POLYGONS USED IN THE FINITE-ELEMENT METHOD [ANALITICHESKII KONTROL' FORMY MNOGOUGOL'NIKOV, PRIMENIAEMYKH V METODE KONECHNYKH ELEMENTOV]

V F VOROBEV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 5, 1982, p 155-158 In Russian

Formulas are derived for analyzing the shape of plane polygonal finite elements specified by nodular point coordinates and element numbers The analytic procedure proposed here is designed to identify errors in the initial data for a problem solved by means of the finite element method The procedure also makes it possible to control the shape of the finite elements without using the graphical representation of the computational scheme when solving the problem on a computer The procedure is demonstrated for a low-aspect-ratio wing. V L

A83-37861#

NEW METAL TECHNOLOGIES IN AIRFRAME CONSTRUCTION

K-F SAHM Dornier-Post (English Edition) (ISSN 0012-5563), no 2, 1983, p 46-51.

Three advanced metallics technologies with the potential for reducing the structural weight of future aircraft are presented. Powder metallurgy is shown to enable the production of finer microstructures and improved mechanical properties in conventional and novel aluminum alloys The technique of superplastic sheet metal forming combined with diffusion bonding is under development as a means for the low-cost production of integral titanium sheet metal constructions and is also being investigated for use with sufficiently superplastic aluminum alloys Finally, the advanced aluminum casting techniques of sand-casting and precision casting show promise for the reduction of aircraft production and operating costs The potential of other metals technologies such as lithium aluminum alloys, the combination of binding and spot welding, hot isostatic pressing and composites is also noted A L W.

A83-37976

MANUFACTURING METHODS FOR COMPOSITE GRAPHITE HOLE GENERATION

J P CHANANI and J A BOLDT (Northrop Corp, Aircraft Div, Hawthorne, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 11 p. Research supported by the Northrop Corp.
(SAE PAPER 821418)

The manufacturing methods, cutting tools, feed rates and speeds developed for reducing the costs of generating high quality holes in composite graphite/epoxy materials are described The equipment used to evaluate hole quality and tool life data is described, including the dynamometer, tool analyzer, profilometer, bore gage, and scanning electron microscope. Four procedures developed to produce quality holes, reduce labor fatigue, and reduce costs are addressed, including one step drilling/countersinking, cutter deployment to eliminate splintering, countersink cutter selection, and deep holes by gun drilling. Test results for each of the procedures are summarized, and productivity improvements that can be attained by their employment are indicated. C D.

A83-37981

IMPLEMENTATION AND INTEGRATION OF PROCESS PLANNING

F A. VALDES (General Electric Co, Fairfield, CT) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct. 25-28, 1982. 6 p
(SAE PAPER 821424)

A Computer Aided Process Planning (CAPP) system is being implemented in the manufacture of rotating components for aircraft engines The system provides a process planning data base and a set of computerized techniques, all easily accessible from a multiple function computer graphics work station This paper briefly describes the use of CAPP as contrasted with the traditional approach to process planning The development of the system, the technologies involved in its design, and the implementation approach are also discussed Author

A83-37985

TITANIUM FAN DISC STRUCTURAL LIFE PREDICTION/CORRELATION PROGRAM

J. C WALCHER (Teledyne CAE, Toledo, OH) and D. L. FINNERTY (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982. 20 p. USAF-sponsored research refs
(SAE PAPER 821437)

A Structural Life Prediction/Correlation program was carried out to develop advanced methods of analyzing cumulative fatigue damage in order to obtain more accurate estimates of the LCF life of a fan disk for correlation with experimental data. The test disks were constructed of the alpha-beta Ti-6Al-4V alloy, the disk life was predicted on the basis of material properties and calibrated model and fan disk test data for an accelerated cycle developed from a representative trainer mission Good agreement was obtained between the predicted and experimental crack initiation lives, whereas crack growth lives were overpredicted V L

A83-38347

CLOSE-RANGE PHOTOGRAMMETRY FOR AIRCRAFT QUALITY CONTROL

D S SCHWARTZ (General Dynamics Corp , Forth Worth, TX) IN: American Congress on Surveying and Mapping and American Society of Photogrammetry Convention; APS Annual Meeting, 48th, Denver, CO, March 14-20, 1982, Technical Papers . Falls Church, VA, American Society of Photogrammetry, 1982, p 353-360

Close range photogrammetry is applicable to quality assurance inspections, design data acquisition, and test management support tasks, yielding significant cost avoidance and increased productivity An understanding of mensuration parameters and their related accuracies is fundamental to the successful application of industrial close range photogrammetry Attention is presently given to these parameters and to the use of computer modelling as an aid to the photogrammetric entrepreneur in industry Suggested improvements to cameras and film readers for industrial applications are discussed O C

A83-38766* Arizona State Univ., Tempe

WAKES FROM ARRAYS OF BUILDINGS

E LOGAN, JR , S H LIN (Arizona State University, Tempe, AZ), and M B ALEXANDER (NASA, Marshall Space Flight Center, Space Sciences Laboratory, Huntsville, AL) IN Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p. 325-330 NASA-supported research refs

Experiments were carried out in a small wind tunnel in which atmospheric flow around buildings was simulated Arrays of one, two, three, and four model buildings were tested, and wake profiles of velocity and turbulence were measured The data indicate the effect of the buildings on the wind environment encountered by aircraft during landing or takeoff operations. It was possible to use the results to locate the boundaries of the air regions affected by the obstacles and to recommend preferred arrangement of buildings to maximize light safety Previously announced in STAR as N83-14430 Author

A83-39106#

ADVANCED TECHNIQUES FOR MEASUREMENT OF STRAIN AND TEMPERATURE IN A TURBINE ENGINE

W A. STANGE (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p (AIAA PAPER 83-1296)

An assessment is made of the following types of instrumentation dynamic strain sensors, static strain sensors, and metal temperature sensors. Dynamic strain sensors have poor survivability, mainly because of fatigue, erosion, and oxidation. What is more, they cannot be used at temperatures exceeding 1200 F. Two methods under investigation that hold promise for overcoming these limitations and meeting the requirements set by the U.S Air Force, NASA, and industry are thin-film strain gages and blade tip deflection sensors, both of which are discussed In discussing static strain sensors, it is pointed out that the current method for measuring static strain is to use wire gages These, however, cannot normally be used in the hot section of a turbine engine Alernatives to the wire gage are double core fiber optic strain sensors, thin-film capacitive sensors, and acoustic guided wave sensors. With regard to metal temperature sensors, current practice dictates the use of wire thermocouples Three alternatives to these are thin-film thermocouples, optical pyrometers, and fiber optic temperature sensors. C.R.

A83-39423

CHANGE IN VIBRATIONS OF AN FLEXIBLE ROTOR DUE TO A CHANGE IN BEARINGS [DIE AENDERUNG DE SCHWINGUNGEN EINES ELASTISCHEN ROTORS BEIM UEBERGANG AUF ANDERE LAGER]

M. MUELLER Ingenieur-Archiv (ISSN 0020-1154), vol. 53, no. 3, 1983, p 165-171 In German refs

A procedure for inferring the vibrational state of operational bearings from knowledge of the vibrational behavior of a balancing machine rotor is presented. The imbalance of the rotor need not be known; but the vibrations in the balancing machine bearings must be measured or taken from construction data The procedure is tested with a simple example. The findings can be extended to more complicated cases by means of matrices or finite elements C D.

A83-39508

THEORETICAL ESTIMATE OF THE EFFECT OF THE ROTATION OF IMPELLERS ON THEIR NATURAL FREQUENCIES [K RASCHETNOI OTSENKE VLIIANIIA VRASHCHENIIA RABOCHIKH KOLES NA IKH SOBSTVENNYE CHASTOTY]

V. P IVANOV and A I ERMAKOV (Kuibyshevskii Aviatsionnyi Institut, Kuibyshev, USSR) Problemy Prochnosti (ISSN 0556-171X), June 1983, p 98-101 In Russian refs

A model is developed for the effect of the field of centrifugal forces on the vibrations of the disk part of impellers in a gas turbine engine. The differential equations of disk vibrations are constructed on the basis of the assumption that radial and circular forces acting on the disk due to rotation and nonuniform heating during vibrations are constant in terms of modulus and direction Compared to previously derived equations, these equations make a fuller allowance for the effect of the centrifugal-force field and do not result in a breakdown of the symmetry of the dynamic stiffness matrices of impeller disk parts. B J.

A83-39511

EVALUATION OF THE EFFICIENCY OF THE DIAMOND BURNISHING OF GAS-TURBINE-ENGINE PARTS [OTSENKA EFFEKTIVNOSTI ALMAZNOGO VYGLAZHIVANIIA DETALEI GTD]

V. K IATSENKO (Zaporozhskii Mashinostroitel'nyi Institut, Zaporozhe, Ukrainian SSR) Problemy Prochnosti (ISSN 0556-171X), June 1983, p. 115-119. In Russian refs

The paper presents results of fatigue tests on steel specimens and full-scale shafts of gas turbine engines treated by diamond burnishing. It is shown that diamond burnishing is most efficient when allowance is made for scale factor and stress concentration, and that this efficiency can be maintained for a prolonged period of time The diamond burnishing produces a 50-percent decrease in the variation coefficient of the mean value of the endurance limit B J

A83-39547

FRACTURE MECHANICS IN DESIGN - PARTICULAR REFERENCE TO THE THICKNESS EFFECT ON THE RISK OF UNSTABLE FRACTURE

J. LEREIM (Norske Veritas, Hovik, Norway) Engineering Fracture Mechanics (ISSN 0013-7944), vol 18, no 3, 1983, p 703-715 refs

The work describes the possible unfavorable effect of thickness on the risk of unstable fracture when a fracture mechanics analysis is applied. The effect is demonstrated in two examples where the fracture mechanics analysis is compared with more conventional criteria for static strength as plastic collapse and buckling instability The results clearly show that fracture mechanics evaluations are highly required in the characterization of the strength if the best combination of design solution and material selection should be *obtained for structures containing defects.* Author

A83-39620*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

METAL HONEYCOMB TO POROUS WIREFORM SUBSTRATE DIFFUSION BOND EVALUATION

A VARY, P E MOORHEAD, and D R HULL (NASA, Lewis Research Center, Nondestructive Evaluation Section, Cleveland, OH) Materials Evaluation (ISSN 0025-5327), vol 41, July 1983, p. 942-945 refs

Two nondestructive techniques were used to evaluate diffusion bond quality between a metal fail honeycomb and porous wireform substrate The two techniques, cryographics and acousto-ultrasonics, are complementary in revealing variations of bond integrity and quality in shroud segments from an experimental aircraft turbine engine. Previously announced in STAR as N82-18612 Author

A83-39991

SECONDARY LOADING OF I-SPAR CAPS DUE TO SHEAR DEFORMATION OF THE WEB [SEKUNDAERE BELASTUNG DER GURTE EINES I-HOLMS INFOLGE DER SCHUBVERFORMUNG DES STEGES]

R. EPPLER (Stuttgart, Universitaet, Stuttgart, West Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung (ISSN 0342-068X), vol. 7, May-June 1983, p. 220-223. In German

Load test failures of wings composed of reinforced synthetic materials are explained by examining the shear deformation of spar webs Significant effects occur only when the I-spar shear deformation undergoes a sudden change, as at the point of introduction of a load or at points where the effective web thickness suddenly changes A simple approximatio formula for evaluating this danger is presented Spars with carbon rovings in the cap and glass fabrics in the web appear to be the most critical. C D

A83-40158

FATIGUE OF COMPOSITE BOLTED JOINTS UNDER DUAL LOAD LEVELS

J N YANG (George Washington University, Washington, DC) and R T COLE (Lockheed-Georgia Co, Marietta, GA) IN: Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 1 . Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p. 333-340 Research supported by the Lockheed-Georgia Co refs (Contract N00019-81-C-0549)

A fatigue and residual strength degradation model previously proposed for advanced composite laminates is applied to predict the fatigue life distribution of composite bolted joints under dual loads. A test program using AS1/3501-6 graphite/epoxy bolted joints has been carried out to generate baseline constant amplitude fatigue data and static ultimate strength data. These data sets are used to determine the parameter values involved in the fatigue model Then, the statistical figure life data under dual load levels are generated to demonstrate the applicability of the theoretical model It is shown that the correlation between the test results and the predictions based on the model is very reasonable. C D

A83-40159

STRENGTH TESTS OF CFRP JOINT ASSEMBLY MODELS FOR TAILPLANE STRUCTURE

Y TADA, K ONO, E. NAKAI, and K TAKEUCHI (National Aerospace Laboratory, Chofu, Tokyo, Japan) IN: Progress in science and engineering of composites, Proceedings of the Fourth International Conference on Composite Materials, Tokyo, Japan, October 25-28, 1982 Volume 1 . Tokyo/Amsterdam, Japan Society for Composite Materials/North-Holland, 1982, p 341-348 refs

Static and fatigue strength tests of CFRP substructure models for an all-composite horizontal tailplane are reported. The models were constructed from layers containing 0 4 mm of eight-harness satin fabric and 0 14 mm of unidirectional laminate The subtructures tested were CFRp spar with rib, CFRP spar with metallic fittings, CFRP skin with stringer, and stringer-stiffened CFRP panel The model geometry, loading procedures, numerical test results, and failure modes are discussed All substructure models passed the static-strength design ultimate, and reasonable fatigue srengths were found. Techniques for further improvements are suggested T.K.

A83-40302

SIMULATED FAN-BEAM RADAR IMAGERY

W B RUHNOW (Rockwell International Corp, Collins Divs, Cedar Rapids, IA) Navigation (ISSN 0028-1522), vol 30, Spring 1983, p. 51-71.

