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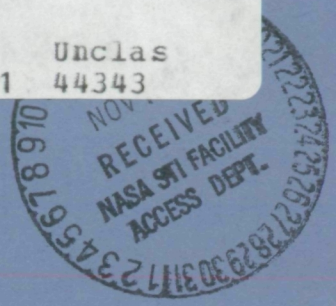
Aeronautical Engineering
A Continuing Bibliography with Indexes

NASA SP-7037(165)
September 1983

(NASA-SP-7937(165)) AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 165) (National Aeronautics and Space Administration) 131 p HC $5.00 CSCL 01A 00/01 N84-10008 Unclas 44343



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ACCESSION NUMBER RANGES

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

STAR (N-10000 Series)	N83-25651 - N83-27949
IAA (A-10000 Series)	A83-33485 - A83-36991

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NASA SP-7037(165)

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 165)

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 August 1983 in

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

NASA Scientific and Technical Information Branch 1983
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INTRODUCTION

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

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 466 reports, journal articles, and other documents originally announced in August 1983 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*

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

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

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

An annual cumulative index will be published

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

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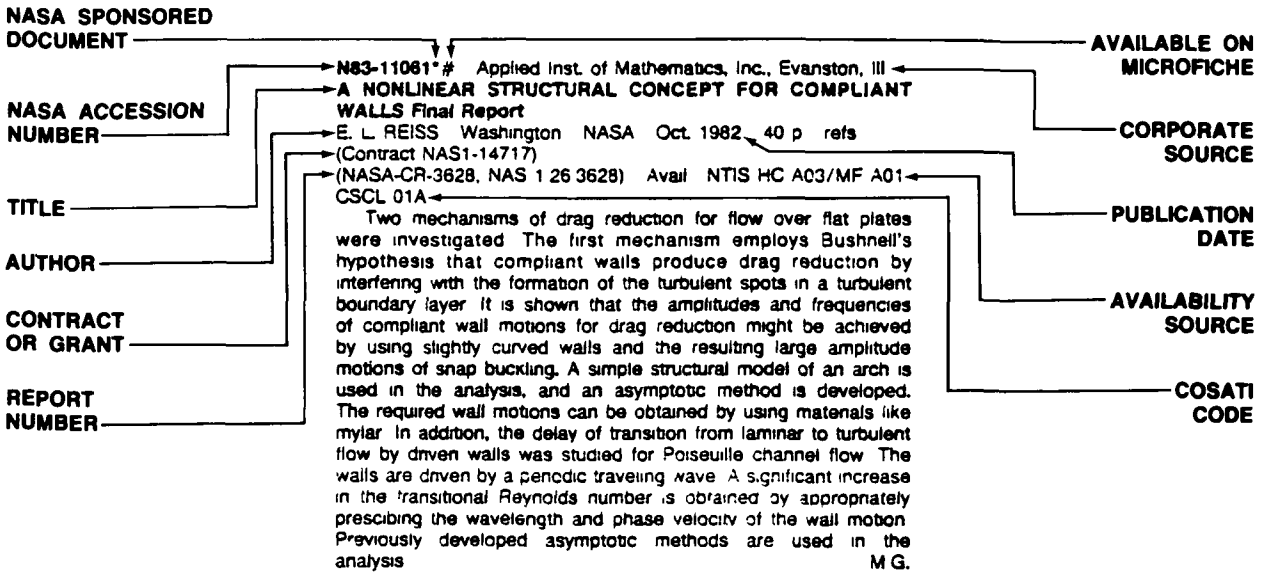

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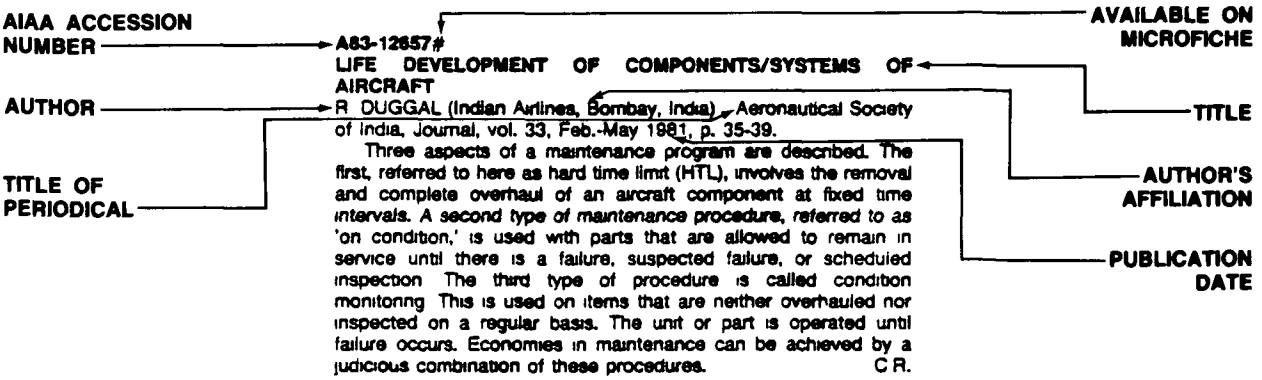

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 165)

SEPTEMBER 1983

01

AERONAUTICS (GENERAL)

A83-33622
A COMPLETE INTRODUCTION TO THE REVOLUTIONARY NEW WAY TO FLY ULTRALIGHTS
J E MRAZEK, JR and J E MRAZEK, SR New York, St Martin's Press, 1982, 204 p

The various materials, construction and piloting techniques, configurations, and uses of ultralight aircraft, which do not require pilot's license to fly, are explored Attention is given to the evolution of the ultralight aircraft from hang gliders based on the Rogallo wing, and to the categories of ultralights, including their propulsion systems The control systems are described, together with the necessary equipment, instrumentation, and maintenance procedures Flight theory is reviewed, as is flying instruction for ultralights Meteorological conditions significant to ultralight pilots are examined, as are uses of ultralights as glider tows, for military missions, and as amphibious aircraft National and international programs, clubs, and other activities involving ultralight aircraft are summarized M S K

A83-36203
FLIGHT SIMULATION TECHNOLOGIES CONFERENCE, NIAGARA FALLS, NY, JUNE 13-15, 1983, COLLECTION OF TECHNICAL PAPERS
Conference sponsored by the American Institute of Aeronautics and Astronautics New York, American Institute of Aeronautics and Astronautics, 1983, 174 p

The present conference on flight simulation technologies considers the indoctrination of U S Navy test pilots in vectored thrust practices by means of the X-22A in-flight simulator, the improvement of flight performance simulator fidelity in the B-52H WST flight station simulator, advanced display techniques for the training of multimember tactical air crews, a visual cueing model for terrain following applications, and the spectral decontamination of real time helicopter simulations Also discussed are benchmarks for a computer system for NASA's Space Shuttle Procedures Simulator, error sources in hybrid computer-based flight simulation, simulator performance definition by cue synchronization analysis, NASA's new Man-Vehicle Systems Research Facility, and the application of experimentally derived pilot perceptual angular response transfer functions O C

A83-36443
AIRCRAFT PRODUCTION TECHNOLOGY (2ND REVISED AND ENLARGED EDITION) [TEKHNOLOGIIA SAMOLETOSTROENIIA /2ND REVISED AND ENLARGED EDITION/]
A L ABIBOV, N M BIRIUKOV, V V BOITSOV, V P GRIGOREV, I A ZERNOV, P F CHUDAREV, and A I IARKOVETS Moscow, Izdatel'stvo Mashinostroenie, 1982, 552 p In Russian refs

This textbook on aircraft fabrication and production reflects recent technological advances both inside and outside the USSR The principles underlying aircraft production technology are examined, with particular attention given to quality control, cost efficiency of fabrication, and techniques of mechanization and automation Processes for the fabrication of aircraft parts, assembly processes, and the assembly of aircraft control systems and equipment are considered in detail B J

A83-36457
AIRCRAFT PROTOTYPE AND TECHNOLOGY DEMONSTRATOR SYMPOSIUM, DAYTON, OH, MARCH 23, 24, 1983, PROCEEDINGS
Symposium sponsored by the American Institute of Aeronautics and Astronautics New York, American Institute of Aeronautics and Astronautics, 1983, 196 p

The present conference on aircraft prototype program management and technology demonstrator development considers the course from technology development to operational stages for the B-36, B-58, x and F-111/FB-111 aircraft, the technology advancements incorporated into the XB-70 aircraft's design, the development of variable sweep wing design from the Bell X-5 to the F-14, the application of low cost demonstrators to the evaluation of advanced fighter technology, and gas turbine engine prototype development practices Also discussed are the YAV-8B flight demonstrator program, the AFTI/F-111 Mission Adaptive Wing development program, Highly Maneuverable Aircraft technology development, the testing of a low altitude 'night-in-weather' attack system, the development history of the Northrop 'Flying Wing' prototypes, and the development history of the F-5 fighter O C

A83-36458#
PROTOTYPING FOR FUN AND PROFIT
M D MARKS (McDonnell Douglas Corp , St Louis, MO) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 1-7
(AIAA PAPER 83-1045)