The simulation of significant aspects of the imagery available from an idealized fan-beam radar is investigated in order to evaluate the utility of such imagery in assessing the progress of an aircraft along postulated final approach paths, and to determine if the sensed imagery from a horizontally scanned fan-beam radar can be enhanced by implementing a second, vertically scanned fan-beam radar and combining the two images Mathematical algorithms are derived for these simulations and plots are drawn for various aircraft positions and attitudes employing discrete points for two runways at Los Angeles International Airport. Simulations of the horizontally scanned Fan-beam Radar Imagery (FRI) shows that while the radar imagery presents an accurate lateral view, it lacks vertical information Next, the combined FRI for the addition of a vertically scanned fan-beam radar to the horizontally scanned fan-beam radar is evaluated. The simulations demonstrate that this technique produces an accurate view in both the lateral and vertical directions It is found that yaw, pitch, and roll information, as well as progress in both the horizontal and vertical planes, are apparent. These results demonstrate that such combined imagery can provide critical aircraft position and attitude information. N B

A83-40471

THE COMPARISON OF THE RESULTS OF SERVICE-SPECTRUM TESTS WITH THE HELP OF THE RELATIVE MINER RULE [VERGLEICH DER ERGEBNISSE VON BETRIEBSFESTIGKEITSVERSUCHEN MIT HILFE DER RELATIV-MINER-REGEL]

A. BUCH (Technion - Israel Institute of Technology, Haifa, Israel), H. LOWAK, and D SCHUETZ (Fraunhofer-Institut fuer Betriebsfestigkeit, Darmstadt, West Germany) Zeitschrift fuer Werkstofftechnik (ISSN 0049-8688), vol. 14, June 1983, p 207-219 In German refs

The use of the relative Miner rule to make aircraft-component loading spectra comparable is demonstrated using data from tests on different aircraft performed at different laboratories, TWIST and FALSTAFF standard tests of the fatigue life of riveted joints, pin-lug joints, and notched sample are compared. It is shown that the test results can be converted to comparable fatigue-life values (such as number of flights) for a common loading frequency distribution, if the Woehler lines of the joints are known. The success of the relative-Miner comparison is found to be limited by certain differences in loading-spectrum, materials, component and sample types, and input data. T.K.

A83-40605

METHODS OF LASER DOPPLER ANEMOMETRY [METODY LAZERNOI DOPLEROVSKOI ANEMOMETRII]

IU. N DUBNISHCHEV and B. S RINKEVICHIUS Moscow, Izdatel'stvo Nauka, 1982, 304 p In Russian refs

A systematic exposition of the principles underlying laser Doppler anemometers (LDA) is presented Attention is given to physical principles and to principles underlying the design of the LDA optical systems. An analysis of the structure of the Doppler signals on the basis of Mie-scattering theory is presented along with an analysis of LDA optical systems on the basis of Fourier-optic methods. The practical implementation of LDAs is considered, and LDA applications (studies of boundary layer flows, turbulent flows, two-phase flows, etc.) are examined B J.

N83-28092 ERA Ltd , Leatherhead (England)
THE PERFORMANCE OF VHF AND UHF AERIALS MOUNTED ON CARBON FIBER COMPOSITE MATERIALS
A. MCHALE *In its* Investigation of the RF Properties of Carbon Fiber Composite Mater 19 p Jul 1982
Avail· Issuing Activity

Antenna isolation, voltage standing wave ratio (VSWR) and radiation pattern measurements were compared for vhf and uhf antennas mounted on carbon fiber composite (CFC) and aluminum cylinders There is little difference between the CFC and aluminum installations, although within the vhf aircraft communications band the results for the CFC cylinder indicate a greater VSWR and a less uniform azimuthal radiation pattern One original panel section of a helicopter tail cone was replaced with CFC Antenna isolation was measured between standard antennas on the helicopter and an antenna first mounted on the original panel and then on the replacement CFC and aluminum panels No differences are found in the isolation results other than those caused by changes in the tail cone contour Author (ESA)

N83-28283# Federal Aviation Administration, Washington, D C.
ADVISORY CIRCULAR. BUILDING FOR STORAGE AND MAINTENANCE OF AIRPORT SNOW REMOVAL AND ICE CONTROL EQUIPMENT: A GUIDE
25 Mar 1983 26 p
(FAA-AC-150/5220-15) Avail: NTIS HC A03/MF A01

Standards are suggested for an airport maintenance, storage, and snow removal equipment building that can protect the airport's investment in snow and ice control equipment, as well as in stored ice conrol materials, as well as support safe all-weather aircraft operations It is advantageous to size the building to include storage for field lighting and other airport maintenance equipment, friction measuring equipment, rubber removal devices, and inspection or bird partol vehicles. Such buildings require site specific design, should be planned by an architectural and engineering firm familiar and airport needs and construction constraints A.R.H

N83-28290# Transportation Research Board, Washington, D C.
AIRPORT AND HIGHWAY NOISE CONTROL, PLANNING AND ANALYSIS
R A HARRIS, R W HENDRIKS, M HATANO, R D DOUGLASS, J. K. DRINKWATER, D J BILLERA, B C CUNNINGHAM, C BRITTLE, W. BROEG, G F HABERLE et al 1982 61 p refs
(PB83-153692, TRB/TRR-865, ISBN-0-309-03369, ISSN-0361-1981, LC-82-24696) Avail NTIS HC A04/MF A01 CSCL 13B

Areas addressed are as follows determination of effectiveness of noise barriers along I-285, Atlanta, evaluation of noise barriers; transparent noise barriers along I-95 in Baltimore City, Maryland; NJ-18 Freeway and Rutgers University classrooms -- unique construction noise mitigation experience; role of airport noise allocations in a regional airport system; comparison of irritation caused by noise generated by road traffic and aviation traffic, enhancement of highway noise modeling through computer graphics, highway construction noise modeling, and noise control through land use planning -- the Calgary case. GRA

N83-28291 Royal Aircraft Establishment, Farnborough (England).
POSSIBLE EFFECTS OF CITIZENS BAND RADIO TRANSMISSIONS ON SERVICE AIRBORNE RADIO NAVAIDS
J. P CHAMBERLAIN 8 Jun 1982 22 p refs
(RAE-TM-RAD-NAV-197, BR84193) Avail Issuing Activity

The potential detrimental effects of interference from CB equipment not within UK specification MPT 1320 on instrument landing systems (ILS) and other navigation aid systems is discussed The frequent use of illegal amplitude modulation and power increases in the UK is commented on The probability of error in ILS due to legal or illegal CB interference is analyzed. The risk of using illegal CB in vulnerable areas such as in proximity of an ILS equipped runway is demonstrated. Author (ESA)

N83-28304# Royal Aircraft Establishment, Farnborough (England)
AN IMPROVED SUSCEPTIBILITY TEST FOR THE EMC TESTING OF AEROSPACE EQUIPMENT
N J CARTER Aug 1982 19 p refs
(AD-A125362; RAE-TM-FS(F)-442; DRIC-BR-86022) Avail: NTIS HC A02/MF A01 CSCL 09C

This Memorandum describes a revised conducted susceptibility EMC test for avionic equipment. The test covers the frequency range 50 kHz to 400 MHz and can be used in conjunction with existing EMC tests Its implementation is described in a form suitable for direct incorporation in project requirements GRA

N83-28308# Naval Postgraduate School, Monterey, Calif
POSITIONING OF JAMMING AIRCRAFT USING THE INTEGRATED REFRACTIVE EFFECTS PREDICTION SYSTEM M.S. Thesis
T W WHITE Oct. 1982 115 p refs
(AD-A125644) Avail NTIS HC A06/MF A01 CSCL 17D

Tactical ECM planning has historically considered only horizontal positioning of self-protection and standoff jamming systems Failure to consider vertical positioning of the jammer, and how the environment affects that positioning, can lead to substantially reduced jamming effectiveness The effects of radar and jamming system antenna patterns and environmental considerations are discussed The Integrated Refractive Effects Prediction System (IREPS) incorporates these effects, but not in a form that is convenient for ECM planning. However, as it is now configured, IREPS can be a useful tool A step-by-step approach for using IREPS and the jamming equations to assist the ECM planner is given Sample calculations for self-protection and standoff jamming under actual environmental conditions are provided Author (GRA)

N83-28317# Physics Lab RVO-TNO, The Hague (Netherlands) Research Group 6: Signal Processing
MEASURING TARGET POSITION WITH THE FUCAS PHASED-ARRAY RADAR SYSTEM
G. A. VANDERSPEK Nov 1982 48 p refs
(Contract A74/K/077)
(PHL-1982-64, TDCK-77306) Avail· NTIS HC A03/MF A01

An experimental system with the ability to measure the position of targets within the main radar antenna beam by applying monopulse processing to the echoes of a single transmission is presented The position estimation process is described and the results of an experiment to determine its performance are presented The experiment was done with an almost stationary helicopter, so that the effects of strong target glint had to be considered The influence of the application of incoherent echo integration, frequency agility and moving target indication are examined. A single target echo from within the half power beam contour is sufficient to provide an accurate position estimate within 4% rms error The applications of frequency agility reduces the effect of target glint. The monopulse performance can be improved by using a set of monopulse relations. Author (ESA)

N83-28326 Royal Aircraft Establishment, Farnborough (England).
THE COOLING OF PRINTED CIRCUIT BOARD MOUNTED COMPONENTS USING COPPER LADDER HEAT CONDUCTION TO A COLD WALL
I C DALE 1 Sep 1982 40 p refs
(RAE-TR-82092, RAE-FS-(F)-184; BR86157) Avail· Issuing Activity

A series of experimental tests, designed to investigate the cooling of printed circuit board (PCB) mounted dual-in-line (DIL) components within an avionic box using the copper ladder/cold wall technique is described Areas of investigation include avionic box orientation, side wall conduction, top plate finning, mixed air-wash, avionic power reduction, cooling air temperature reduction, cooling air mass flow rate reduction, cold wall heat pick-up and avionic box insulation. Results were obtained from thermocouple temperature measurements. The use of an aluminum alloy interplate to cool two adjacent PCBs is discussed. Results in graphic form are included together with a list of conclusions on the effects of all the major parameters considered Author (ESA)

N83-28364 Case Western Reserve Univ, Cleveland, Ohio.
PREDICTION OF NATURAL CONVECTION FLOW PATTERN IN LOW-ASPECT RATIO ENCLOSURES Ph.D. Thesis
J LEE 1982 134 p
Avail Univ Microfilms Order No DA8224690

The natural convection of a fluid confined within a low aspect ratio rectangular enclosure with differentially heated end walls is addressed The objective is to predict the core flow pattern a priori once the boundary and geometry conditions are given. Multiple scales technique is employed to obtain a proper mathematical model from which the core flow patterns are analyzed based on various force balances Global analyses show a number of possible core configurations Detailed analyses lead to predictions for the occurrence of possible flow subregimes, such as secondary cells. Comparison with the existing experimental results shows good agreement Dissert Abstr

N83-28377# University of Southern California, Los Angeles Dept of Aerospace Engineering.
LUNATE-TAIL SWIMMING PROPULSION AS A PROBLEM OF CURVED LIFTING LINE IN UNSTEADY FLOW. 1: ASYMPTOTIC THEORY
H. K CHENG and L. E MURILLO Dec. 1982 82 p refs
(Contract NSF CME-79-26003)
(USCAE-139) Avail NTIS HC A05/MF A01

The asymptotic theory of a high aspect ratio wing in an incompressible flow was generalized to an oscillating domain where the reduced frequency based on the half span, omega, is of unit order In this domain, the streamwide and cross stream components of the wake vorticities are comparable in magnitude Together with formulation for a higher reduced frequency, the analysis completes a framework bridging the high and low frequency realms of high aspect ratio, planar wings of arbitrary shapes In the quasi-steady limit, the work solves the crescent moon wing problem, and provides a basis for explaining Weissenger's method for swept wings, the analysis also generalizes a skew symmetry principle correlating 3 D effects on forward swept and aft swept wings S.L

N83-28378*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EFFECTS OF FLOW SEPARATION AND COVE LEAKAGE ON PRESSURE AND HEAT-TRANSFER DISTRIBUTIONS ALONG A WING-COVE-ELEVON CONFIGURATION AT MACH 6.9
W D DEVEIKIS Jun 1983 95 p refs
(NASA-TP-2127; L-15513, NASA 1.60 2127) Avail NTIS HC A05/MF A01 CSCL 20D

External and internal pressure and cold-wall heating-rate distributions were obtained in hypersonic flow on a full-scale heat-sink representation of the space shuttle orbiter wing-elevon-cove configuration in an effort to define effects of flow separation on cove aerothermal environment as a function of cove seal leak area, ramp angle, and free-stream unit Reynolds number. Average free-stream Mach number from all tests was 6.9, average total temperature from all tests was 3360 R; free-stream dynamic pressure ranged from about 2 to 9 psi, and wing angle of attack was 5 deg (flow compression) For transitional and turbulent flow separation, increasing cove leakage progressively increased heating rates in the cove When ingested mass flow was sufficient to force large reductions in extent of separation, increasing cove leakage reduced heating rates in the cove to those for laminar attached flow. Cove heating-rate distributions calculated with a method that assumed laminar developing channel flow agreed with experimentally obtained distributions within root-mean-square differences that varied between 11 and 36 percent where cove walls were parallel for leak areas of 50 and 100 percent Author

N83-28383# Royal Aircraft Establishment, Farnborough (England)
CALCULATION AND MEASUREMENT OF SEPARATED TURBULENT BOUNDARY LAYERS
P D SMITH, R. C HASTINGS, and B R WILLIAMS Oct. 1982 39 p refs Presented at Euromech 148 2-Dimensional Separated Flows, Bochum, West Germany, 13-15 Oct. 1981
(AD-A125392, RAE-TM-AERO-1955, DRIC-BR-86356) Avail NTIS HC A03/MF A01 CSCL 20D

An inverse integral prediction method for the development of separated turbulent boundary layers developed from the lag-entrainment method is described. The inverse method uses the concept of equilibrium separated boundary layer flows and the predicted characteristics of such flows will be compared with measurements which represent the first known demonstration that equilibrium separated boundary layers can be realised experimentally In these experiments the data were obtained with a single-component laser Doppler anemometer usually set up to measure streamwise components of mean velocity and turbulence intensity; in addition, however, one pair of profiles of the mean velocity and turbulence intensity normal to the wall was obtained. The separated flow on a NACA 4412 aerofoil has been measured by Wadcock using the flying hot-wire technique It is shown that predicted values of momentum thickness agree with the measured values but that the calculation predicts a pressure rise in the separated region whereas the pressure is almost constant in the experiment The result of introducing second order effects into the calculation is shown The equivalent inviscid flow is constructed and the matching of the equivalent and real flows is considered GRA

N83-28387# Naval Postgraduate School, Monterey, Calif Dept of Aeronautics.
EVALUATION OF THE PERFORMANCE AND FLOW IN AN AXIAL COMPRESSOR M.S. Thesis
J. L. WADDELL Oct 1982 161 p refs
(AD-A125619) Avail NTIS HC A08/MF A01 CSCL 13G

An experimental evaluation of the axial compressor test rig with one stage of symmetric blading was conducted to determine its suitability for studies of tip clearance effects. Measurements were made of performance parameters and internal flow fields. The configuration tested was found to be unsuitable due to poor flow from the inlet guide vanes, particularly near the tip region. Secondary flows and flaws in construction of the guide vanes were suggested as probable causes Recommendations were made for a program to resolve the problem Author (GRA)

N83-28455*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCES IN TRACTION DRIVE TECHNOLOGY
S. H. LOEWENTHAL, N. E. ANDERSON, and D. A. ROHN 1983 21 p refs Proposed for presentation at the Intern. Off-Highway Meeting and Exposition, Milwaukee, 12-15 Sep 1983, sponsored by SAE Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TM-83397; E-1674; NAS 1 15:83397; AVRADCOM-TR-83-C-5) Avail. NTIS HC A02/MF A01 CSCL 13I

Traction drives are traced from early uses as main transmissions in automobiles at the turn of the century to modern, high-powered traction drives capable of transmitting hundreds of horsepower Recent advances in technology are described which enable today's traction drive to be a serious candidate for off-highway vehicles and helicopter applications. Improvements in materials, traction fluids, design techniques, power loss and life prediction methods will be highlighted. Performance characteristics of the Nasvytis fixed-ratio drive are given Promising future drive applications, such as helicopter main transmissions and servo-control positioning mechanisms are also addressed Author

N83-28458# General Power Corp , Paoli, Pa
DOE WAVE-TURBINE-ENGINE DEMONSTRATION Final Report
R R COLEMAN 11 Jun 1982 24 p refs
(Contract DE-FG05-79ER-10063)
(DE82-018322, DOE/ER-10063/T1) Avail NTIS HC A02/MF A01

Research on a wave turbine engine, a device which uses energy of vehicle engine exhaust gases to compress the engine inlet air, and which can perform the same function as a conventional turbocharger, is described. A wave turbine engine was designed, built and tested with results that clearly demonstrate effective wave compression and expansion; and a proportional relationship between fuel flow and shaft horsepower at low speed, under 11,000 rpm This relationship shows increasing overall efficiency with increased power This project had demonstrated the potential of the wave engine for a wide range of applications Significant progress was made to show that this technology is a practical basis for advanced power units with definite advantages over high performance conventional units. DOE

N83-28501# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Abteilung Strukturberechnung.
ON THE FAIL-SAFE CHARACTERISTICS OF STIFFENED PANELS
J Y WANG and F M LIU Nov. 1982 67 p refs
(DFVLR-FB-83-08) Avail NTIS HC A04/MF A01, DFVLR, Cologne DM 24,20

Residual strength crack growth rate of riveted, stiffened panels are evaluated The method is based on the fail-safe characteristics of stiffened panels and on the material R-curves These data, obtained in tests, are used to calculate the fracture characteristics and the residual life of the Y-10 wing lower stiffened panel The plastic material behavior of the sheet, rivets, and stringers are considered. Computational results and corresponding tests are in good agreement Author (ESA)

N83-28622# Union Carbide Corp , Oak Ridge, Tenn. Nuclear Div
ROTOR TESTING IN FY 1982
E. F BABELAY, JR. *In* Courtesy Assoc , Inc. Proc. of the DOE Phys. and Chem Storage Ann. Contractors' Rev. Meeting p 270-278 Dec 1982 refs
(Contract W-7405-ENG-26)
Avail: NTIS HC A25/MF A01

The results and observations are reported from flywheel spin tests conducted for the Mechanical Energy Storage Program at the Oak Ridge National Laboratory. Test results include the completed cyclic fatigue test of a flywheel, as well as ultimate speed evaluations for a modified rotor and three low cost flywheels A.R.H.

N83-29216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DILUTION ZONE MIXING
J D HOLDEMAN *In its* Combust Fundamentals Res p 65-76 Mar 1983 refs
Avail· NTIS HC A12/MF A01 CSCL 20D

Studies to characterize dilution zone mixing; experiments on the effects of free-stream turbulence on a jet in crossflow, and the development of an interactive computer code for the analysis of the mixing of jets with a confined crossflow are reviewed R.J F.

N83-29217*# Michigan State Univ , East Lansing. Dept. of Mechanical Engineering
INFLUENCE OF A LARGE FREE STREAM DISTURBANCE LEVEL ON DYNAMICS OF A JET IN A CROSS FLOW
J. J FOSS and C. E. WARK *In* NASA. Lewis Research Center Combust Fundamentals Res p 77-84 Mar 1983
Avail· NTIS HC A12/MF A01 CSCL 20D

An experiment to study the physical agents that are responsible for the jet turning into the streamwise direction, and the mixing of the jet and the cross stream fluid in the case of a jet in a cross flow is discussed. R J.F

N83-29232*# California Inst. of Tech , Pasadena.
UNSTEADY FLOW EFFECTS IN COMBUSTOR SYSTEMS
M V SUBBAIAH *In* NASA Lewis Research Center Combust Fundamentals Res. p 239-248 Mar. 1983 refs
Avail NTIS HC A12/MF A01 CSCL 20D

A wide variety of combustion problems, including combustion instabilities and turbulent diffusion flames, appear to involve the entrainment and deformation of laminar flames by large vortex structures in the flow field. First, some details of this process of laminar flame distortion are examined by considering the interactions of time-dependent diffusion flames with two dimensional vortices Second, Some results on the modelling of the non-steady combustion in burners for aircraft gas turbines are given. The general aim of the work is to develop a one dimensional model applicable to the NASA-Lewis Non-Steady Combustion Rig L.F M

N83-29448*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
CAD OF CONTROL SYSTEMS: APPLICATION OF NONLINEAR PROGRAMMING TO A LINEAR QUADRATIC FORMULATION Final Report
P. FLEMING (University Coll. of North Wales) Jun. 1983 9 p refs
(Contract NAS1-17070)
(NASA-CR-172151; ICASE-83-24, NAS 1 26 172151) Avail NTIS HC A02/MF A01 CSCL 13B

The familiar suboptimal regulator design approach is recast as a constrained optimization problem and incorporated in a Computer Aided Design (CAD) package where both design objective and constraints are quadratic cost functions This formulation permits the separate consideration of, for example, model following errors, sensitivity measures and control energy as objectives to be minimized or limits to be observed. Efficient techniques for computing the interrelated cost functions and their gradients are utilized in conjunction with a nonlinear programming algorithm The effectiveness of the approach and the degree of insight into the problem which it affords is illustrated in a helicopter regulation design example Author

N83-29561# Kansas Univ Center for Research, Inc , Lawrence Remote Sensing Lab
HELICOPTER-BORNE SCATTEROMETER
R. G ONSTOTT, R K MOORE, S P. GOGINENI, Y S KIM, and D E BUSHNELL Oct 1982 113 p refs
(Contract N00014-76-C-1105)
(AD-A125796; CRINC/RSL-TR-331-24) Avail NTIS HC A06/MF A01 CSCL 17I

The purpose of this report is to provide a detailed technical description of the University of Kansas helicopter-borne microwave active spectrometer (HELOSCAT). A major advantage of this calibrated system is the mobility of the helicopter platform, it has the advantages of both a ground-based system and an aircraft system without many of the inherent disadvantages The Bell 206 helicopter was chosen as the best platform because of its wide availability in the High Arctic (and continental U S , for that matter) and its low operating cost when compared to its sister aircraft, the Bell 205 and 212. Costs are in the range of $350/flight hour with a fuel consumption of 30 gallons per hour In contrast, the larger Bell 205 costs are $1000/hour with a fuel consumption of 80 gallons per hour This system features the ability to acquire data at frequencies from 4 to 18 GHz with like-and cross-antenna polarizations and angles of incidence from 10 degrees to 70 degrees All control, including that of the angles and antenna polarizations, is from within the aircraft. Frequency selection may be performed both manually or via microprocessor. The microprocessor also multiplexes data from a fast true rms detector (0 1 second average) and an averaging true rms detector (1 second average). Author (GRA)

N83-29579# Ohio State Univ , Columbus Electroscience Lab
JAM RESISTANT COMMUNICATIONS SYSTEMS TECHNIQUES Final Technical Report, Feb. 1979 - May 1982
A. A. KSIENSKI Griffiss AFB, N Y RADC Dec 1982 320 p refs
(Contract F30602-79-C-0068; AF PROJ 4519)
(AD-A126217, RADC-TR-82-328, ESL-711679-11) Avail: NTIS HC A14/MF A01 CSCL 17D

The objective of this effort was to develop techniques to increase the jam resistant capability of communication systems. The effort involved the assessment of the limitations, both theoretical and practical, that restrict the effectiveness of adaptive arrays operating in various environments, and wherever possible to overcome these limitations by appropriate design changes. A technique was developed to predict adaptive array performance and provide guidelines for the design of adaptive arrays on complex structures to produce specified performance levels A cascaded adaptive array consisting of a power inversion stage followed by an LMS stage has been designed, built and tested showing improved dynamic range performances. An angle of arrival estimation system capable of providing accurate angle estimates in the presence of multiple high powered jammers has been developed The angle of arrival estimate could be utilized to provide pointing information in a demand assignment TDMA SATCOM system employing high gain switchable downlink beams GRA

N83-29597*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
DESIGN OF A HIGH-SPEED DIGITAL PROCESSING ELEMENT FOR PARALLEL SIMULATION
E J. MILNER and D S CWYNAR Jun 1983 24 p refs
(NASA-TM-83373, E-1641; NAS 1.15 83373) Avail: NTIS HC A02/MF A01 CSCL 09C

A prototype of a custom designed computer to be used as a processing element in a multiprocessor based jet engine simulator is described The purpose of the custom design was to give the computer the speed and versatility required to simulate a jet engine in real time Real time simulations are needed for closed loop testing of digital electronic engine controls The prototype computer has a microcycle time of 133 nanoseconds This speed was achieved by prefetching the next instruction while the current one is executing, transporting data using high speed data busses, and using state of the art components such as a very large scale integration (VLSI) multiplier. Included are discussions of processing element requirements, design philosophy, the architecture of the custom designed processing element, the comprehensive instruction set, the diagnostic support software, and the development status of the custom design Author

N83-29634*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AN EXPERIMENTAL INVESTIGATION OF THE SUBCRITICAL AND SUPERCRITICAL FLOW ABOUT A SWEPT SEMISPAN WING
W K LOCKMAN and H. L SEEGMILLER Jun 1983 249 p refs
(NASA-TM-84367, A-9359, NAS 1 15 84367) Avail: NTIS HC A11/MF A01 CSCL 20D

An experimental investigation of the turbulent, subcritical and supercritical flow over a swept, semispan wing in a solid wall wind tunnel is described. The program was conducted over a range of Mach numbers, Reynolds numbers, and angles of attack to provide a variety of test cases for assessment of wing computer codes and tunnel wall interference effects. Wing flows both without and with three dimensional flow separation are included. Data include mean surface pressures for both the wing and tunnel walls; surface oil flow patterns on the wing, and mean velocity, flow field surveys. The results are given in tabular form and presented graphically to illustrate some of the effects of the test parameters. Comparisons of the wing pressure data with the results from two inviscid wing codes are also shown to assess the importance of viscous flow and tunnel wall effects. S L

N83-29636*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
NUMERICAL SIMULATION OF VORTEX BREAKDOWN BY THE VORTEX-FILAMENT METHOD
Y NAKAMURA, A LEONARD, and P R SPALART Washington Jul 1983 16 p refs Presented at the AGARD Symp on Aerodyn. of Vortical Type Flows in Three Dimensions
(NASA-TM-84334; A-9263; NAS 1 15:84334) Avail. NTIS HC A02/MF A01 CSCL 20D