Attention is given to the prototype program experiences gained in the course of developing such experimental and military services design competition aircraft as the XP-85 'parasite fighter', the XP-88 supersonic fighter prototype, and the subsequently highly successful F4H-1 Phantom, of which more than 5000 were produced Prototype development and testing experiences are also related for the cases of the XHJD-1 twin engine/twin rotor helicopter and the HV-1 and HV-3 advanced rotary wind concept demonstrator aircraft O C

A83-36459#
FROM NEW TECHNOLOGY DEVELOPMENT TO OPERATIONAL USEFULNESS B-36, B-58, F-111/FB-111
F E ARMSTRONG (General Dynamics Corp , Fort Worth, TX) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 9-17
(AIA PAPER 83-1046)

While the B-36, B-58 and F-111 weapon systems all achieved superior performance through the selective use of advanced technology to meet demanding requirements, a number of retrospectively interesting technologies developed and tested in connection with these programs never reached the operational phase Cases in point are the track landing gear developed for the B-36 prototype, which could not withstand landing loads, and the use of the B-36 as a mother aircraft for F-84F reconnaissance

fighters and as nuclear reactor test bed Attention is given to the variety of F-111 variants O C

A83-36471#
THE NORTHROP FLYING WING PROTOTYPES
L BEGIN (Northrop Corp , Aircraft Div , Hawthorne, CA) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 135-144
(AIAA PAPER 83-1047)

The evolution of the Northrop Flying Wing prototypes is described with attention given to preliminary design work in the 1920's, the evolution through several prototype stages beginning with the N-1M in 1939, the development of the N-9M series as one-third scale prototypes for a projected long-range bomber, the first flight of the XB-35 in June 1946, and the 1947 flight of the YB-49 Consideration is also given to such prototypes as the XP-56 Black Bullet, a fighter/interceptor, the XP-79B Flying Ram, the MX-324/MX-334, prototypes for a rocket-powered interceptor, and the X-4 Skylancer, a Flying Wing research vehicle built to study high subsonic stability and control phenomena The XT-37 Turbodyne engine program, involving the first turboprop qualified for flight in the United States, is also considered B J

A83-36914#
DYNAMICS OF AIR COMBAT
W B HERBST (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) *(Israel Annual Conference on Aviation and* Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 594-598

Previously cited in issue 07, p 862, Accession no A83-21026

A83-36960
THE FUTURE OF THE MANNED AIRCRAFT
M LAMBERT Interavia (ISSN 0020-5168), vol 38, June 1983, p 581-593

After assessing the prospects for manned aircraft system developments from the present to the year 2000 and beyond, with attention to longterm requirements being formulated for payload capacity, fuel consumption and life cycle costs in the various passenger, cargo and military aircraft categories, a series of detailed aircraft system element considerations is presented These concern laminar flow techniques, advanced fighter design, airliner and business aircraft, digital avionics, active control technology, satellite-aided navigation, air traffic control, propfan airliner propulsion system development, and such advanced, low weight/high strength materials and construction techniques as metal matrix composites, all composite primary aircraft structures, and powder metallurgy techniques All present considerations are informed and complicated by the fact that aviation is a highly political industry, constituting an important component of national defence O C

N83-25652# Federal Aviation Administration, Washington, D C Office of Aviation Policy and Plans
FAA AVIATION FORECASTS. FISCAL YEARS 1983-1994
Feb 1983 80 p
(AD-A124611, FAA-APO-83-1) Avail NTIS HC A05/MF A01 CSCL 01B

This report contains the Fiscal Years 1983-1994 Federal Aviation Administration (FAA) forecasts of aviation activity at FAA facilities These include airports with FAA control towers, air route traffic control centers, and flight service stations Detailed forecasts were made for the four major users of the national aviation system air carriers, air taxi/commuters, general aviation and the military The forecasts have been prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities, by the aviation industry and the general public The overall outlook for the forecast period is for moderate economic growth, relatively stable real fuel prices, and decreasing inflation Based upon these assumptions, aviation activity is forecast to increase by Fiscal Year 1994 by 97 percent at towered airports, 50 percent at air route traffic control centers, and 54 percent in flight services performed Hours flown by general aviation is forecast to increase 56 percent and helicopter hours flown 80 percent Scheduled domestic revenue passenger miles (RPM's) are forecast to increase 81 percent, with scheduled international RPM's forecast to increase by 80 percent and commuter RPM's forecast to increase by 220 percent GRA

N83-25653# Federal Aviation Administration, Washington, D C Office of Management Systems
GENERAL AVIATION ACTIVITY AND AVIONICS SURVEY Annual Report, 1981
J C SCHWENK (Transportation Systems Center) and P W CARTER Dec 1982 110 p refs
(AD-A124595, FAA-MS-82-5) Avail NTIS HC A06/MF A01 CSCL 01B

This report presents the results and a description of the 1981 General Aviation Activity and Avionics Survey The survey was conducted during 1982 by the FAA to obtain information on the activity and avionics of the United States registered general aviation aircraft fleet, the dominant component of civil aviation in the U S The survey was based on a statistically selected sample of about 8 9 percent of the general aviation fleet and obtained a response rate of 61 percent Survey results are based upon response but are expanded upward to represent the total population Survey results revealed that during 1981 an estimated 40 7 million hours of flying time were logged by the 213,226 active general aviation aircraft in the U S fleet, yielding a mean annual flight time per aircraft of 188 1 hours The active aircraft represented about 83 percent of the registered general aviation fleet The report contains breakdowns of these and other statistics by manufacturer/model group, aircraft type, state and region of based aircraft, and primary use Also included are fuel consumption, lifetime airframe hours, avionics, and engine hours estimates In addition, tables are included for detailed analysis of the avionics capabilities of GA fleet GRA

N83-25654# Federal Aviation Administration, Washington, D C Office of Aviation Policy and Plans
AVIATION EXECUTIVE CONFERENCE Summary Report
1981 48 p Conf held in Washington, D C , 30 June 1981
(AD-A124581, FAA-APO-81-9) Avail NTIS HC A03/MF A01 CSCL 01B

Partial Contents Deregulation-How Far Should the FAA Go?, What Should be the FAA's Role in Encouraging and Fostering the Development of aviation and Helping U S Airframe Manufacturers be More Competitive with Foreign Manufacturers?, What User/Information Services Should Continue After CAB Abolishment?, Major Hub Airports Sharing Revenues with Reliever Airports, Air Traffic Control System of the Future Labor Intensive Versus Capital Intensive, and Airport/Aircraft Noise Policy GRA

N83-25655# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Systems and Logistics
THE EFFECTS OF THE PRODUCTION ORIENTED MAINTENANCE ORGANIZATION (POMO) CONCEPT ON ADTAC AIRCRAFT MAINTENANCE PRODUCTIVITY AND QUALITY M.S. Thesis
J B AMEND and L E ERIKSEN Sep 1982 139 p refs
(AD-A123981, AFIT-LSSR-70-82) Avail NTIS HC A07/MF A01 CSCL 01C

Virtually all USAF tactical fighter and interceptor units work under the AFR 66-5 decentralized POMO concept for aircraft maintenance This thesis used an aggregation of maintenance data from five ADTAC Fighter Interceptor Squadrons spanning periods preceding and following POMO implementation Hypotheses reflecting POMO's intended effects on maintenance productivity and quality were then statistically tested using the Analysis of Variance, Duncan'S Multiple Range Test, and the Large Sample Test of Significance The final research results showed that conversion to POMO generally improved aircraft maintenance performance in the ADTAC FISs, but not to any great extent

These findings may possibly be generalizable to other USAF tactical air force operations Author (GRA)

N83-25656# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Systems and Logistics
AIRFRAME RDT&E COST ESTIMATING: A JUSTIFICATION FOR AND DEVELOPMENT OF UNIQUE COST ESTIMATING RELATIONSHIPS ACCORDING TO AIRCRAFT TYPE M S Thesis
C L BECK, JR and D L PFEIL Sep 1982 205 p refs
(AD-A123848, AFIT-LSSR-56-82) Avail NTIS HC A10/MF A01 CSCL 01C

Airframe RDT&E costs are invariably predicted by utilizing one general cost estimating relationship (CER) regardless of aircraft type(fighter, attack, or bomber/cargo) This practice results in inconsistent and often very significant inaccuracies in predicting weapon system development costs which may affect subsequent program funding This thesis examines the utility of a unique CER for each aircraft type to be used for estimating airframe development costs The methodology consisted of factor analysis and step-wise multiple regression analysis Based on the results, the authors concluded that the unique CERs are consistently and significantly more accurate when estimating airframe RDT&E costs than the general CERs developed by former studies The results of this study should be applicable to those organizations dealing with the procurement of aircraft airframes Author (GRA)

N83-26785*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SOME HISTORICAL TRENDS IN THE RESEARCH AND DEVELOPMENT OF AIRCRAFT
M L SPEARMAN Apr 1983 15 p
(NASA-TM-84665, NAS 1 15 84665) Avail NTIS HC A02/MF A01 CSCL 01B

A survey of some trends in aircraft design was made in an effort to determine the relation between research, development, test, and evaluation (RDT and E) and aircraft mission capability, requirements, and objectives Driving forces in the history of aircraft include the quest for speed which involved design concepts incorporating jet propulsion systems and low drag features The study of high speed design concepts promoted new experimental and analytical research techniques These research techniques, in turn, have lead to concepts offering new performance potential Design trends were directed toward increased speed, efficiency, productivity, and safety Generally speaking, the research and development effort has been evolutionary in nature and, with the exception of the transition to supersonic flight, little has occurred since the origin of flight that has drastically changed the basic design fundamentals of aircraft However, this does not preclude the possibility of dramatic changes in the future since the products of research are frequently unpredictable Advances should be expected and sought in improved aerodynamics (reduced drag, enhanced lift, flow field exploitation), propulsion (improved engine cycles, multimode engines, alternate fuels, alternate power sources), structures (new materials, manufacturing techniques), all with a view toward increased efficiency and utility Author

N83-26786# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
AGARD BULLETIN: MEETINGS, PUBLICATIONS, MEMBERSHIP
Jan 1983 77 p
(AGARD-BUL-83/1) Avail NTIS HC A05/MF A01

Information on all the planned meetings including dates, locations and brief descriptions of their themes is included Included also is a list of all publications which were issued together with their abstracts Complete listings of all publications which appeared since the founding of this agency are included in the index of publications Information on how AGARD documents may be obtained is also given S L

N83-26787# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio
A COLLECTION OF PAPERS IN THE AEROSPACE SCIENCES Final Report, Dec. 1978 - Nov. 1979
K S NAGARAJA, ed and J S PETTY, ed Jun 1982 660 p refs
(AD-A122667, AFAPL-TR-79-2126) Avail NTIS HC A99/MF A01 CSCL 01A

A collection of thirty-five papers covering a range of topics in the aerospace sciences, including propulsion, fluid dynamics, aerodynamics, energy conversion, and mathematical analysis is presented The introductory paper is a biography of Dr Hans von Ohain, a pioneer in the development of the aircraft jet engine

02

AERODYNAMICS

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

A83-33772
OPTIMUM WIRE SCREENS FOR CONTROL OF TURBULENCE IN WIND TUNNELS
G I DERBUNOVICH, A S ZEMSKAIA, E U REPIK, and IU P SOSEDKO (TsAGI, Uchenye Zapiski, vol 13, no 1, 1982, p 11-20) Fluid Mechanics - Soviet Research (ISSN 0096-0764), vol 10, Sept-Oct 1981, p 136-147 Translation refs

Recommendations are made for selecting the set of screens that will give the most effective damping of free-stream turbulence for a specified screen drag Attention is also given to the structure of the turbulence generated by a screen placed in nonturbulent flow Optimal geometry is sought because the introduction of flow-damping screens significantly increases the pressure drop and the pumping penalty It is pointed out that the mechanisms of the screen's damping effect involves primarily the reduction of the scale of the turbulence fluctuations, with the smaller fluctuations then being damped more rapidly than large-scale turbulence C R

A83-33972*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
RECENT STUDIES AT NASA-LANGLEY OF VORTICAL FLOWS INTERACTING WITH NEIGHBORING SURFACES
J E LAMAR and J F CAMPBELL (NASA, Langley Research Center, Hampton, VA) NATO, AGARD, Symposium on Vortical Type Flows in Three Dimensions, Rotterdam, Netherlands, Apr 25-28, 1983, Paper 33 p refs

The importance of leadingedge vortical flows, which occur near and interact with neighboring surfaces, is stressed Research in this area conducted or sponsored by the NASA Langley Research Center since 1978 is surveyed Particular attention is given to the cumulative results of a number of theoretical and experimental studies It is noted that these studies have been carried out in order to understand and use this kind of flow Much of the work has been devoted to improving the lift-to-drag ratio and pitch characteristics for wings in this flow, although work has also been done on examining the unsteady and lateral characteristics C R

A83-35535
THE AERODYNAMICS OF HYPOSONIC VELOCITIES (ON FLOWS WITH LOW MACH NUMBERS) [AERODINAMIKA GIPOZVUKOVYKH SKOROSTEI /O TECHENIIAKH S MALYMI CHISLAMI MAKHA/]
R KH ZEITUNIAN PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki (ISSN 0044-4626), Mar-Apr 1983, p 53-61 In Russian refs

The paper introduces the concept of hyposonic flow which describes slow subsonic weakly compressible gas flow Hyposonic flow is discussed with reference to the phenomena of unsteadiness,

viscosity, and acoustics which are connected with it Particular consideration is given to the necessity of correctly allowing for weak compressibility in the mathematical modeling of flow phenomena The discussion is illustrated by several simple problems, and solutions are indicated for some of these problems Particular attention is given to the case where S is not equal to zero and R is not equal to infinity, the case of hyposonic flow within a limited region, the effect of weak compressibility on viscosity, the theory of small perturbations for hyposonic flows, and the external unsteady problem B J

A83-35541
CALCULATION OF SUBSONIC FLOW PAST RECTANGULAR WINGS AND THEIR COMBINATIONS ON THE BASIS OF A DISCRETE VORTEX SCHEME [RASCHET OBTEKANIIA PRIAMOUGOL'NYKH KRYE'EV I IKH KOMBINATSII V DOZVUKOVOM POTOKE PO DISKRETNOI VIKHREVOI SKHEME]
N F VOROBEV and G N SHASHKINA PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki (ISSN 0044-4626), Mar -Apr 1983, p 91-98 In Russian refs

The effect of the parameter K on the aerodynamic characteristics of rectangular-planform wings is evaluated, the variation of K from 0 to 1 corresponds to the modeling of the intensity of a vortex sheet in the process of shedding (K = 0 corresponds to nonseparated flow while K = 1 corresponds to the limiting case of total separation) An analysis is also presented of the effect of individual computational parameters and individual elements of a free vortex sheet on the overall aerodynamic characteristics Calculations of flow past combinations of rectangular wings of small aspect ratio are presented, and results of calculations of normal force coefficients and pitching moment are compared with available experimental data A scheme is proposed for modeling the twisting of the vortex sheet into two vortex cores some distance from the wing B J

A83-35590
PROFILE LOSSES DURING THE RELEASE OF AIR ONTO THE SURFACE OF NOZZLE VANES [PROFIL'NYE POTERI PRI VYPUSKE VOZDUKHA NA POVERKHNOST' SOPLOVYKH LOPATOK]
S Z KOPELEV and V V ZIKEEV Promyshlennaia Teplotekhnika (ISSN 0204-3602), vol 5, May-June 1983, p 51-59 In Russian refs

The results of a gas-dynamic study of profile losses in nozzle vane cascades where air is released onto the surface of the vanes are presented A procedure for calculating the profile losses for an arbitrary arrangement of perforation rows is discussed whereby allowance is made for both mixing losses and additional friction losses resulting from the release of the cooling agent V L

A83-35620
THE SWIRL IN AN S-DUCT OF TYPICAL AIR INTAKE PROPORTIONS
R W GUO and J SEDDON Aeronautical Quarterly (ISSN 0001-9259), vol 34, May 1983, p 99-129 refs

Measurements were made of the static pressure, total pressure, and swirl in an S-shaped duct typical of jet air intakes Various angles of attack and different flow-through ratios were examined It was determined that swirl presence in an S-duct is affected by the interaction between pressure gradients caused by bends and by the angle of attack, the flow inertia, the viscous flow condition, and the geometry of the duct cross-sections The pattern and intensity of the swirl is dependent on the first three factors, as well as the duct geometry A high mean total pressure at the engine face is present at a low incidence, then decreases with increasing incidence High values of the distortion parameter at high incidence are lowered through use of spoilers and an auxiliary inflow area M S K

A83-35707
SEPARATED FLOWS ON A CONCAVE CONICAL WING [OTRYVNYE TECHENIIA NA VOGNUTOM KONICHESKOM KRYLE]
V V KRAVETS and A I SHVETS Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza (ISSN 0568-5281), Mar -Apr 1983, p 83-91 In Russian refs

A series of models of concave conical wings were tested in a wind tunnel, along with flat delta wings, at Mach 3 and angles of attack ranging from 0 to 15 deg In comparison with flat delta wings, the concave configuration makes it possible to achieve higher shock waves, avoid additional pressure losses associated with transverse flows, and prevent flow over the leading edge of the wing at larger angles of attack Experimental data on pressure distribution, shock waves, and separated flows are discussed in detail, and some of the results are presented in graphical form V L

A83-35828#
APPLICATIONS OF COMPUTATIONAL TECHNIQUES IN THE DESIGN OF RAMJET ENGINES
M D GRIFFIN, F S BILLIG, and M E WHITE (Johns Hopkins University, Laurel, MD) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 215-228 refs

A discussion is presented concerning computational fluid dynamics techniques for ramjet engine design and analysis which are sufficiently efficient to allow their routine use as part of the iterative design and optimization process The applications and limitations noted for purely inviscid analyses of inlet flowfields are complemented by steady state, parabolized Navier-Stokes methods considering the effects of viscosity Attention is given to modeling techniques, and to a procedure for flow field analysis, in the case of a dual combustor ramjet O C

A83-35838#
NUMERICAL COMPUTATION OF TURBULENT FLOW AROUND THE SPINNER OF A TURBOFAN ENGINE
Y OBIKANE (Ishikawajima-Harima Heavy Industries Co , Ltd , Tokyo, Japan) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 304-312 refs