The vortex filament method was applied to the simulation of vortex breakdown. The principal vortex region was represented by multiple filaments, and an axial velocity component was induced by a spiral winding of the filaments. First, an accuracy check was performed for a cylindrical swirling flow with simple analytical expressions for the axial and theta velocities. The result suggests that the flow field is simulated to any accuracy by increasing the number of filaments. Second, an axisymmetric type vortex breakdown was simulated, with experimental data serving as upstream conditions. The calculated axial and theta velocity contours show the breakdown of the vortex, including a rapid change in the vortex core, followed axially by a recovery zone and then a second breakdown When three dimensional initial data are used the second breakdown appears to be of the spiral type in correspondence with experimental observations. The present method is easily used to simulate other types of vortex breakdown or other vortex flows with axial velocity. Author

N83-29670# Rolls-Royce Ltd , Derby (England)
IMPROVING THE ACCURACY OF THERMOCOUPLE TEMPERATURE MEASURING CIRCUITS
K. STRINGFELLOW 22 Apr. 1980 11 p refs
(PNR-90148, REPRINT-839) Avail· NTIS HC A02/MF A01

The voltage measurement accuracy in thermocouple circuits used for air/gas temperature measurements in gas turbine aero engines is discussed A circuit composed of three sections of different cable materials is considered. The voltage output is produced by the addition of three thermocouple voltages. A floating reference junction, where the temperature is measured by a resistance thermometer, is used. The thermal plane is a commercially available uniform temperature reference box with a capacity of 60 thermocouple channels. Readout is by on-line computer The equivalent resultant accuracy is 0.5 deg up to 480 deg The use of connectors and sliprings in thermocouple circuits is also discussed. Author (ESA)

N83-29708*# National Aeronautics and Space Administration Pasadena Office, Calif
CENTRIFUGAL-RECIPROCATING COMPRESSOR Patent Application
W. H. HIGA, inventor (to NASA) 23 Jul 1982 27 p
(NASA-CASE-NPO-14597-2; US-PATENT-APPL-SN-401288)
Avail: NTIS HC A03/MF A01 CSCL 13I

A centrifugal compressor includes at least one pair of cylinders arranged in coaxial alignment and supported for angular displacement about a common axis of rotation normally bisecting a common longitudinal axis of symmetry for the cylinders. The cylinders are characterized by ported closures located at the mutually remote ends thereof through which the cylinders are charged and discharged, and a pair of piston heads seated within the cylinders and supported for floating displacement in compressive strokes in response to unidirectional angular displacement imparted to the cylinders Author

N83-29726# Battelle Pacific Northwest Labs., Richland, Wash
RESEARCH TO DEVELOP AND EVALUATE ADVANCED EDDY CURRENT SENSORS FOR DETECTING SMALL FLAWS IN METALLIC AEROSPACE COMPONENTS Final Technical Report, 20 Sep. 1980 - 31 Jul. 1982
J. M PRINCE and B. A AULD Wright-Patterson AFB, Ohio AFWAL Dec 1982 101 p refs
(Contract F33615-80-C-5172, AF PROJ 2418)
(AD-A125873, AFWAL-TR-82-4155) Avail NTIS HC A06/MF A01 CSCL 21E

The purpose of this program was to develop a reproducible, highly sensitive novel eddy current probe applying the technique of ferromagnetic resonance (FMR) The method developed must be suited to inspect test objects where access may be limited, for example bolt holes of turbine engine disks This program studied the FMR probe in both its passive and active modes An active probe was developed and tested that demonstrated that the FMR technique is a practical approach for inspection of metallic aerospace components. The program consisted of three tasks. In Task 1 the theoretical analysis and modeling was performed by Stanford Universtiy under subcontract with Battelle This analysis and modelling served as a guide in probe design concepts for Battelle's experimental evaluation, which was performed in Task 2. Finally, a demonstration, comprising Task 3, was performed for Air Force Materials Laboratory personnel at Battelle's facility in which five FMR probes of the same design were tested. The results of the demonstration confirmed the FMR probe design's reproducibility and repeatable high sensitivity for detecting flaws located in a titanium bolt-hole specimen Author (GRA)

N83-29732*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
GROUND TEST EXPERIENCE WITH LARGE COMPOSITE STRUCTURES FOR COMMERCIAL TRANSPORTS
H L. BOHON, A J CHAPMAN, III, and H A LEYBOLD Mar. 1983 22 p refs Presented at the Am. Helicopter Soc. Composite Struct Specialist's Conf., Philadelphia, 23-25 Mar. 1983
(NASA-TM-84627, NAS 1 15 84627) Avail: NTIS HC A02/MF A01 CSCL 20K

The initial ground test of each component resulted in structural failure at less than ultimate design loads While such failures represent major program delays, the investigation and analysis of each failure revealed significant lessons for effective utilization of composites in primary structure Foremost among these are secondary loads that produce through-the-thickness forces which may lead to serious weaknesses in an otherwise sound structural design The sources, magnitude, and effects of secondary loads need to be thoroughly understood and accounted for by the designers of composite primary aircraft structures Author

N83-29733*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADVANCED STRUCTURES TECHNOLOGY AND AIRCRAFT SAFETY
H G MCCOMB, JR Jul 1983 16 p refs
(NASA-TM-85664, NAS 1.15 85664) Avail NTIS HC A02/MF A01 CSCL 20K

NASA research and development on advanced aeronautical structures technology related to flight safety is reviewed. The effort is categorized as research in the technology base and projects sponsored by the Aircraft Energy Efficiency (ACEE) Project Office Base technology research includes mechanics of composite structures, crash dynamics, and landing dynamics The ACEE projects involve development and fabrication of selected composite structural components for existing commercial transport aircraft Technology emanating from this research is intended to result in airframe structures with improved efficiency and safety Author

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GEOSCIENCES

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

A83-38013#
COMPARISON OF NACA 6-SERIES AND 4-DIGIT AIRFOILS FOR DARRIEUS WIND TURBINES
P G MIGLIORE (California, University, Davis, CA) Journal of Energy (ISSN 0146-0412), vol 7, July-Aug 1983, p. 291, 292 Research supported by the U S Department of Energy refs

The aerodynamic efficiency of Darrieus wind turbines as effected by blade airfoil geometry was investigated. Analysis was limited to curved-bladed machines having rotor solidities of 7-21 percent and operating at a Reynolds number of 3 x 10 to the 6th Ten different airfoils, having thickness-to-chord ratios of 12, 15, and 18 percent, were studied. Performance estimates were made using a blade element/momentum theory approach Results indicated that NACA 6-series airfoils yield peak power coefficients as great as NACA 4-digit airfoils and have broader and flatter power coefficient-tip speed ratio curves Sample calculations for an NACA 63(2)-015 airfoil showed an annual energy output increase of 17-27 percent, depending on rotor solidity, compared to an NACA 0015 airfoil Author

A83-38746
OPERATIONAL ASPECTS OF DELTA AIR LINES METEOROLOGICAL DEPARTMENT
C L CHANDLER (Delta Air Lines, Inc , Atlanta, GA) IN: Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p. 226-228

In 1959, a meteorological department was created by a U S airline for the purpose of flight planning and weather support of the new jet transport fleet whic entered service in early fall of 1959 Both surface and upper air forecasting has been provided. In order to operate the aircraft efficiently, it was found to be necessary to use a special type of surface and upper air analysis and develop a refined forecasting technique. Presently a forecast is issued three times each day for 75 terminals Attention is given to the meteorological aspects of flight planning and the new computer flight planning system. The three things which an airline seeks in flight planning are related to safety, the smoothest possible flight, and minimum cost. G R

A83-38749
SPECIFICATION OF SLANT WIND SHEAR WITH AN OFFSET TOWER OBSERVATION SYSTEM
H. A BROWN (USAF, Geophysics Laboratory, Bedford, MA) IN: Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p 241-246. refs

It is pointed out that the vertical velocity field, w, is rarely measured and that wind shears are computed for horizontal winds, u and v, only along a vertical and horizontal distance. It is contended here that neither of these measurements represents the wind shear of greatest importance to the aircraft operator On takeoffs and landings, the aircraft follows a slant trajectory and encounters winds that are separated over a considerable horizontal distance and, to a somewhat lesser extent (about one order of magnitude) in the vertical For this reason, wind shears measured along a vertical axis alone by a tower or acoustic Doppler or along a horizontal axis by a surface network of wind sets may give a misleading picture of the operationally important wind-shear field The results of research into the use of the modular automated airfield weather system (MAWS), developed by Chisholm et al (1981), on surface winds in order to determine the slant wind shear over the approach or takeoff zone of an airfield are discussed C.R

A83-38750
DFVLR-REMOTE SLANT VISUAL RANGE (SVR) AND WIND VECTOR MEASURING SYSTEMS
CH WERNER, F KOEPP (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Optoelektronik, Oberpfaffenhofen, West Germany), and R L. SCHWIESOW IN. Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints . Boston, MA, American Meteorological Society, 1983, p 247-251 Research supported by the Bundesministerium fuer Verkehr, Deutsche Lufthansa AG, Bayerisches Staatsministerium fuer Wirtschaft- und Verkehr, and Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt. refs

A slant visual range detector (SVR-detector) obtained by modifying a laser ceilometer is described, along with its field test Also described is an infrared Doppler lidar, which is a cw homodyne system designed for boundary layer wind measurements, especially for such aircraft-related wind phenomena as the low-level jet, shear winds, and wake vortices The system is similar in size and optical layout to Doppler lidars described by other research groups, but it has features to facilitate wind determinations. These include scanning, readout, and data reduction An application to low-level wind maxima is described In the SVR device, the extraction of the visibility from the lidar signature is based on the slope method (Collis et al., 1970) in the reduced version proposed by Werner (1981). It is demonstrated that a laser transmitter used in commercially available laser ceilographs can be used for slant visual measurements The infrared cw Doppler lidar is shown to give useful wind profiles at altitudes of up to 750 m C.R.

A83-38751
MEASUREMENTS OF AN AIRCRAFT WAKE VORTEX SYSTEM USING A METEOROLOGICAL TOWER
A. J. BEDARD, JR (NOAA, Wave Propagation Laboratory, Boulder, CO) IN Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p. 252-256 refs

The experiment for the data presented here involved flybys near the Boulder Atmospheric Observatory (BAO), which provided real-time outputs of various parameters, including wind speed, wind direction, and temperature. These data are used to predict the motion of the vortex system and to guide the aircraft height, bearing, and position in relation to the tower and the radar The results of the experiment, which focused chiefly on the evaluation of an FM/CW radar for wake vortex detection, are seen as providing an interesting case study of vortex impingement upon a well-instrumented meteorological tower The horizontal and vertical wind speed measurements are compared with those expected from the passage of a wake vortex system The temperature perturbation obtained gives a data set indicating the temperature distribution in a wake vortex system. C R.

A83-38760
METEOROLOGICAL DATA REQUIREMENTS FOR FUEL EFFICIENT FLIGHT
H. C TRUE and D E WINER (FAA, Washington, DC) IN: Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p 293-298 refs

Development in flight management systems and automated air traffic control are discussed Attention is also given to the meteorological data required by these systems and to the way in which they depend on this data. Radiosondes, satellites, and systems for automated pilot reporting are discussed and compared. The systems capable of meeting aviation requirements in the 1990s are described It is pointed out that automated air traffic control and flight management will provide potential fuel savings only if accurate, complete, and timely meteorological data are available. Better upper wind and temperature data for flight planning could save one to three percent of domestic commercial aviation fuel, or 100 to 300 millions gallons each year An advanced automated air traffic control system taking advantage of accurate and timely weather information would save at least three percent of commercial aviation fuel C R

A83-38761
THE AIR FORCE GLOBAL WEATHER CENTRAL COMPUTER FLIGHT PLANNING SYSTEM
S G KERN (USAF, Offutt AFB, NE) IN: Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p 299-302

AFGWC (Air Force Global Weather Central) produces approximately 500 flight plans per day and has the ability to produce 3000 More than 70 percent of the plans are supplied to the Military Airlift Command (MAC) AFGWC can produce 23 different types of fixed-format flight plans or select from any of 55 free-format options to create the desired format. There are also 15 override options that can be used in the request Once the flight plan request arrives at AFGWC, it is processed through a real-time operating system, recognized there as a flight plan request, and then passed to the flight plan control The flight plan control archives the message on disk, decodes the request type, sends an acknowledgment message to an in-house device, assigns the request an identification number, stores the request in a queue, and constructs the appropriate library Also described are capabilities that are being added to the system C R

A83-38762* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ANALYSIS OF SPANWISE GUST GRADIENT DATA
W. CAMPBELL, D W. CAMP (NASA, Marshall Space Flight Center, Atmospheric Science Div, Huntsville, AL), and W. FROST (Tennessee, University, Tullahoma, TN) IN. Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p 303-309. refs

Plots of winds encountered during flight are presented for severe turbulence cases from flights 6 and 7 of the Joint Airport Weather Studies (JAWS) Project (McCarthy et al., 1982) During run 10 of flight 7, analyzed here in considerable detail, the B-57B Cambera aircraft showed a sharp increase in airspeed of 15 m/sec over a distance of about 130 m and then a more gradual decrease of 20 to 25 m/sec over a distance of about 2 km This suspected outflow feature was associated with a downdraft exceeding 10 m/sec. The horizontal wind direction changed nearly 180 deg during the pass through the feature Unexpectedly, the intensity of the velocity differences decreased for all three components within the downdraft Calculated probability density functions for u, v, and w show a jagged character, whereas delta-u, delta-v, and delta-w show a much smoother, unimodal behavior The distributions for delta-u, delta-v, and delta-w are distinctly non-Gaussian C R

A83-38764* California Univ., Los Angeles
NUMERICAL SIMULATION OF THE ATMOSPHERE DURING A CAT ENCOUNTER
T L KELLER, M G WURTELE (California, University, Los Angeles, CA), and L. J EHERNBERGER (NASA, Flight Research Center, Edwards AFB, CA) IN· Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints Boston, MA, American Meteorological Society, 1983, p. 316-319 refs (Contract NSG-4024)

In an attempt to determine whether clear air turbulence (CAT) which caused a brief, intense turbulence encounter to a jetliner might have been related to gravity waves generated by a line of thunderstorms, local sounding data taken within two hours of the incident have been used as input to a numerical model designed to simulate stratified flow over obstacles. In the model a rigid obstacle at the lower boundary acted as the source of the gravity waves. The model results show a large amplitude disturbance localized over the obstacle at and above flight level, in regions where CAT would be expected Stratification studies have been conducted, varying the height and shape of the obstacle and the input wind profile. The success of the experiment leads to the conclusion that atmospheric gravity wave simulation can be useful in understanding and possibly avoiding CAT C D

A83-38765
CAT DETECTION AND FORECASTING USING OPERATIONAL NMC ANALYSIS DATA
J. L. KELLER (Dayton, University, Dayton, OH) IN: Conference on Aerospace and Aeronautical Meteorology, 9th, Omaha, NE, June 6-9, 1983, Preprints . Boston, MA, American Meteorological Society, 1983, p 320-324. refs

Several incidents involving severe Clear Air Turbulence (CAT) have occurred within the past two years Each of these incidents resulted in serious injuries to both passengers and crew. The development of a reliable, quantitative and more specific index for CAT would be beneficial to aviation A computer software system, the Specific CAT Risk (SCATR) system has been developed to use National Meteorological Center (NMC) analysis fields obtained from currently operational radiosonde and satellite data systems The SCATR system has been applied to one of the considered incidents and to a case study by Kennedy and Shapiro (1980) The present investigation is concerned with the results obtained in these applications It is found that the performance of SCATR appears promising, taking into consideration the limitations of precision reasonably expected in locating the encounters with severe CAT. G R.

A83-39118
THE USE OF PRESSURE FLUCTUATIONS ON THE NOSE OF AN AIRCRAFT FOR MEASURING AIR MOTION
E N BROWN, C A FRIEHE, and D. H. LENSCHOW (National Center for Atmospheric Research, Boulder, CO) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol 22, Jan 1983, p. 171-180 refs

A new air motion system for mounting on the nose of an aircraft is described The instrument consists of holes drilled in the aircraft nose, measuring forward motion and sideslip. The 858 probe features a ring of pressure holes 2.5 diameters behind the radome tip The pressure holes lead to pressure transducers, thermometers, and inertial navigation equipment. The instrumentation was based on designs employed with NASA flights of the X-15. Trials were run with the new configuration to examine angle of attack measurements in comparison with a boom Calculations demonstrated that the holes in the radome provided accurate air-motion measurements in the Mach 0 2-0 7 range Further tests on other aircraft are recommended, as are installation of an anti-icing system for the radome, as well as flush-mounted transducers to alleviate water ingestion problems for flights in the rain M.S K

A83-39120
PRODUCTION OF ICE PARTICLES IN CLOUDS DUE TO AIRCRAFT PENETRATIONS
A L. RANGNO and P. V HOBBS (Washington, University, Seattle, WA) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol 22, Feb. 1983, p 214-232 refs
(Contract NSF ATM-79-00948; NOAA-NA-82RAA03404)

Flight trials were performed over Puget Sound to demonstrate that numerous ice particles can be generated at temperatures over -20 C by high temperature aircraft exhaust Data were collected on the particulate, ice particle, and liquid water cloud content to prove the presence of aircraft produced ice particles (APIP) Ice particle concentrations exceeding 1000/L were measured at temperatures up to -8 C. The APIPs were located, initially, within a narrow cylinder defined by the track of the aircraft passage, a factor that may have bearing on the effectiveness of cloud seeding flights Further trials are recommended with various types of aircraft to determine the ice-forming influence of each, to define the range of conditions amenable to APIP formation, and to track the effects of APIPs on cloud evolution are indicated. M S.K.

A83-39562
STATUS OF HYDROGEN DEVELOPMENT FOR AIRCRAFT IN FIVE COUNTRIES - A CANADIAN PERSPECTIVE
J. MITCHELL (Transport Canada, Ottawa, Canada) International Journal of Hydrogen Energy (ISSN 0360-3199), vol. 8, no. 6, 1983, p. 453-458 refs

The results of studies funded by the Canadian government to identify fuel alternatives to oil derivatives and estimate the potential for H2 as a fuel are presented Hydrogen and electricity were concluded as the prime energy carriers in 50 years in Canada, and suggestions were made that the Canadian government initiate a long-term transition by funding programs to establish the infrastructure for hydrogen production, transportation, and use Periodic reviews of the program were recommended at specified intervals A conclusion was reached that electrolysis would be the lowest cost generation option by the 1990s. Widespread H2 usage will depend on the progress in H2-fueled road vehicles, on-board storage, and the distribution and refueling systems Studies were also indicated in electrochemistry and safety M.S K.

A83-39872
FEASIBILITY TEST OF AN AIRBORNE PULSE-DOPPLER METEOROLOGICAL RADAR
D. P. JORGENSEN (NOAA, National Hurricane Research Laboratory, Coral Gables, FL), P H HILDEBRAND, and C. L. FRUSH (National Center for Atmospheric Research, Boulder, CO) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol 22, May 1983, p. 744-757. refs

A vertically scanning, airborne, pulse-Doppler radar is described. Data processing methods to yield pseudodual-Doppler horizontal winds are presented Results of an intercomparison with a ground-based dual-Doppler network are presented and discussed These results indicate that the accuracy of the Doppler estimates are not seriously degraded by the aircraft's motion in a nonturbulent environment. Reasonable wind velocities were obtained in a stratiform precipitation (pre-warm-frontal) regime despite relatively long time periods for data gathering (about 20 min). Potential error sources are discussed, with the principal conclusion being that the uncertainty in the airborne Doppler mean velocity estimates are slightly larger than would be expected for a ground-based Doppler. However, the time period over which data are gathered is much longer than for a ground-based dual-Doppler network Potential modifications to the antenna and data system to improve data quality are also discussed Author

A83-39939*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
AIRBORNE RECONNAISSANCE IN THE CIVILIAN SECTOR - AGRICULTURAL MONITORING FROM HIGH-ALTITUDE POWERED PLATFORMS
J. W. YOUNGBLOOD (NASA, Langley Research Center, Hampton, VA) and R D. JACKSON (U.S. Department of Agriculture, Agricultural Research Service, Phoenix, AZ) SPIE - The International Society for Optical Engineering, Annual International Technical Symposium and Instrument Display, 27th, San Diego, CA, Aug 21-26, 1983, Paper 9 p refs

Design concepts and mission applications for unmanned high-altitude powered platforms (HAPPs) are discussed A chemically powered HAPP (operating altitude 18-21 km, wingspan 26 m, payload 91 kg, endurance 2-3 days) would use current turboprop technology. A microwave-powered HAPP (operating altitude around 21 km, wingspan 57.9 m, payload 500 kg, endurance weeks or months) would circle within or perform boost-glide maneuvers around a microwave beam of density 1.1 kw/sq m Of two solar-powered-HAPP designs presented, the more promising uses five vertical solar-panel-bearing fins, two of which can be made horizontal at night, (wingspan 57.8/98 3 m, payload 113 kg, endurance weeks or months) The operating altitude depends on the latitude and season· this HAPP design is shown to be capable of year-round 20-km-altitude flights over the San Joaquin Valley in California, where an agricultural-monitoring mission using Landsat-like remote sensors is proposed. Other applications may be better served by the characteristics of the other HAPPs. The primary advantage of HAPPs over satellites is found to be their ability to provide rapidly available high-resolution continuous or repetitive coverage of specific areas at relatively low cost T K

N83-28788 Texas A&M Univ., College Station
A STUDY OF ATMOSPHERIC FLOW IN THE WAKE OF A LARGE STRUCTURE Ph.D. Thesis
D D W CHU 1981 92 p
Avail: Univ Microfilms Order No DA8225489

A theoretical-empirical study was performed to establish the structure of the velocity and pressure fields in the wake of an airport hangar. For the theoretical aspect, the perturbation technique was applied to the hydrodynamic equations for steady-state turbulent flow. The equations were put into non-dimensional form by the use of dimensions of the structure and the assumption that the basic or reference flows fit the logarithmic profile in the vertical. Observational values of the wind within a wake at a height of 2.4 m were used to establish the values of two parameters which were needed to complete the solution Tables and graphs show the resulting computations of the flow and pressure deviation fields in three dimensions. The patterns seem reasonable for a region extending upward to about 1 5 h, where h is the height of the structure However, the flow patterns above this level are suspect. Dissert. Abstr

N83-29930# Weather Squadron (28th), (MAC), New York 09127. Detachment 18.
TERMINAL FORECAST REFERENCE NOTEBOOK FOR RAF FAIRFORD, UNITED KINGDOM Final Report
3 Jan 1983 69 p refs
(AD-A126095) Avail: NTIS HC A04/MF A01 CSCL 04B

Meteorological data was collected and processed to aid in the forecasting of weather for the facility at RAF Fairford Author

N83-29955# Naval Ocean Research and Development Activity, Bay St. Louis, Miss Advanced Sensor and Survey Branch
A PLAN FOR OPTICAL OCEANOGRAPHY R&D TO SUPPORT MC&G Final Report
D. C BRIGHT Jan 1983 24 p
(AD-A126215, NORDA-TN-201) Avail NTIS HC A02/MF A01 CSCL 05A

This study was undertaken to determine a course of action for NORDA to provide a balanced R/D program in optical oceanography to support MC/G requirements. Aspects considered in this analysis include an initially broad view of general MC/G requirements for ocean optics, a review of existing programs, sponsors and funding in ocean optics, and an assessment of available NORDA resources in ocean optics Current technical literature in ocean optics and optical instrumentation was also reviewed to establish the current state of knowledge and technology. An integrated coastal ocean optics program covering basic research, exploratory development, and advanced development, using all relevant available NORDA resources is recommended This work was funded by Dr. J. Andrews, NORDA Technical Director, under Program Element 65861N GRA

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MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general), computer operations and hardware, computer programming and software; computer systems; cybernetics, numerical analysis; statistics and probability, systems analysis, and theoretical mathematics.

A83-37085
A COMPARISON OF MINIMIZING STRATEGIES FOR MAXIMUM LIKELIHOOD IDENTIFICATION
K. M. SOBEL and E. Y. SHAPIRO (Lockheed-California Co , Burbank, CA) IN. American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1982, p. 160-164. refs

The Newton-Raphson procedure for minimizing the negative log likelihood function which appears in maximum likelihood estimation is reviewed. Four methods for obtaining the step size in the current search direction are compared by utilizing an LTI model of the lateral dynamics of a widebody transport aircraft Step size optimization is shown to be important when simultaneously identifying all the parameters When physical insight into the system is available, the multisweep method can be used to create a synergistic effect which decreases the computation time and produces a defined figure merit for the lateral dynamics of a widebody aircraft. C.D.

A83-37093* Notre Dame Univ , Ind
CONTROLLER SCHEDULING - A POSSIBLE ALGEBRAIC VIEWPOINT
M SAIN and S YURKOVICH (Notre Dame, University, Notre Dame, IN) IN: American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1982, p. 261-269 refs
(Contract NSG-3048)

In the applications, one common way to design a control system for a nonlinear plant is to localize its behavior along lines of operation specified by the plant manufacturer, to develop linear multi-variable controls for these localizations, and to schedule those controls with key plant variables which vary smoothly along operating lines. An important part of practical design lore, the art of controller scheduling has received little modern attention from the conceptual point of view. This paper describes four basic types of scheduling questions and outlines some of the theoretical issues associated with them Schedules are considered in terms of state equations; however, some relations with the input/output description are discussed, together with an analysis of the effects on the overall configuration of approximations made to the individual subsystems Author

A83-37102
INTEGRATED CONTROL TECHNIQUES
F M KRACHMALNICK and G J VETSCH (McDonnell Aircraft Co., St. Louis, MO) IN. American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1982, p. 584, 585

Aspects of aircraft integrated-control-system design are discussed. The advantages of establishing a control hierarchy early in the design process to facilitate the identification of information-flow and problem constraints are outlined The optimization of multivariable control algorithms is illustrated by an approach employed in the NASA INTERACT program to improve thrust-control performance, extending the classical frequency-response tools by using singular values, by specifying the open-loop response matrix, and by applying linear-quadratic-regulator and Kalman-Bucy-filter properties to compensator design It is shown that the digital throughput requirements of integrated control systems can be met by parallel arrays of available microprocessors T.K.

A83-37104

ROLE OF STANDARDS WITH INTEGRATED CONTROL

R G. GADBOIS (Lear Siegler, Inc, Astronics Div, Dayton, OH) IN: American Control Conference, 1st, Arlington, VA, June 14-16, 1982, *Proceedings. Volume 2* New York, Institute of Electrical and Electronics Engineers, 1982, p 588, 589

The effect of standardization on the application of integrated control technology to military aircraft is discussed in terms of a latent conflict between the cost benefits of standardized systems and those attainable by implementing new technologies unaccounted for by the standards The signal-interface standard MIL-STD-1553, while beneficial for connecting avionic systems that need to interact, is found to be potentially inefficient for self-contained packages (such as those being developed for integrated flight and propulsion control), and less reliable for components requiring the exchange of very few signals. Architecture standards referring to instruction sets and high-order languages need to be applied pragmatically, focusing on form, fit, and function, computer-aid programs allowing access in natural English may be able to achieve the benefit goals of a standardized high-order language T.K.