The Reynolds stress in the flow around the spinner of a turbofan engine has been predicted with a second order turbulence modeling equation It has been shown that the large mean strain rate and the mean shear gradient change significantly the turbulent kinetic energy and the anisotropy Especially, it is predicted that the turbulent kinetic energy is strongly intensified on the streamline near the spinner Therefore, one may expect that the intensified turbulence is swallowed into the core region of the turbofan engine The turbulence model may be applicable for higher intensified turbulent flow such as the blade-to-blade flow in turbine and could be very useful for engine design Author

A83-35839#
AERODYNAMIC OPTIMIZATION THEORY OF A 3-D AXIAL-FLOW ROTOR-BLADING VIA OPTIMAL CONTROL
L GAOLIAN (Shanghai Institute of Mechanical Engineering, Shanghai, People's Republic of China) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 313-318 refs

In this paper a theory of optimum aerodynamic design of a whole 3-D rotor-blading with cylindrical hub and casing in compressible flow is put forth It has been formulated as an optimal control problem with multiple inequality constraints on control- and phase-variables, including also a constraint on centrifugal stress in rotating blades The essential feature of the present theory consists in its capability of handling a variety of practical design constraints (to account for aerodynamic, cooling, material-strength, vibrational and technological requirements) in a unified manner,

so that the optimal solution thus obtained is surely feasible and can be adopted for practical use Author

A83-35852#
A CONTRIBUTION TO THE CALCULATION OF SECONDARY FLOWS IN AN AXIAL FLOW COMPRESSOR
K D PAPAILIOU (Athens, National Technical University, Athens, Greece) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 439-446 refs

Modifications are introduced into the theoretical development of flow equations based on a parabolic (boundary layer) formulation in the longitudinal flow direction and an elliptic (secondary vorticity) formulation in the transverse flow direction, introducing a simple approximation technique which accounts for viscous/inviscid interaction effects in the course of viscous flow calculations The application given for this approach is the case of a compressor cascade, with the theoretical modifications and the approximate viscous/inviscid interaction procedure incorporated O C

A83-35853#
EXPERIMENTAL STUDY OF A HIGH-THROUGH-FLOW TRANSONIC AXIAL COMPRESSOR STAGE
A J WENNERSTROM (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 447-457 refs

Design features and experimental performance data are given for the case of a 195 kg/sec per sq m transonic axial compressor achieving a 1 95 pressure ratio at a tip speed of 457 m/sec This design incorporates several novel features that are instrumental in the attainment of a design speed peak isentropic efficiency of more than 88 percent An optimum rotor tip clearance is determined for the design, and it is found that the placing of vortex generators upstream is ineffective in influencing stall margin The installing of vortex generators on the rotor did, however, improve stall margin, and increased efficiency at speeds above 90 percent of the design speed O C

A83-35868#
EFFECT OF ENTRY BOUNDARY LAYER THICKNESS ON SECONDARY FLOWS IN AN ANNULAR CASCADE OF TURBINE NOZZLE AND ROTOR BLADES
M GOVARDHAN and N VENKATRAYULU (Indian Institute of Technology, Madras, India) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 585-594

This paper presents the results of some of the initial investigations carried out on a low speed annular cascade of turbine nozzle blades, with a view to study the secondary flows and losses arising out of the three-dimensional nature of the flow and interaction of such parameter like the entry boundary layers From the results obtained, the spanwise variation of circumferentially averaged total pressure, local loss coefficient, velocity, flow angle and pitch angle downstream of the cascade are presented Also presented in the paper are the contours of total pressure, velocity, flow direction and local loss coefficient at the downstream for one typical boundary layer thickness Results from linear cascade by using rotor blades are presented in the form of total pressure contours for two typical entry boundary thicknesses Author

A83-35873#
FLOW MEASUREMENTS WITHIN ROTATING STALL CELLS IN SINGLE AND MULTISTAGE AXIAL-FLOW COMPRESSORS
D K DAS (New York, State University, Utica, NY) and H K JIANG (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 623-631 refs

Detailed measurements were taken with combined probes containing fast-response transducers for the flow field and the parameter transducers for the flow field and the parameter distributions both in single and multistage axial-flow compressors operating in the rotating stall regime The large amount of results presented in this paper reveal in detail the structure of the rotating stall cell and show certain new features of the stalled compressor The contents of this paper are anticipated to make a significant contribution to the development of a physical model for rotating stall in axial-flow compressor Author

A83-35874#
FLOW IN ROTATING STALL CELLS OF A LOW SPEED AXIAL FLOW COMPRESSOR
F A E BREUGELMANS, K MATHIOUDAKIS, and F CASALINI (Institut von Karman de Dynamique des Fluides, Rhode-Saint-Genese, Belgium) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 632-642 refs

A high hub-tip ratio single stage compressor is investigated over the entire characteristic, using fast response instrumentation The flow field is explored in the absolute and relative reference frame The information is digitized for further analysis of the instantaneous and averaged flow parameters Two distinct types of perturbations are explored the small oscillating eight cell and the single or double cell pattern with deep stall The energy spectra, autocorrelation function and phase locked averaging technique are used in the analysis The instantaneous traces are used in the description of the cell structure for the deep stall case Vortices and strong reversed flows are observed during the passage of the large stall cells and large radial drifts occur on the blade surfaces Author

A83-35875#
HIGH ANGLE-OF-ATTACK CASCADE MEASUREMENTS AND ANALYSIS
W F OBRIEN, H L MOSES, S B THOMASON, and A M YOCUM (Virginia Polytechnic Institute and State University, Blacksburg, VA) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 643-648 refs

Results are presented from cascade tests of double-circular-arc compressor blades at high angle-of-attack A specially-designed cascade tunnel permitted operation at angles-of-attack to 28 degrees with good retention of two-dimensional flow in the test section Results from the tests are compared with predictions of a cascade flow theory based on simultaneous solution of an inviscid free stream and an integral boundary layer model Author

A83-36046*# Jet Propulsion Lab, California Inst of Tech, Pasadena
ENTRAINMENT AND MIXING IN THRUST AUGMENTING EJECTORS
L BERNAL and V SAROHIA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 21st, Reno, NV, Jan 10-13, 1983 10 p NASA-supported research refs
(Contract N62269-80-MP-00034, AF-AFOSR-ISSA-81-00029)
(AIAA PAPER 83-0172)

An experimental investigation of two-dimensional thrust augmenting ejector flows has been conducted Measurements of

the shroud surface pressure distribution, mean velocity, turbulent intensities and Reynolds stresses were made in two shroud geometries at various primary nozzle pressure ratios The effects of shroud geometry and primary nozzle pressure ratio on the shroud surface pressure distribution, mean flow field and turbulent field were determined From these measurements the evolution of mixing within the shroud of the primary flow and entrained fluid was obtained The relationship between the mean flow field, the turbulent field and the shroud surface pressure distribution is discussed Author

A83-36076*# Technion - Israel Inst of Tech , Haifa
NUMERICAL CALCULATION OF NONLINEAR AERODYNAMICS OF WING-BODY CONFIGURATIONS
E WASSERSTROM (Technion - Israel Institute of Technology, Haifa, Israel), A SEGINER (NASA, Ames Research Center, Moffett Field, CA, Technion Israel Institute of Technology, Haifa, Israel), and Z RUSAK (Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers, p 187-197) AIAA Journal (ISSN 0001-1452), vol 21, July 1983, p 929-936 refs

Previously cited in issue 07, p 864, Accession no A83-21022

A83-36078#
SINGLE- AND MULTIPLE-CRATER INDUCED NOSETIP TRANSITION
A TODISCO, B REEVES, D SIEGELMAN, and R MASCOLA (Avco Corp , Avco Systems Div , Wilmington, MA) AIAA Journal (ISSN 0001-1452), vol 21, July 1983, p 939, 940
(Contract F04701-78-C-0144)

Previously cited in issue 03, p 313, Accession no A82-13977

A83-36235*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EMPENNAGE/AFTERBODY INTEGRATION FOR SINGLE AND TWIN-ENGINE FIGHTER AIRCRAFT
B L BERRIER (NASA, Langley Research Center, Transonic Aerodynamics Div , Hampton, VA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 13 p refs
(AIAA PAPER 83-1126)

An extensive experimental program to determine the effects of empennage surfaces on single and twin-engine afterbody/nozzle drag has been conducted by the Propulsion Aerodynamics Branch at the NASA Langley Research Center Empennage interference drag was obtained by using experimental values of afterbody/nozzle drag and computed values of empennage drag The effects of tail location, span, number (single versus twin), toe angle, cant angle, camber and root chord length are discussed The magnitude of empennage interference drag on single and twin engine configurations is examined Author

A83-36258#
NUMERICAL CALCULATIONS OF TIME DEPENDENT THREE-DIMENSIONAL VISCOUS FLOWS IN A BLADE PASSAGE WITH TIP CLEARANCE
A R WADIA (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(AIAA PAPER 83-1171)

It is pointed out that significant grains in efficiency are possible by minimizing the aerodynamic losses in various mechanical components of a gas turbine engine Endwall losses constitute a major portion of the total losses, and a significant portion of the total endwall flow losses is attributed to tip leakage flow Wadia and Booth (1982) have computed the two-dimensional streamline patterns in the tip region Several tip configurations were analyzed and the pressure side winglet was found to seal quite effectively The present investigation is concerned with further improvements in rotor-tip winglet configurations, taking into account the systematic and economical approach developed by Wadia and Booth It is found that the pressure side winglet is a more effective sealing configuration than a suction side winglet The obtained numerical results suggest that a partial shroud is the best performer among all the members of the winglet family Attention is also given to the development of a full three-dimensional viscous flow model of the tip leakage problem G R