A83-37121* Bolt, Beranek, and Newman, Inc, Cambridge, Mass

A FAULT TOLERANT APPROACH TO STATE ESTIMATION AND FAILURE DETECTION IN NONLINEAR SYSTEMS

R E LANCRAFT and A K CAGLAYAN (Bolt Beranek and Newman, Inc, Cambridge, MA) IN American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 2 New York, Institute of Electrical and Electronics Engineers, 1982, p 799-804. refs

(Contract NAS1-16579)

The design problem considered in the present investigation involves a nonlinear discrete time stochastic system where replicated sensors provide redundant observations of inputs and outputs of the system, compensate for sensor 'normal operating' bias levels, and generate reliable estimates for the plant states in the presence of possible sensor failures The resulting fault tolerant design should utilize inherent analytical redundancy and be capable of detecting many different types and levels of sensor failures In addition, it should have minimal complexity In connection with these goals, a sensor fault tolerant system design methodology is developed The performance of the considered approach to an application is discussed, taking into account the design of a sensor fault tolerant system using analytic redundancy for the Terminal Configured Vehicle research aircraft in a microwave landing system environment G R

A83-37128

MODEL REFERENCE ADAPTIVE CONTROL IN THE PRESENCE OF MEASUREMENT NOISE

K. SOBEL (Lockheed California Co, Burbank, CA) and H. KAUFMAN (Rensselaer Polytechnic Institute, Troy, NY) IN American Control Conference, 1st, Arlington, VA, June 14-16, 1982, Proceedings Volume 3 New York, Institute of Electrical and Electronics Engineers, 1982, p 859, 860 refs

(Contract NSF ENG-77-07446)

A83-37447

ONE NEW METHOD OF DYNAMIC FLIGHT CONTROL

M. K. VUKOBRATOVIC, D. M STOKIC (Institut za Automatizaciju i Telekomunikacije, Belgrade, Yugoslavia), and R. D STOJIC (Aeronautical Institute, Belgrade, Yugoslavia) IN Automatic control in space 1982, Proceedings of the Ninth Symposium, Noordwijkerhout, Netherlands, July 5-9, 1982 Oxford, Pergamon Press, 1983, p 149-155 refs

A novel approach to the decoupled control of large scale nonlinear systems is presently applied to dynamic flight control, with control synthesis being performed in two steps (1) the synthesis of the nominal programmed control using the complete flight dynamics model, yielding a trajectory in ideal conditions and without perturbations, and (2) the tracking of this nominal trajectory, viewing the system as a set of decoupled subsystems, for each of which local control is synthesized. The stability of the overall system is then analyzed and global control is introduced, in order to compensate for coupling among subsystems A unique choice of subsystems is proposed for a hypothetical flight control case, and a flight control simulation using the present control law is given O C

A83-37979

ROBOTIC TESTING FOR DIGITAL SYSTEMS

H. M YOUSSEF (Lockheed-California Co, Burbank, CA) Society of Automotive Engineers, Aerospace Congress and Exposition, Anaheim, CA, Oct 25-28, 1982 7 p refs

(SAE PAPER 821422)

Robotic Testing (RT) considered in the present study is a consistent, flexible, and efficient means to demonstrate the safety of full-time flight-critical Digital Flight Control Systems (DFCS) which are wide bandwidth, functionally integrated, and highly reconfigurable. System validation involves a demonstration that the system is performing according to specification under fault and fault-free conditions. The RT concept is developed to be used in the Vehicle System Simulation (VSS), commonly known as the iron bird which serves as a key element in the system verification, validation, and flight qualification The RT concept is highly modularized and can be integrated into existing iron bird facilities with modest addition or modifications The cockpit robotic computer emulates the pilot actions to control the aircraft for those test states requiring manual interactions G R.

A83-38776*

NUMERICAL GRID GENERATION; PROCEEDINGS OF THE SYMPOSIUM ON NUMERICAL GENERATION OF CURVILINEAR COORDINATE SYSTEMS AND THEIR USE IN THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS, NASHVILLE, TN, APRIL 13-16, 1982

J. F. THOMPSON, ED. (Mississippi State University, Mississippi State, MS) Symposium sponsored by NASA and U S Air Force,. New York and Amsterdam, North-Holland, 1982, 934 p.

(Contract NASW-3552)

General curvilinear coordinate systems are considered along with the error induced by coordinate systems, basic differential models for coordinate generation, elliptic grid generation, conformal grid generation, algebraic grid generation, orthogonal grid generation, patched coordinate systems, and solid mechanics applications of boundary fitted coordinate systems. Attention is given to coordinate system control and adaptive meshes, the application of body conforming curvilinear grids for finite difference solution of external flow, the use of solution adaptive grids in solving partial differential equations, adaptive gridding for finite difference solutions to heat and mass transfer problems, and the application of curvilinear coordinate generation techniques to the computation of internal flows Other topics explored are related to the solution of nonlinear water wave problems using boundary-fitted coordinate systems, the numerical modeling of estuarine hydrodynamics on a boundary-fitted coordinate system, and conformal grid generation for multielement airfoils G R.

A83-38785

PATCHED COORDINATE SYSTEMS

P. E RUBBERT and K. D LEE (Boeing Commercial Airplane Co, Seattle, WA) IN: Numerical grid generation, Proceedings of the Symposium on Numerical Generation of Curvilinear Coordinate Systems and Their Use in the Numerical Solution of Partial Differential Equations, Nashville, TN, April 13-16, 1982 New York and Amsterdam, North-Holland, 1982, p 235-252. refs

It is pointed out that numerical grid generation has been an excellent tool for producing curvilinear body-fitted coordinate systems In practice, numerical grid generation usually involves transformation of the physical domain of interest into a geometrically simple domain, such as a rectangular block or assembly of blocks When the topology of the physical domain is simple enough, this process is usually straightforward But when dealing with geometrically and topologically complex domains such as surround an aircraft configuration, the total issue of grid generation becomes more complex. The irregularities present in the boundary surface may render the achievement of smooth, regular volume grids an impossible task It becomes necessary to employ hosted algorithms which are compatible with grid irregularities Evidence is accumulating that this can generally be achieved if made an algorithm design requirement The use of patched coordinate systems is a feasible and systematic way of generating orderly grids for complex configurations G R.

A83-38804* Lockheed Missiles and Space Co , Palo Alto, Calif
NUMERICAL GENERATION OF COMPOSITE THREE DIMENSIONAL GRIDS BY QUASILINEAR ELLIPTIC SYSTEMS
P D THOMAS (Lockheed Research Laboratory, Palo Alto, CA) IN Numerical grid generation, Proceedings of the Symposium on Numerical Generation of Curvilinear Coordinate Systems and Their Use in the Numerical Solution of Partial Differential Equations, Nashville, TN, April 13-16, 1982 New York and Amsterdam, North-Holland, 1982, p 667-686. Research sponsored by the Lockheed Independent Research Program and NASA refs

A three-dimensional grid generation technique designed to numerically construct a boundary-conforming grid within a three-dimensional region bounded by a closed surface is described The boundary values are generated numerically by a modified elliptic system and are used to compute grid control parameters that are contained in the elliptic systems. The interior grid distribution is governed by the distribution of points on the boundary as well as by the boundary's geometric shape The composite three-dimensional grid remains both continuous and smooth across the surface of juncture between any two adjoining subregions. The details of the method and its implementation are presented, displaying numerical results for three-dimensional composite grid for a wing-body combination and surface grids C.D.

A83-38810* Ohio State Univ., Columbus
MARCHING GRID GENERATION USING PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS
S. NAKAMURA (Ohio State University, Columbus, OH) IN Numerical grid generation; Proceedings of the Symposium on Numerical Generation of Curvilinear Coordinate Systems and Their Use in the Numerical Solution of Partial Differential Equations, Nashville, TN, April 13-16, 1982 New York and Amsterdam, North-Holland, 1982, p. 775-786.
(Contract NCA2-OR-565-101)

The feasibility of using parabolic partial differential equations for grid generation is examined Source terms in the form of a linear interpolation between the current grid and the outer boundary are used in generating a grid for a two-dimensional airfoil flow. Grid generation equations are derived by assuming that grid spacings are locally nonuniform on the computational domain The grid spacing control method is described in detail, and the local orthogonality of the grid lines is discussed An O-mesh and an H-mesh generated by the described method are shown C D

A83-40303
KALMAN FILTER FORMULATIONS FOR TRANSFER ALIGNMENT OF STRAPDOWN INERTIAL UNITS
A. M SCHNEIDER (California, University, La Jolla, CA) Navigation (ISSN 0028-1522), vol. 30, Spring 1983, p. 72-89

Formulations of Kalman filters are obtained which are capable of aligning one strapdown inertial sensor assembly with another by estimating the misalignment angle between them One strapdown inertial sensor assembly could be in the cockpit of a fighter aircraft and the other could be in a missile on the wing One formulation treats the case of a fixed misalignment and another formulation treats the case of a dynamic misalignment, caused, for exammple, by bending of the common supporting body It is shown that measurements can be made by gyros only, or by gyros plus accelerometers Also examined are filters which estimate inertial sensor error parameters N B

A83-40307#
COMPUTER-AIDED ENGINEERING - THE AI CONNECTION
A. L. ELIAS (MIT, Cambridge, MA) Astronautics and Aeronautics (ISSN 0004-6213), vol 21, July-Aug 1983, p. 48-54.

Systems concepts suitable for providing maximum flexibility in computer aided preliminary design (CAPD) for engineers are described The CAPD programs serve as mathematical models of the physical system and are reconfigurable design tools The necessity of avoiding custom-coded programs using classical languages such as Fortran is stressed, due to lack of flexibility in such programs. The addition of artificial intelligence (AI) capabilities permits symbolic manipulation by the designer, i.e , the engineer specifies and operates on design elements at a high level of abstraction and the computer converts the symbols into more primitive forms internally for processing. Data can also be transferred with greater facility from one computer to another It is suggested that implementation of AI capabilities in CAPD may result in a greater understanding of the way the designer thinks, a factor that could lead to a redefinition of man-machine interaction in the design process Use of the experimental aircraft design program Paper Airplane is outlined. M S K.

N83-30060*# Georgia Univ , Athens
FOR OPERATION OF THE COMPUTER SOFTWARE MANAGEMENT AND INFORMATION CENTER (COSMIC) Monthly Progress Report, May 1983
J. L CARMON 15 Jun 1983 30 p
(Contract NASW-3247)
(NASA-CR-172904; NAS 1 26:172904) Avail NTIS HC A03/MF A01 CSCL 09B

Computer programs for degaussing, magnetic field calculation, low speed wing flap systems aerodynamics, structural panel analysis, dynamic stress/strain data acquisition, allocation and network scheduling, and digital filters are discussed. Author

N83-30061*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
OPTIM: COMPUTER PROGRAM TO GENERATE A VERTICAL PROFILE WHICH MINIMIZES AIRCRAFT FUEL BURN OR DIRECT OPERATING COST. USER'S GUIDE
May 1983 120 p refs
(Contract NAS1-15497)
(NASA-CR-166061; NAS 1 26.166061) Avail NTIS HC A06/MF A01 CSCL 09B

A profile of altitude, airspeed, and flight path angle as a function of range between a given set of origin and destination points for particular models of transport aircraft provided by NASA is generated Inputs to the program include the vertical wind profile, the aircraft takeoff weight, the costs of time and fuel, certain constraint parameters and control flags The profile can be near optimum in the sense of minimizing (1) fuel, (2) time, or (3) a combination of fuel and time (direct operating cost (DOC)). The user can also, as an option, specify the length of time the flight is to span The theory behind the technical details of this program is also presented Author

N83-30062*# Analytical Mechanics Associates, Inc., Mountain View, Calif
TRAGEN: COMPUTER PROGRAM TO SIMULATE AN AIRCRAFT STEERED TO FOLLOW A SPECIFIED VERTICLE PROFILE. USER'S GUIDE
May 1983 71 p
(Contract NAS1-15497)
(NASA-CR-166062, NAS 1.26.166062) Avail NTIS HC A04/MF A01 CSCL 09B

The longitudinal dynamics of a medium range twin-jet or tri-jet transport aircraft are simulated. For the climbing trajectory, the thrust is constrained to maximum value, and for descent, the thrust is set at idle. For cruise, the aircraft is held in the trim condition. For climb or descent, the aircraft is steered to follow either (a) a fixed profile which is input to the program or (b) a profile computed at the beginning of that segment of the run. For climb, the aircraft is steered to maintain the given airspeed as a function of altitude.

For descent, the aircraft is steered to maintain the given altitude as a function of range-to-go In both cases, the control variable is angle-of-attack The given output trajectory is presented and compared with the input trajectory Step climb is treated just as climb For cruise, the Breguet equations are used to compute the fuel burned to achieve a given range and to connect given initial and final values of altitude and Mach number 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

A83-37074#

RECURSIVE RELATIONSHIPS FOR BODY AXIS ROTATION RATES

D M HENDERSON (TRW, Inc., Houston, TX) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 6, July-Aug. 1983, p 318-320

In many algorithms and areas of analysis in flight dynamics and flight control systems, both body axis rotation rates and Euler angle rates are measured and/or employed to control the motion of the vehicle There are a number of Euler sequences, including 12 possible sets for three Euler rotations Any one of the Euler sequences can be used to describe a problem or may be required by hardware definition Each equation relating the body axis rotation rates to the Euler rates is unique for the involved sequence In connection with the large number of possibilities the relationships are not written out in the literature The present investigation is concerned with an analysis which provides the engineer with a method of computing all the relationships, taking into account an extension of the equations to n Euler rotations The equations are suited for computer applications and can also be used to write out a particular Euler sequence when the computing equations are needed G R.

A83-37253

METHOD FOR CALCULATING JET NOISE IN THE PRESENCE OF A SHIELDING SURFACE [METOD RASCHETA SHUMA REAKTIVNOI STRUI PRI NALICHII EKRANIRUIUSHCHEI POVERKHNOSTI]

E. V. VLASOV, V A. GEDYMIN, and R K KARAVOSOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 1, 1982, p. 30-38. In Russian refs

A calculation method is proposed which takes into account jet-noise shielding by structural elements of the aircraft The jet is considered as a complex source of noise whose characteristics are determined on the basis of detailed data concerning the microstructure of the flow in the jet-mixing zone Results of calculations using this method are compared with experimental data and with theoretical results obtained using a simplified noise-source model. B.J

A83-37512

SOUND PROPAGATION IN DUCTS WITH IMPEDANCE WALLS IN THE PRESENCE OF AN AIR FLOW. II - OPTIMIZATION OF ACOUSTIC ATTENUATION IN DUCTS [O RASPROSTRANENII ZVUKA V KANALAKH S IMPEDANSNYMI STENKAMI PRI NALICHII VOZDUSHNOGO POTOKA. II - OPTIMIZATSIIA ZATUKHANIIA ZVUKA V KANALAKH]

A. F GLADENKO and E. A. LEONTEV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol. 13, no 3, 1982, p. 61-68 In Russian

Results of a theoretical study on acoustic attenuation in cylindrical and annular ducts with uniform axial flow are presented Equations for the optimal values of wall impedance are derived and solved via computer The dependence of optimal impedance on Mach number, dimensionless frequency, and the ratio of the inner diameter of the duct to its outer diameter is investigated for the example of low-order-number modes The dependence of attenuation on frequency is analyzed for various modes of a cylindrical duct, when optimal attenuation (i e, optimal wall impedance) is achieved at a specified frequency for a specified mode The results are pertinent to the reduction of aircraft engine noise B J

A83-37535

DETERMINATION OF THE EQUIVALENT NOISE LEVEL CONTOUR FOR A PASSENGER JET AIRCRAFT OVER A PLACE IN THE CASE OF QUASI-STEADY FLIGHT REGIMES [POSTROENIE KONTURA RAVNOGO UROVNIA SHUMA, SOZDAVAEMOGO REAKTIVNYM PASSAZHIRSKIM SAMOLETOM NA MESTNOSTI PRI KVAZIUSTANOVIVSHIKHSIA REZHIMAKH POLETA]

V F ILLARIONOV and A V SHUSTOV TsAGI, Uchenye Zapiski (ISSN 0321-3429), vol 13, no 2, 1982, p 87-95. In Russian refs

A simplified method is proposed for calculating the distribution of effective perceived noise levels (EPNL) over a place and the characteristics of the equivalent noise level contour (ENLC) for the quasi-steady flight regimes of a passenger jet. The ENLC is defined as the line on the earth's surface satisfying the equation EPNL (x, z) = EPNL sub 0 = const, where EPNL sub 0 is a given noise level, and x, z are coordinates of points on the earth's surface. Results obtained using the proposed approach are compared with those obtained using other calculation methods B.J

A83-37570#

A STUDY OF THE DISTRIBUTION OF THE NOISE SOURCE STRENGTHS IN COAXIAL DOUBLE JET

Y. NAKAZONO (Kyushu Tokai University, Kumamoto, Japan) (Japan Society for Aeronautical and Space Sciences, Fluid Dynamics Conference, 13th, Oct 20, 1981) Japan Society for Aeronautical and Space Sciences, Transactions (ISSN 0549-3811), vol 26, May 1983, p 10-21. refs

The apparent noise source distributions in a coaxial double jet at subsonic speed were determined using a reflector-type directional microphone system which has an elliptical concave mirror with a diameter of 40 cm It was found that the 1/3 octave band sound pressure spectrum in the far-field which was calculated with the sound source distribution agreed with the results obtained by an omnidirectional microphone at each velocity ratio of the bypass jet to the core jet. These results indicate that the directional microphone system will be a highly effective tool for the measurement of the sound source strength distribution of a coaxial double jet as well as that of a single jet. In addition, the overall pressure fluctuations in the jet flow were measured at each velocity ratio, and the influence of the correlation upon the far-field noise was examined based on the pressure fluctuations and the noise source distribution. N.B.

A83-37731

SAMPLING STRATEGIES FOR MONITORING NOISE IN THE VICINITY OF AIRPORTS

P. D. SCHOMER (U S. Army, Construction Engineering Research Laboratory, Champaign, IL), R. E DEVOR, and W A KLINE (Illinois, University, Champaign, IL) Acoustical Society of America, Journal (ISSN 0001-4966), vol. 73, June 1983, p 2041-2050 refs

The Dynamic Data System (DDS) was used to model the Day/Night Average Sound Level (DNL) data obtained for several East Coast airport sites Monte Carlo simulations were performed to verify the sampling requirements obtained from the DDS modeling of the data and to study alternatives to consecutive sampling. The results obtained here for East Coast (multidirection) airports, along with the results for West Coast (one-direction) airports discussed in two previous papers, are used to form a set of guidelines for sampling strategies in the vicinity of airports In particular, it is demonstrated that nonconsecutive sampling strategies reduce the overall sampling requirements for nonstationary data V.L.

A83-39424
INTENSITY OF FOCUSED SONIC BOOMS IN STRAIGHT FLIGHT AT CONSTANT ALTITUDE [STAERKE FOKUSSIERTER UEBERSCHALLKNALLE AM BEISPIEL EINES GERADLINIGEN FLUGES IN KONSTANTER HOEHE]
H. SCHILLING (Rheinmetall GmbH, Duesseldorf, West Germany) Ingenieur-Archiv (ISSN 0020-1154), vol. 53, no. 3, 1983, p. 181-195. In German refs

The occurrence of focused sonic booms is studied. The nature of a sonic boom and its occurrence on the ground are first discussed, and the development of focused sonic booms is considered. For accelerated, straight flight at constant altitude, conditions for the generation of sonic booms are addressed An expression for the pressure jump of a sonic boom is obtained using previously published work and delay equalization A similar technique is used to calculate the 'focus factor' of a focused sonic boom, defined as the pressure jump of the superboom divided by the pressure jump of a sonic boom at the same place, generated by a level flight with the same Mach number Comparisons with experimental results show very satisfactory agreement. C.D

N83-28983# Toronto Univ. (Ontario) Inst. for Aerospace Studies.
EXPERIMENTAL AND ANALYTICAL STUDIES OF SHIELDING CONCEPTS FOR POINT SOURCES AND JET NOISE
R L M. WONG May 1983 191 p refs
(UTIAS-266; ISSN-0082-5255) Avail NTIS HC A09/MF A01

Concepts for jet noise shielding were explored Model experiments center on solid planar shields, simulating engine-over-wing installations and sugar scoop shields Tradeoff on effective shielding length is set by interference 'edge noise' as the shield trailing edge approaches the spreading jet In general, shielding attentuation increases steadily with frequency, following low frequency enhancement by edge noise Although broadband attenuation is typically only several decibels, the reduction of the subjectively weighted perceived noise levels is higher Calculated ground contours of peak PN dB (perceived noise level) show a substantial contraction due to shielding: this reaches 66% for one of the sugar scoop shields for the 90 PN dB contour The experiments are complemented by analytical predictions. They are divided into an engineering scheme for jet noise shielding and more rigorous analysis for point source shielding. A R H

N83-28984*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROPELLER NOISE PREDICTION
W E. ZORUMSKI May 1983 61 p refs Presented at the Acoustical Society of America Meeting, Cincinnati, 10 May 1983
(NASA-TM-85636; NAS 1 15 85636) Avail· NTIS HC A04/MF A01 CSCL 20A

Analytic propeller noise prediction involves a sequence of computations culminating in the application of acoustic equations. The prediction sequence currently used by NASA in its ANOPP (aircraft noise prediction) program is described The elements of the sequence are called program modules The first group of modules analyzes the propeller geometry, the aerodynamics, including both potential and boundary layer flow, the propeller performance, and the surface loading distribution This group of modules is based entirely on aerodynamic strip theory The next group of modules deals with the actual noise prediction, based on data from the first group Deterministic predictions of periodic thickness and loading noise are made using Farassat's time-domain methods Broadband noise is predicted by the semi-empirical Schlinker-Amiet method. Near-field predictions of fuselage surface pressures include the effects of boundary layer refraction and (for a cylinder) scattering Far-field predictions include atmospheric and ground effects Experimental data from subsonic and transonic propellers are compared and NASA's future direction is propeller noise technology development are indicated. A R H

N83-28985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACOUSTIC MEASUREMENTS OF THE X-WING ROTOR
M MOSHER Jun 1983 109 p refs
(NASA-TM-84292; A-9080; NAS 1.15.84292) Avail: NTIS HC A06/MF A01 CSCL 20A

Noise measurements of a stoppable X-wing rotor system model, tested in the Ames 40- by 80-foot wind tunnel, are summarized Performance, control system stability, and noise of the model were investigated at various forward speeds, tip speeds, collective blade angles, jet blowing velocities, and model attack angles The model was tested in the rotating wing helicopter configuration, in the fixed wing configuration, and in wing configurations between the two. Noise data obtained in the helicopter configuration at the two highest tip speeds (Mach 0.44 and 0.47) and at wind tunnel speeds below 140 knots are reported. Test configuration and performance information are included General acoustic measurements (dB, dBA, and PNdB) at six microphone locations are presented for all conditions under which the background noise was below the model noise More specific measurements (1/3-octave and blade passage frequency harmonic levels) are presented for selected conditions Graphs of dBA and 1/3-octave spectra, which show the noise trends as functions of operating condition, are included The noise depends mainly on the jet blowing velocity. The noise levels were highest at moderate jet blowing velocities, less at the highest velocity, and lowest with no blowing at all. M G.

N83-28986*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
ACOUSTIC MEASUREMENTS OF A FULL-SCALE COAXIAL HINGELESS ROTOR HELICOPTER
R. L. PETERSON and M MOSHER Jun 1983 127 p
(NASA-TM-84349; A-9301, NAS 1 15 84349) Avail: NTIS HC A07/MF A01 CSCL 20A

Acoustic data were obtained during a full-scale test of the XH-59A Advancing Blade Concept Technology Demonstrator in the 40- by 80-Foot Wind Tunnel The XH-59A is a research helicopter with two coaxial rotors and hingeless blades. Performance, vibration, and noise at various forward speeds, rotor lift coefficients and rotor shaft angles of attack were investigated The noise data were acquired over an isolated rotor lift coefficient range of 0 024 to 0.162, an advance ratio range of 0.23 to 0 45 corresponding to tunnel wind speeds of 89 to 160 knots, and angles of attack from 0 deg to 10 deg Acoustic data are presented for seven microphone locations for all run conditions where the model noise is above the background noise Model test configuration and performance information are also listed Acoustic waveforms, dBA, and 1/3-octave spectra as functions of operating condition for selected data points and microphones are presented. In general, the noise level is shown to increase with rotor lift coefficient except under certain operating conditions where significant impulsive blade/vortex interactions increase noise levels Author

N83-28992# European Space Agency, Paris (France).
GROUND REFLECTION EFFECTS IN MEASURING PROPELLER AIRCRAFT FLYOVER NOISE
W DOBRZYNSKI Sep. 1982 92 p refs Transl. into ENGLISH of "Interferenzwirkungen durch Bodenreflexion bei Fluglaermmessungen an Propellerflugzeugen" DFVLR Rept. DFVLR-FB-81-28 DFVLR, Brunswick, West Germany, Aug 1981 Original report in GERMAN previously announced as N82-22990
(ESA-TT-742; DFVLR-FB-81-28) Avail· NTIS HC A05/MF A01, original German version available from DFVLR, Cologne DM 21

The influence of ground reflection on the maximum A-weighted aircraft noise level was investigated. Depending on propeller rotational speed and number of blades ground-reflection causes level differences of up to 3 dB(A) Since reflection corrections cannot successfully be applied to propeller noise signatures, alternative measuring arrangements such as microphones in close proximity to the ground were assessed. Depending on the positioning of the microphone in relation to an even, reverberant ground surface, or above ground plates, in the case of grass-covered surfaces, frequency ranges not affected by ground-reflection interferences are determined Author (ESA)

N83-28993# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Abteilung Technische Akustik
PROPELLER AIRCRAFT NOISE CERTIFICATION AND FLIGHT TESTING
H HELLER Oct 1982 126 p refs
(DFVLR-MITT-82-16) Avail NTIS HC A07/MF A01, DFVLR, Cologne DM 46,90

The ICAO Annex 16 International Standards and Recommended Practices, Vol. 1 Aircraft Noise, 1981 Edition is discussed. The experience gained in the application of these Standards specifically for propeller aircraft over a period of more than 10 years is evaluated. Propeller aircraft testing procedures for purposes other than certification, through overflight flyby and ground static noise measurements are also discussed Author (ESA)

N83-30165*# Bionetics Corp , Hampton, Va
CHARACTERISTICS OF THE TRANSMISSION LOSS APPARATUS AT NASA LANGLEY RESEARCH CENTER
F W. GROSVELD Jun 1983 43 p refs
(Contract NAS1-16978)
(NASA-CR-172153, NAS 1 26 172153) Avail NTIS HC A03/MF A01 CSCL 20A

A descripton of the Transmission Loss Apparatus at NASA Langley Research Center, which is specifically designed to accommodate general aviation type aircraft structures, is presented The measurement methodology, referred to as the Plate Reference Method, is discussed and compared with the classical method as described in the Standard of the American Society for Testing and Materials This measurement procedure enables reliable and accurate noise transmission loss measurements down to the 50 Hz one-third octave band The transmission loss characteristics of add-on acoustical treatments, applied to the basic structure, can be established by inclusion of appropriate absorption corrections for the treatment Author

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SOCIAL SCIENCES

Includes social sciences (general), administration and management, documentation and information science; economics and cost analysis, law and political science, and urban technology and transportation

A83-39043
LEGISLATIVE DEVELOPMENTS AFFECTING THE AVIATION INDUSTRY 1981-1982
C. E. DUBUC and L. B. DOCTOR (Finley, Kumble, Wagner, Heine, Underberg, Manley and Casey, Washington, DC) Journal of Air Law and Commerce (ISSN 0021-8642), vol 48, Winter 1983, p 263-285 refs

Attention is given to three major legislative actions taken in 1981-1982 in the United States which may significantly affect future aviation insurance practices as well as aviation litigation The Product Liability Risk Retention Act of 1981 may affect the insurance formats of some aircraft and component parts manufacturers The Senate Foreign Relations Committee recommended that the Senate give its advice and consent to the Montreal Protocols, which are the proposed amendments to the international treaties governing procedures and limitations of liability. The Civil Aeronautics Board adopted new rules which increase the insurance coverage required by U.S. and foreign carriers operating air transportation to and from the U.S , thereby affecting the cost and sources of insurance coverage for the airline industry. O.C.