A83-36259#
PREDICTION OF STAGNATION FLOW HEAT TRANSFER ON TURBOMACHINERY AIRFOILS
O K KWON, E R TURNER, and Y M KOU (General Motors Corp , Indianapolis, IN) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p refs
(AIAA PAPER 83-1173)

An analytic procedure is developed for obtaining preliminary design predictions of nonporous turbine airfoil stagnation point heat transfer based on the numerical solution of the compressible boundary layer similarity equations The effective viscosity/Prandtl number concept is introduced to account for the effects of free-stream turbulence An existing eddy diffusivity turbulence model developed specifically for the analysis of cylinders in crossflow is modified to explicitly reflect the influence of arbitrary stagnation point pressure gradient Predictions for both cylinder and turbine airfoil stagnation flows are compared with results from existing theory and experiments Author

A83-36287*# Vigyan Research Associates, Inc , Hampton, Va
METHOD FOR CALCULATING EFFECTS OF A PROPFAN ON AIRCRAFT AERODYNAMICS AT SUBSONIC SPEEDS
B CHANDRASEKARAN (Vigyan Research Associates, Inc , Hampton, VA) and G BARTLETT (George Washington University, Hampton, VA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 15 p refs
(Contract NAS1-16742)
(AIAA PAPER 83-1216)

A subsonic-flow panel code has been modified to handle the effects of a propeller wake The effects of the propeller were modelled by a system of ring vortices of constant strength Principles based on the blade element theory and the momentum theory were used to evaluate the swirl velocity and the pressure increase, across the propeller Theoretical calculations are compared to experimental results at a Mach number of 0 50 The discrepancies between the theory and the experimental results are analysed Suggestions for improvements to enhance the accuracy of the theoretical prediction are indicated Author

A83-36291*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
STOL WIND TUNNEL TEST RESULTS FOR A TACTICAL SUPERCRUISER
R A HUTCHISON, M B SUSSMAN (Boeing Military Airplane Co , Seattle, WA), R MAINQUIST (USAF, Eglin AFB, FL), and J W PAULSON, JR (NASA, Langley Research Center, Hampton, VA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(Contract F33615-80-C-3001)
(AIAA PAPER 83-1224)

Attention is given to the NASA Langley Research Center's testing of a 10 5 percent-scale supersonic cruiser (supercruiser) aircraft model in its V/STOL wind tunnel, in order to investigate the low speed aerodynamic characteristics of STOL enhancement devices The STOL devices employed by the supercruiser configuration are high vector angle ramp nozzles, working in conjunction with a remote augmented lift system (RALS), in addition to a canard trim system Also investigated were thrust reverser/ground plane interaction effects, for the evaluation of landing characteristics It is noted that STOL approach thrust management requires the use of a partially reversing RALS nozzle which develops approximately 31 percent of main nozzle thrust, and that strong nose-up interactions during ground roll, with reverser operation, may limit dry power engine thrust for braking assistance to about 50 percent of maximum dry power O C

A83-36292#
A HIGH SPEED WIND TUNNEL TEST EVALUATION OF STOL DEDICATED ADVANCED EXHAUST NOZZLE CONCEPTS
J G DOONAN, C J CALLAHAN (Grumman Aerospace Corp., Bethpage, NY), and D L BOWERS (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 18 p refs
(Contract F33615-79-C-3009)
(AIAA PAPER 83-1225)

Recent studies concerned with advanced exhaust nozzle concepts have identified numerous potential benefits for advanced tactical aircraft These benefits are related to increased maneuverability through vectored thrust, increased range through reduced cruise drag, and enhanced aircraft survivability through reduced observables The present investigation is concerned with a significant contribution to enlarging the advanced exhaust nozzle data base available for aircraft preliminary design Four advanced exhaust nozzle configurations have been studied over a Mach number range from 0 6 to 1 45 The exhaust nozzle configurations considered include an advanced, lightweight, vectoring, convergent-divergent axisymmetric nozzle, and a low aspect ratio Axisymmetric Load balanced Exhaust Nozzle Each nozzle was examined at representative nonafterburning (dry cruise) and afterburning (combat maneuver) power settings and thrust vector angles up to 20 deg G R

A83-36324*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
A STATIC INVESTIGATION OF YAW VECTORING CONCEPTS ON TWO-DIMENSIONAL CONVERGENT-DIVERGENT NOZZLES
B L BERRIER and M L MASON (NASA, Langley Research Center, Transonic Aerodynamics Div., Hampton, VA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 13 p refs
(AIAA PAPER 83-1288)

The flow-turning capability and nozzle internal performance of yaw-vectoring nozzle geometries were tested in the NASA Langley 16-ft Transonic wind tunnel The concept was investigated as a means of enhancing fighter jet performance Five two-dimensional convergent-divergent nozzles were equipped for yaw-vectoring and examined The configurations included a translating left sidewall, left and right sidewall flaps downstream of the nozzle throat, left sidewall flaps or port located upstream of the nozzle throat, and a powered rudder Trials were also run with 20 deg of pitch thrust vectoring added The feasibility of providing yaw-thrust vectoring was demonstrated, with the largest yaw vector angles being obtained with sidewall flaps downstream of the nozzle primary throat It was concluded that yaw vector designs that scoop or capture internal nozzle flow provide the largest yaw-vector capability, but decrease the thrust the most M S K

A83-36355#
AERODYNAMIC MEASUREMENTS ABOUT A ROTATING PROPELLER WITH A LASER VELOCIMETER
J LEPICOVSKY and W A BELL (Lockheed-Georgia Co., Marietta, GA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p Research supported by the Lockheed-Georgia Co refs
(AIAA PAPER 83-1354)

Data treatment and analysis techniques, as well as test results with the flowfield around propeller blades, are reported for a laser velocimetry system Triggering pulses are initiated in synchronization with the propeller speed and data is acquired at a rate down to 8 microsec between samples Data processing involves dividing the propeller revolution into 360 time slots with a velocity for each time slot The rms value for all corresponding time slots for a series of propeller revolutions, when compared with the mean values, yields the local turbulence intensity at a given propeller angular position Experimental data from examination of a two-bladed propeller are presented, including derivation of the mean, axial, radial, and tangential velocity and turbulence components A blade to blade turbulence distribution was also generated M S K

A83-36363*#
PROGRESS TOWARD THE ANALYSIS OF COMPLEX PROPULSION INSTALLATION FLOW PHENOMENON
P R A KERN and R G HOPCROFT (Boeing Military Airplane Co., Seattle, WA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(Contract NAS1-16150)
(AIAA PAPER 83-1367)

A trend toward replacement of parametric model testing with parametric analysis for the design of aircraft is driven by the rapidly escalating cost of wind tunnel testing, the increasing availability of large fast computers, and powerful numerical flow algorithms In connection with the complex flow phenomena characteristic of propulsion installations, it is now necessary to employ both parametric analysis and testing for design procedures Powerful flow analysis techniques are available to predict local flow phenomena However, the employment of these techniques is very expensive It is, therefore, necessary to link these analyses with less powerful and less expensive procedures for an accurate analysis of propulsion installation flowfields However, the interfacing and coupling processes needed are not available The present investigation is concerned with progress made regarding the development of suitabale linking methods Attention is given to methods of analysis for predicting the flow around a nacelle coupled to a highly swept wing G R

A83-36364#
PAN AIR APPLICATIONS TO AERO-PROPULSION INTEGRATION
A W CHEN and E N TINOCO (Boeing Commercial Airplane Co., Seattle, WA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p refs
(AIAA PAPER 83-1368)

Several diverse applications of the PAN AIR system to aeropropulsion problems are presented in order to demonstrate the versatility of the method These illustrative examples involve the coupling of PAN AIR to a three-dimensional boundary layer analysis for obtaining iterative solutions, and include a study of the internal flow losses through a calibration nozzle, the calculation of surface pressures about an isolated nacelle, the modeling of exhaust flows, and the analysis of nacelle blowing effects on a complete wing-body strut nacelle configuration C D

A83-36365#
PANAIR PILOT CODE APPLICATION TO SUBSONIC NACELLE TYPE INTERIOR FLOWS
W D SIDDONS, JR (United Technologies Corp., Pratt and Whitney Group, East Hartford, CT) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p refs
(AIAA PAPER 83-1369)

This paper reports results from an investigation into the applicability of the PANAIR Pilot Code to the calculation of nacelle-type interior flows A flow model proposed for use in such calculations is found to permit the adjustment of interior flow leakage The doublet matching at network edges imposed by the Pilot Code is found to be the cause of this unusual capability A leakage parameter is defined which permits an assessment of the quality of interior flow solutions as well as providing a guide to the calculation of low leakage solutions Pilot Code predictions are compared to exterior and interior solutions for nacelle flows from alternative calculations and to measurements of internal nacelle pressures for low speed flow at angle of attack Author

A83-36391*# Garrett Turbine Engine Co , Phoenix, Ariz
THREE-DIMENSIONAL COMPRESSIBLE VISCOUS ANALYSIS OF MIXER NOZZLES
R K GOYAL, W L BLACKMORE (Garrett Turbine Engine Co , Phoenix, AZ), V HEAD, and L POVINELLI (NASA, Lewis Research Center, Cleveland, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 13 p refs
(AIAA PAPER 83-1401)

An analysis-based design procedure for compound-mixer exhaust nozzles is presented and compared to test data The design approach is based on two numerical solutions to the 3-D viscous compressible Navier-Stokes equations an equation splitting technique used for the analysis of the core and bypass flow, and a parabolic marching scheme used in the analysis of the mixing duct The selection of the analytical methods through test data comparisons and their coupling into an integrated design system are discussed NASA test data is used to demonstrate the validity of the computations from the exhaust system rating station, upstream of the mixer lobe, to the nozzle throat An estimate is made of the savings in development time and cost utilizing the new procedure Author

A83-36403#
RESPONSE OF A SUPERSONIC INLET TO DOWNSTREAM PERTURBATIONS
T J BOGAR, M SAJBEN, and J C KROUTIL (McDonnell Douglas Research Laboratories, St Louis, MO) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(Contract N00014-80-C-0481)
(AIAA PAPER 83-2017)

Experimental results are reported for flows in a ramp-type, external compression inlet with a large-aspect-ratio, rectangular cross-section, operated at a freesteam Mach number of 1 84 under the influence of a mechanically generated downstream perturbation High-speed schlieren and time dependent pressure measurements were employed extensively In supercritical operation, pressure fluctuations throughout the inlet caused by the excitation varied linearly with the fluctuations at the exit station, even for large exit station amplitudes In subcritical operation (buzz), the excitation interacted nonlinearly with the naturally present, highly periodic oscillations by either modifying the natural frequency, if the excitation was near a natural harmonic, or by having the excitation modulate the naturally occurring oscillation In addition, the conditions at the two criticality boundaries were determined as a function of excitation amplitude and frequency Author

A83-36409*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
NATURAL LAMINAR FLOW DATA FROM FULL-SCALE FLIGHT AND WIND-TUNNEL EXPERIMENTS
B J HOLMES, P F COY, L P YIP, P W BROWN (NASA, Langley Research Center, Hampton, VA), and C J OBARA (George Washington University, Hampton, VA) American Institute of Aeronautics and Astronautics, Annual General Aviation Technology Fest, 8th, Wichita, KS, Nov 13, 14, 1981, Paper 22 p

Experimental results obtained at NASA Langley during studies of natural laminar flow (NLF) over commercially produced aircraft surfaces are reported The general aviation aircraft examined were light aircraft, yet displayed NLF extents close to the maximum available and equivalent to high performance business aircraft flying envelopes Sublimating chemicals and acoustic detection techniques were employed to measure the boundary layer transition Theoretical predictions of boundary layer stability were found to match well with the experimental data, with consideration given to both swept wings and the amplitudes of allowable waves on the airfoil surfaces The presence of the NLF on the airfoil surfaces confirmed the benefits available from use of composite materials for airfoil surfaces M S K

A83-36414#
FRICTION DRAG MEASUREMENTS OF ACOUSTIC SURFACES
T-M LIU and J S MOUNT (Rohr Industries, Inc , Chula Vista, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p refs
(AIAA PAPER 83-1356)

Drag measurements have been made for several acoustic panels from 25 ft/sec up to Mach 0 75, using both direct and indirect methods, at two different facilities Testing was conducted with and without an augmented noise source It was found that, because of the intercoupling of the normal turbulent intensity near the surface and the acoustic attenuation through the face sheet and honeycomb cavity, all panels tested resulted in higher drag in comparison to a flat plate, though differently for different structures With the augmented noise source turned on with a spectrum typical of that in a turbo-fan engine exhaust duct, it was found that drag was higher than that encountered without augmented noise Estimates of the equivalent sand-grain roughness for these surfaces at the condition tested have been made Skin-friction coefficients measured have been presented as a function of Reynolds number based on momentum thickness Author

A83-36450
THE MOTION DYNAMICS OF PARACHUTE SYSTEMS [DINAMIKA DVIZHENIIA PARASHIUTNYKH SISTEM]
A I ANTONENKO, O V RYSEV, F F FATYKHOV, V M CHURKIN, and IU N IURTSEV Moscow, Izdatel'stvo Mashinostroenie, 1982, 152 p In Russian refs

The present work considers the analysis of the dynamic and aerodynamic characteristics of load-parachute systems at the stage of their motion from the moment of full opening of the canopy to the moment of landing Results are presented of linear and nonlinear analyses of the equations of motion of a load-parachute system corresponding to various mathematical models a geometrically invariant system, a rigid parachute with a freely suspended load, and an inertialess parachute B J

A83-36913#
A TECHNIQUE TO DETERMINE LIFT AND DRAG POLARS IN FLIGHT
A KNAUS (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 587-593

Previously cited in issue 03, p 312, Accession no A82-13859

A83-36916#
WIND TUNNEL TESTS OF OVER-THE-WING NACELLES
J SZODRUCH and J KOTSCHOTE (Messerschmitt-Boelkow-Blohm GmbH, Vereinigte Flugtechnische Werke GmbH, Bremen, West Germany) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 606-611 Research supported by the Bundesministerium fuer Forschung und Technologie refs

Previously cited in issue 05, p 595, Accession no A83-16774

A83-36917#
IMPROVED NUMERICAL METHOD FOR UNSTEADY LIFTING SURFACES IN INCOMPRESSIBLE FLOW
A ICHIKAWA and S ANDO (Nagoya University, Nagoya, Japan) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 612-616 refs

An improved numerical method has been developed for unsteady thin rectangular wings in incompressible flow To satisfy the wing boundary conditions, the spanwise pressure distribution is assumed to be stepwise constant, while the chordwise integral is reduced to a finite sum using several kinds of quadratures, Cauchy and logarithmic singularities are treated appropriately The present method gives excellent results over a wide range of reduced frequency k (k = 0 0-5 0) within reasonable computer time Extension to compressible flow and to swept tapered wings applications is discussed briefly Author

A83-36920#
CORRECTION TO THE WING SOURCE VELOCITY ERROR IN WOODWARD'S USSAERO CODE
G J VAN DEN BROEK (National Institute for Aeronautics and Systems Technology, Pretoria, Republic of South Africa) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 628-632 refs

An analytical error present in the USSAERO computer code used to compute the subsonic and supersonic potential-flow aerodynamic characteristics of aircraft configurations is described, and a correction is proposed The expressions of the USSAERO model for the vertical-perturbation-velocity component induced by the linear source distribution on a wing panel (WL) is shown to be incorrect, resulting in erroneous values of the vertical flowfield below a tapered wing, regardless of the chordwise paneling scheme employed Correct expressions for the velocity components are derived, it is shown that function G(2) in the USSAERO WL expression must be replaced by the quantity G(2)-G(3) A further refinement involves the removal of the undesirable effects of the residual source sheet on the vertical perturbation velocities by applying the USSAERO treatment of wing-panel linear vortex distribution to the linear source distribution The validity of the corrections is demonstrated for a typical case T K

A83-36922#
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF WALL SUCTION AND BLOWING ON THE PERFORMANCE OF HIGHLY OFFSET DIFFUSERS
W H BALL (Boeing Military Airplane Co , Seattle, WA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 14 p
(AIAA PAPER 83-1169)

Tests were conducted in the Boeing Diffuser Test Facility to investigate the effect on diffuser performance of centerline offset, wall suction and blowing Effects of offset were studied using a family of two-dimensional diffusers Effectiveness of wall suction and blowing in controlling the diffuser boundary layer was investigated initially with the highest offset two-dimensional diffuser This was followed by a more detailed investigation of wall suction and blowing using a three-dimensional offset diffuser model Configuration variables included center-line offset, hole area for distributed suction, and blowing slot height Diffuser exit total pressure profiles and longitudinal wall static pressure distributions were measured to determine diffuser overall performance and to obtain an indication of local flow behavior Test results indicate that good performance can be achieved for diffusers with large offset by using small amounts of wall suction or blowing upstream of the separation point Author

A83-36924#
DEFINITION OF VECTORED NONAXISYMMETRIC NOZZLE PLUMES
M COMPTON and D L BOWERS (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 14 p refs
(AIAA PAPER 83-1290)

In approximately 1971, the nonaxisymmetric exhaust nozzle emerged as a large contributor to tactical aircraft mission performance These nozzles, especially if equipped with the functions of thrust vectoring and thrust reversing, can increase aircraft maneuverability, agility, provide STOL capability, and increase aircraft survivability Many advanced aircraft concepts are being configured with this nozzle type In connection with the importance of this technology, it was determined that a need existed for a comprehensive investigation of nonvectored and vectored nonaxisymmetric exhaust plumes issuing from highly integrated nozzles in a general advanced aircraft configuration An experimental investigation was initiated with the objective to define, with a very fine survey grid, the characteristics of an integrated nonaxisymmetric exhaust nozzle plume to establish an empirical data base and to update analytical aircraft performance prediction techniques A description is provided of the approach taken and the apparatus utilized in the study G R