A83-39044
AIRCRAFT CRASHWORTHINESS IN THE UNITED STATES - SOME LEGAL AND TECHNICAL PARAMETERS
J SABA (Champlain College, Saint Lambert, Quebec, Canada) Journal of Air Law and Commerce (ISSN 0021-8642), vol 48, Winter 1983, p. 287-346 refs

A discussion is undertaken of the tort liability of aircraft airframe and component manufacturers in cases of deficient aircraft crashworthiness. It is suggested that tort liability is so intimately linked to a complex matrix of technical factors and legal issues as to require substantial reform of the present process of court adjudication in crashworthiness cases Attention is given to the definition of key concepts, an examination of technical factors affecting aircraft crashworthiness, an analysis of the origins and development of legal concepts and doctrines governing manufacturer tort liability in crashworthiness cases, and recommendations for the remedy of deficiencies in current aircraft crashworthiness claim litigation O C

A83-39045
STRICT LIABILITY IN MILITARY AVIATION CASES - SHOULD IT APPLY?
F. FINN and J. H MARTIN (Thompson and Knight, Dallas, TX) Journal of Air Law and Commerce (ISSN 0021-8642), vol 48, Winter 1983, p. 347-379 refs

Military aircraft manufacturers and government purchasers are treated differently in lawsuits brought to recover damages for injuries caused by product defects While the doctrine of sovereign immunity shields the government against claims by injured military personnel or the survivors of deceased servicemen, manufacturers are not accorded similar protection A question then arises as to whether the manufacturer should bear the risk of loss alone, when culpability may reside entirely with the federal government. An examination of the six most frequently cited reasons supporting the imposition of strict liability on manufacturers indicates that none provides sufficient justification for imposing this doctrine in cases involving military aircraft or components, especially in the context of aircraft design O C.

A83-39696
MANUFACTURER'S LIABILITY IN INTERNATIONAL AEROSPACE - A VIEW FROM THE UNITED STATES
E S. BRASLOW Northrop University Law Journal of Aerospace, Energy, and the Environment (ISSN 0196-1489), vol. 4, no. 1, 1983, p. 127-143. refs

Aspects of national laws and international agreements to determine liability for aerospace activities that result in personal injuries are examined. Yugoslavian law governing proportional liability has been applied in California courts to define a limited settlement for a mid-air crash over Yugoslavia involving an American-built aircraft The plaintiff must satisfy burden-of-proof provisions when suing a manufacturer, who is required to have provided a state-of-the-art product, including crash-worthiness, when vending the aircraft National governments are responsible for spacecraft launched from within their boundaries NASA acts mainly as a self-insurer, and allows manufacturers to make whatever third-party insurance arrangements necessary, while in some instances offering damage limitation provisions in contracts it issues International law only indicates which laws are applicable in any given instance. M S K.

A83-39698
AIRPORT USE AND ACCESS
D. DEPUE Northrop University Law Journal of Aerospace, Energy, and the Environment (ISSN 0196-1489), vol. 4, no. 1, 1983, p 159-179 refs

Areas where problems may potentially develop as a result of the Airline Deregulation Act (ADA) of 1978 are discussed, with attention given to aircraft noise and airport access. Supreme Court opinion has held that local statutes defending the public interest will hold sway unless severe economic burdens would result, such as in closing down an airport However, airport proprietors can refuse service to an airline if the proprietor deems the aircraft produce excessive noise However, a federal essential facility doctrine exists which can lead to rulings that petitioning airlines and air services be granted access to the runways, ticket counters, and baggage handling equipment of an airport where no others are available The Supreme Court has also allowed that concerted efforts made by different companies within an industry to influence enactment of provisions of a law are legal, as long as the lobbying efforts are not a sham used to perpetrate a monopoly. M S K.

N83-29123# Library of Congress, Washington, D C
WHO KNOWS? SELECTED INFORMATION RESOURCES ON AERONAUTICS AND ASTRONAUTICS
J A FEULNER, comp Aug 1982 60 p
(SL-82-32) Avail. NTIS HC A04/MF A01

Aeronautics and astronautics activities at NASA The Department of Transportation, Air Force, Army, and Navy are discussed Author

N83-29134# Committee on Appropriations (U. S Senate)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION RESEARCH AND DEVELOPMENT, INCLUDING SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS
In its Dept of Housing and Urban Develop.-Independent Agencies Appropriation Bill, 1984 p 60-66 1983
Avail US Capitol, Senate Document Room

A research and development appropriation is recommended The Space Transportation System, space science and application, technology utilization, aeronautics and space technology, and tracking and data acquisition are described Construction of facilities and research and program management are also described. N W

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SPACE SCIENCES

Includes space sciences (general), astronomy, astrophysics; lunar and planetary exploration, solar physics, and space radiation

A83-40454* Cornell Univ, Ithaca, N Y
INFRARED OBSERVATIONS FROM THE NASA AIRBORNE OBSERVATORIES
M HARWIT (Cornell University, Ithaca, NY, Max-Planck-Institut fuer Radioastronomie, Bonn, West Germany) IN· ESO Infrared Workshop, 2nd, Garching, West Germany, April 20-23, 1982, Proceedings Garching, European Southern Observatory, 1982, p 275-283 refs
(Contract NSG-2347, NGR-33-010-146)

The results of observations made aboard the Kuiper Airborne Observatory, with its 91-cm telescope and the Lear Jet with its 30-cm system, are summarized, and instrumental advances accomplished for NASA aircraft facilities are described. Information has been obtained about the ring brightness of Saturn, a new broadband feature in carbon stars and two planetary nebulae, the temperature of dust globules, rotational transitions of CO in the Kleinmann-Low nebula, and far infrared emission from a quasar Improvements in the minimum signals reported for photometry and spectrometry are described, and possibilities for improvements in the polarization, time resolution measurements, and in angular limitations are addressed C D

A83-40455
ASTROPLANE - A EUROPEAN AIRBORNE OBSERVATORY FOR INFRARED ASTRONOMY
C B COSMOVICI (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wessling, West Germany) IN ESO Infrared Workshop, 2nd, Garching, West Germany, April 20-23, 1982, Proceedings Garching, European Southern Observatory, 1982, p. 285-306. refs

The history, goals, and design concepts of Astroplane, a proposed European airborne IR and submillimeter observatory, are discussed The various proposals advanced since 1979 are summarized, and the need for an airborne observatory to complement ground and satellite observations and to offer European astronomers observing opportunities like those provided by the NASA KAO in the U.S is stressed The effects of the atmosphere on IR transmission, some typical NASA airborne results, and the observability of different atomic species (from ground, air, or satellite) are documented in tables The importance of airborne IR observations of Halley's comet during its 1986 perihelion is shown The Astroplane design proposed by DFVLR is described a circular 120-cm Cassegrain telescope carried to an altitude of about 13 km by a modified Challenger CL-601 aircraft. It is found in an overall cost comparison that the DFVLR Astroplane, with a life of 20 years and 600 observing hours per year, would cost only one seventh as much per observing hour as either balloon or satellite (IRAS) observatories T K.

A83-40456
ASTROPLANE - THE AIRBUS PROPOSAL
P. LENA (Paris VII, Universite, Paris, Meudon, Observatoire, Meudon, Hauts-de-Seine, France) IN: ESO Infrared Workshop, 2nd, Garching, West Germany, April 20-23, 1982, Proceedings Garching, European Southern Observatory, 1982, p 307-314. refs

The design features and capabilities of an airborne IR observatory intended for carriage on a modified Airbus A 300-B2 are presented The telescope would weigh three tons, including all equipment and operators, and require modifications to the engine regime and trailing flaps suitable for high altitude flight An extra fuel tank is needed to assure quick flight to altitudes over 40,000 ft, and to fly missions in the Southern Hemisphere The telescope would have an elevation range from 15-55 deg, good vibration insulation, a 1 cu m focal tracking plane capability, and weigh about 300 kg The tracking capability would be 3 arcsec (rms), and be built in either a 1 5 m or 2 m configuration Interior modifications would be needed for mounting the telescope in the cargo aircraft, and the instrument would be shaped for minimum aerodynamic interference M S K.

19

GENERAL

N83-29170*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
HISTORICAL DEVELOPMENT OF WORLDWIDE SUPERSONIC AIRCRAFT
M L SPEARMAN May 1983 40 p
(NASA-TM-85637; NAS 1 15 85637) Avail NTIS HC A03/MF A01 CSCL 01B

Some major milestones in the progression of airplane speeds from subsonic to supersonic are traced. Historical background is included on work done prior to the Twentieth Century, but the major emphasis is on the Twentieth Century developments after the man carrying airplane became a practical reality The techniques of increasing airplane speed revolve around means of increasing the propulsive force and means of reducing the airframe resistance (drag) With the changes in speed, the attendant changes in flow patterns due to the compressibility of air introduce some aerodynamic problems In addition, geometric changes introduced to combat the effects of compressibility also promote aerodynamic problems Some of the solutions to these problems are illustrated, and many design features that evolved are discussed A.R.H.

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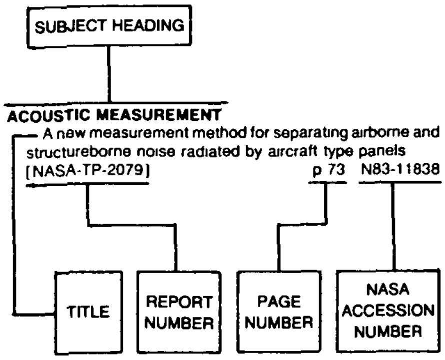

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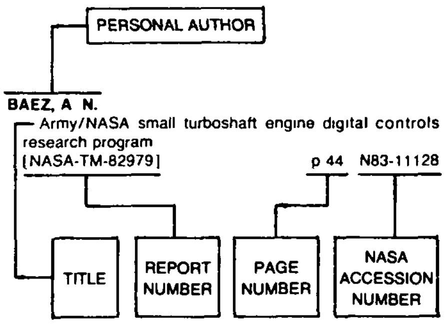

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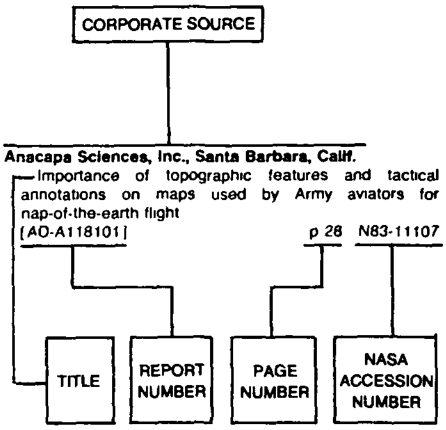

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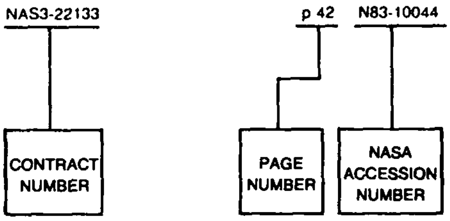

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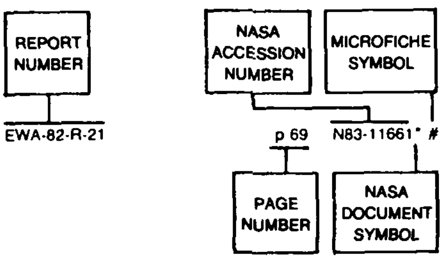

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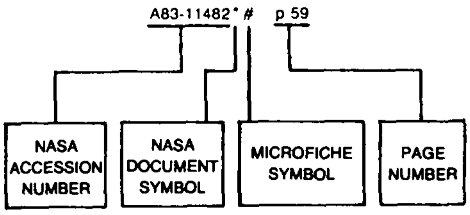

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