N83-25657*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
EXPERIMENTAL RESULTS OF A DEFLECTED THRUST V/STOL NOZZLE RESEARCH PROGRAM
P L BURSTADT and A L JOHNS Mar 1983 26 p refs Presented at the 21st Aerospace Sci Conf , Reno, Nev , 10-13 Jan 1983, sponsored by AIAA Original contains color illustrations
(NASA-TM-83069, E-1539, NAS 1 15 83069) Avail NTIS HC A03/MF A01 CSCL 01A

Four deflected thrust nozzle concepts, designed to operate at the low pressure ratio typical of high bypass-ratio turbofan engines for medium speed (subsonic) V/STOL aircraft, were studied Maps of overall performance characteristics and exit velocity distributions are used to highlight similarities and differences between the four concepts Analytically determined secondary flows at the exit of a 90 deg circular pipe bend are compared with the experimental results from the more complex three dimensional geometries The relative impact of total-pressure losses and secondary flows on nozzle thrust coefficient is addressed by numerical integration of exit velocity measurements Author

N83-25658*# Georgia Inst of Tech , Atlanta School of Aerospace Engineering
HELICOPTER ROTOR LOADS USING DISCRETIZED MATCHED ASYMPTOTIC EXPANSIONS Final Report
G A PIERCE and A R VAIDYANATHAN May 1983 76 p refs
(Contract NAS1-16817)
(NASA-CR-166092, NAS 1 26 166092) Avail NTIS HC A05/MF A01 CSCL 01A

The numerical practicality of a matched asymptotic expansion approach for the computation of unsteady three dimensional airloads on a helicopter rotor was improved This effort utilizes a discretized repesentation of the doublet strength distribution and helical streamlines to decrease the computational requirements of the original analysis The continuous variation of the doublet strength was approximated by piecewise constant or piecewise quadratic distributions, and the helical trajectory of a fluid particle was approximated by connected straight line segments As a direct result of these simplified representations the computational time required for the execution of a typical flight condition was reduced by an order of magnitude with respect to the requirements of the original analysis Airloads which were computed using the discretized method for a two bladed model rotor and a full scale four bladed rotor are in close agreement with measured results and airloads from the original asymptotic analysis For conditions characterized by significant rotor/wake interaction the piecewise constant representation requires a reduced azimuth spacing to maintain acceptable accuracy S L

N83-25659*# Georgia Inst of Tech , Atlanta School of Aerospace Engineering
HELICOPTER ROTOR LOADS USING MATCHED ASYMPTOTIC EXPANSIONS: USER'S MANUAL Final Report
G A PIERCE and A R VAIDYANATHAN May 1983 92 p
(Contract NAS1-16817)
(NASA-CR-166093, NAS 1 26 166093) Avail NTIS HC A05/MF A01 CSCL 01A

Computer programs were developed to implement the computational scheme arising from Van Holten's asymptotic method for calculating airloads on a helicopter rotor blade in forward flight, and a similar technique which is based on a discretized version of the method The basic outlines of the two programs are presented, followed by separate descriptions of the input requirements and output format Two examples illustrating job entry with appropriate input data and corresponding output are included Appendices contain a sample table of lift coefficient data for the NACA 0012 air foil and listings of the two programs S L

N83-25660*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
HIGH REYNOLDS NUMBER TESTS OF THE CAST 10-2/DOA 2 AIRFOIL IN THE LANGLEY 0 3-METER TRANSONIC CRYOGENIC TUNNEL, PHASE 1
D A DRESS (Kentron International, Inc), P D MCGUIRE, E STANEWSKY (DFVLR, West Germany), and E J RAY May 1983 347 p refs
(NASA-TM-84620, NAS 1 15 84620) Avail NTIS HC A15/MF A01 CSCL 01A

A wind tunnel investigation of an advanced technology airfoil, the CAST 10-2/DOA 2, was conducted in the Langley 0 3 meter Transonic Cryogenic Tunnel (0 3 m TCT) This was the first of a series of tests conducted in a cooperative National Aeronautics and Space Administration (NASA) and the Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt e V (DFVLR) airfoil research program Test temperature was varied from 280 K to 100 K to pressures from slightly above 1 to 5 8 atmospheres Mach number was varied from 0 60 to 0 80, and the Reynolds number (based on airfoil chord) was varied from 4 x 10 to the 8th power to 45 x 10 to the 6th power This report presents the experimental aerodynamic data obtained for the airfoil and includes descriptions of the airfoil model, the 0 3 m TCT, the test instrumentation, and the testing procedures Author

N83-25662*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
NASA LOW-SPEED CENTRIFUGAL COMPRESSOR FOR FUNDAMENTAL RESEARCH
J R WOOD, P W ADAM, and A E BUGGELE 1983 13 p refs Presented at the 19th Joint Propulsion Conf and Tech Display, Seattle, 27-29 Jun 1983, sponsored by AIAA, SAE and ASME
(NASA-TM-83398, E-1675, NAS 1 15 83398) Avail NTIS HC A02/MF A01 CSCL 01A

A centrifugal compressor facility being built by the NASA Lewis Research Center is described, its purpose is to obtain benchmark experimental data for internal flow code verification and modeling The facility will be heavily instrumented with standard pressure and temperature probes and have provisions for flow visualization and laser Doppler velocimetry The facility will accommodate rotational speeds to 2400 rpm and will be rated at pressures to 1 25 atm The initial compressor stage for testing is geometrically and dynamically representative of modern high-performance stages with the exception of Mach number levels Design exit tip speed for the initial stage is 500 ft/sec with a pressure ratio of 1 17 The rotor exit backsweep is 55 deg from radial M G

N83-25665*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
PRESSURES MEASURED IN FLIGHT ON THE AFT FUSELAGE AND EXTERNAL NOZZLE OF A TWIN-JET FIGHTER
J NUGENT, T J PLANT, R A DAVIS, and N V TAILLON May 1983 90 p refs
(NASA-TP-2017, H-1161, NAS 1 60 2017) Avail NTIS HC A05/MF A01 CSCL 01A

Fuselage, boundary layer, and nozzle pressures were measured in flight for a twin jet fighter over a Mach number range from 0 60 to 2 00 at test altitudes of 6100, 10,700, and 13,700 meters for angles of attack ranging from 0 deg to 7 deg Test data were analyzed to find the effects of the propulsion system geometry The flight variables, and flow interference The aft fuselage flow field was complex and showed the influence of the vertical tail, nacelle contour, and the wing Changes in the boattail angle of either engine affected upper fuselage and lower fuselage pressure coefficients upstream of the nozzle Boundary layer profiles at the forward and aft locations on the upper nacelles were relatively insensitive to Mach number and altitude Boundary layer thickness decreased at both stations as angle of attack increased above 4 deg Nozzle pressure coefficient was influened by the vertical tail, horizontal tail boom, and nozzle interfairing, the last two tended to separate flow over the top of the nozzle from flow over the bottom of the nozzle The left nozzle axial force coefficient was most affected by Mach number and left nozzle boattail angle At Mach 0 90, the nozzle axial force coefficient was 0 0013 Author

N83-25666*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EFFECT OF EMPENNAGE LOCATION ON TWIN-ENGINE AFTERBODY-NOZZLE AERODYNAMIC CHARACTERISTICS AT MACH NUMBERS FROM 0.6 TO 1.2
L D LEAVITT May 1983 223 p refs
(NASA-TP-2116, L-15527, NAS 1 60 2116) Avail NTIS HC A10/MF A01 CSCL 01A

The Langley 16-foot transonic tunnel was used to determine the effects of several empennage and afterbody parameters on the aft-end aerodynamic characteristics of a twin-engine fighter-type configuration Model variables were as follows horizontal tail axial location and incidence, vertical tail axial location and configuration (twin- versus single-tail arrangements), tail booms, and nozzle power setting Tests were conducted over a Mach number range from 0 6 to 1 2 and over an angle-of-attack from -2 deg to 10 deg Jet total-pressure ratio was varied from jet off to approximately 10 0 Author

N83-25667*# Kansas Univ Center for Research, Inc, Lawrence Flight Research Lab
ANALYSIS OF NONPLANAR WING-TIP-MOUNTED LIFTING SURFACES ON LOW-SPEED AIRPLANES Final Report
C P VANDAM and J ROSKAM Washington NASA Jun 1983 175 p refs
(Contract NSG-1633)
(NASA-CR-3684, NAS 1 26 3684, KU-FRL-427-1) Avail NTIS HC A08/MF A01 CSCL 01A

Nonplanar wing tip mounted lifting surfaces reduce lift induced drag substantially Winglets, which are small, nearly vertical, winglike surfaces, are an example of these devices To achieve reduction in lift induced drag, winglets produce significant side forces Consequently, these surfaces can seriously affect airplane lateral directional aerodynamic characteristics Therefore, the effects of nonplanar wing tip mounted surfaces on the lateral directional stability and control of low speed general aviation airplanes were studied The study consists of a theoretical and an experimental, in flight investigation The experimental investigation involves flight tests of winglets on an agricultural airplane Results of these tests demonstrate the significant influence of winglets on airplane lateral directional aerodynamic characteristics It is shown that good correlations exist between experimental data and theoretically predicted results In addition, a lifting surface method was used to perform a parametric study of the effects of various winglet parameters on lateral directional stability derivatives of general aviation type wings S L

N83-25668# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
WIND TUNNEL INVESTIGATION OF VARYING HINGED FLAPS M.S. Thesis
H J PRICE, JR Dec 1982 110 p refs
(AD-A124703, AFIT/GAE/AA/82D-23) Avail NTIS HC A06/MF A01 CSCL 14B

The objective of this thesis was to compare thin-airfoil theoretical predictions of the change in zero-lift angle of attack divided by flap deflection versus flap-hinge location and the change in moment coefficient about the aerodynamic center GRA

N83-25669# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
TRANSIENT HEAT-TRANSFER MEASUREMENT TECHNIQUE IN WIND TUNNEL AND DATA ANALYSIS TECHNIQUE USING SYSTEM IDENTIFICATION THEORY M.S. Thesis
Y K WOO Dec 1982 93 p refs
(AD-A124663, AFIT/GAE/AA/82D-34) Avail NTIS HC A05/MF A01 CSCL 14B

A transient maneuver testing technique has been developed by the Air Force Flight Test Center (AFFTC) for aerothermodynamic evaluation of the Space Shuttle Orbiter Thermal Protection System

(TPS) during reentry The objectives are to determine the feasibility of the testing technique and the feasibility of using the transient maneuver technique for wind tunnel heat transfer measurements The transient maneuver technique can enhance the capability of wind tunnel testing by reducing the overall required testing time, and in turn lower the cost of testing significantly Wind tunnel data were obtained using the TPS materials of the Orbiter as wind tunnel test articles The principle finding indicates the heating estimates are significantly lower for the TPS test articles than the thin skin test article and Eckert theory The discrepancy is believed to be caused mainly by the non-isothermal wall effect Finally, the transient maneuver testing technique has been proven since the transient maneuvers agree well with the steady state results GRA

N83-25670# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
THEORETICAL DETERMINATION OF THE LIFT OF A SIMULATED EJECTOR WING M S Thesis
J T DOMALSKI Dec 1982 74 p refs
(AD-A124695, AFIT/GAE/82D-10) Avail NTIS HC A04/MF A01 CSCL 12A

The solution procedure and supporting theory have been developed for calculation of the lift per unit span of an ejector wing model Model consists of two vortex sheets A point sink and a point source in a uniform stream The solution is shown to be dependent on the number of control points used and examples using five control points are presented A FORTRAN computer program for the Five-Control-Point case is presented Author (GRA)

N83-25671# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
WIND TUNNEL TEST OF A C-18 AIRCRAFT MODIFIED WITH THE ADVANCED RANGE INSTRUMENTATION AIRCRAFT RADOME M.S. Thesis
D M SPRINKEL Dec 1982 185 p refs
(AD-A124771, AFIT/GAE/AA/82D-28) Avail NTIS HC A09/MF A01 CSCL 20D

The Air Force intends to modify Boeing 707-320C aircraft (Air Force designation, C-18) with the large blunt nosed Advanced Range Instrumentation Aircraft (ARIA) radome formerly installed on EC-135 aircraft This modification will significantly increase fuselage area forward of the aircraft center of gravity and is expected to reduce longitudinal and directional stability, and increase drag These anticipated aerodynamic changes were evaluated from data gathered on a modified (ARIA) gathered on a modified (ARIA) and unmodified (BASIC) 1/100 scale model C-18 tested in the AFIT five foot low speed wind tunnel GRA

N83-25673# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
A WIND TUNNEL STUDY OF THE EFFECTS OF A CLOSE-COUPLED CANARD ON THE AERODYNAMIC CHARACTERISTICS OF A FORWARD-SWEPT WING IN INCOMPRESSIBLE FLOW M.S. Thesis
P M WEAVER Dec 1982 237 p refs
(AD-A124722, AFIT/GAE/AA/82D-30) Avail NTIS HC A11/MF A01 CSCL 01C

Low speed wind tunnel tests and a boundary layer flow visualization study were conducted in the Air Force Institute of Technology fourteen inch wind tunnel to determine the differences in the aerodynamic characteristics among a forward-swept wing and several forward-swept wing/canard configurations Both the wing and canard were constructed with an NACA 0006 airfoil section and had quarter chord sweeps of -30 and +40 deg, respectively All tests were conducted at a dynamic pressure of 25 6 lbf/sq ft and a Reynolds number of 1 9 x 100,000 based on the wing mean aerodynamic chord The results show that the changes in the aerodynamic characteristics are dependent upon canard location relative to the wing, canard incidence, and model angle of attack The largest increases in CL were observed for the two canard positions above and closest to the wing A decrease in CM was noted as the canard location changed vertically from the upper to the lower test positions An increase in CD occurred as the canard location approached the wing horizontally Comparison of the force and moment data with the flow study photographs suggests that the canard wake/vortex system is responsible for the changes in the wing/canard aerodynamic characteristics GRA

N83-25674# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
APPLICATION OF A FINITE DIFFERENCE METHOD TO THE TRANSONIC AIRFOIL PROBLEM M.S. Thesis
M P BURKE Dec 1982 52 p refs
(AD-A124720, AFIT/GAE/AA/79D-4) Avail NTIS HC A04/MF A01 CSCL 20D

This study presents the development and evaluation of a numerical solution technique used to analyze the two dimensional transonic airfoil problem The full potential equation of motion and the irrotationality condition are used for the governing equations A coordinate transformation is applied to the governing equations to limit the domain of the problem and for easier application of the boundary conditions The method of lines is then used to reduce the equations from partial to ordinary differential equations Solutions obtained using this numerical solution technique are compared to published data for both incompressible and compressible flowfield cases It is concluded that the solution technique developed in this study is accurate and efficient when analyzing subcritical flowfields around circular airfoil shapes Author (GRA)

N83-25675# Naval Ship Research and Development Center, Bethesda, Md Aviation and Surface Effects Dept
WIND TUNNEL INVESTIGATION OF CARGO EXTRACTION PARACHUTES IN THE WAKE OF A LOCKHEED C-141B STARLIFTER AIRCRAFT Final Report, Jul. - Sep. 1981
G G HUSON Aug 1982 86 p refs
(Contract MIPR-79-102, MIPR-79-404)
(AD-A124523, DTNSRDC/ASED-82/09) Avail NTIS HC A05/MF A01 CSCL 01C

Wind tunnel investigations were conducted to probe the wake of a C-141 aircraft in an airdrop configuration A rake with twelve 5-hole yaw head probes measured velocities at various positions in the wake, and these measurements were used to compute the vorticity of the wake In addition, motion pictures and force measurements were taken with three differently sized extraction parachute models attached to the model aircraft by three extraction lines of different lengths Correlation of parachute behavior with the airflow data indicates that the vortex shed by the inboard flaps and the fuselage-wing junction causes an instability in the performance of the smallest parachute models while the performance of the larger parachute models is relatively unaffected Author (GRA)

N83-25676# 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 2: TABULATED DATA Final Report, 15 Apr. - 14 Dec. 1982
R A COX Dec 1982 850 p 2 Vol
(Contract N00014-82-C-0340, RF41411801)
(AD-A124068, FZA-540-VOL-2) Avail NTIS HC A99/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 angles of -10, 0, and +10 deg This report presents the complete set of longitudinal

aerodynamic data and static pressure data Volume I presents an analysis and summary of these data Author (GRA)

N83-25677# Royal Aircraft Establishment, Farnborough (England)
FINITE DIFFERECNCE CALCULTION OF AN INVISCID TRANSONIC FLOW OVER OSCILLATING AIRFOILS
T ISHIGURO Oct 1980 45 p refs Transl into ENGLISH from Japan Natl Aerospace Lab (Japan), no TR-632, Oct 1980
(AD-A123982, RAE-LIBRARY-TRANS-2087, DRIC-BR-86199) Avail NTIS HC A03/MF A01 CSCL 20D

A procedure is presented to calclate the compressible inviscid pitch In order to treat precisely boundary conditions on the oscillating airfoil surface and at infinity, the exterior of the airfoil shaped contour in the physical plane is mapped onto a rectangle in a computational plane The two dimensonal unsteady Euler equations are solved there by the Lax-Wendroff finite difference scheme with artificial viscosity Test calculations were made for the unsteady flows over the Joukowski airfoil and the NACA 0012 airfoil oscillating in pitch, in order to obtain several individual flow patterns The resulting unsteady pressure distributions, shock wave locations, etc, are presented Furthermore, the unsteady numerical results obtained by this procedure for the NLP 7301 airfoil and the NACA 64A010 airfoil are compared with the experimental ones GRA

N83-25679# McDonnell-Douglas Research Labs, St Louis, Mo Flight Sciences Dept
HIGHER-ORDER COMPUTATIONAL METHODS FOR TRANSONIC WING/BODY FLOWFIELDS Final Report, 16 Mar. 1981 - 30 Sep. 1982
L T CHEN 30 Sep 1982 54 p refs
(Contract N00167-81-C-0057)
(AD-A124079, DTNSRDC/ASED-CR-03-82, MDC-Q0773) Avail NTIS HC A04/MF A01 CSCL 01C

This report presents the development of high-order finite-difference schemes for application to transonic wing-body flow calculations These schemes treat supersonic flows and shocks more accurately than most existing schemes A transformed full potential equation in a general curvilinear coordinate system is derived, and higher-order operators are introduced A new shock-point operator produces Mach number jumps at a shock that agree reasonably well with Rankine-Hugoniot values Second-, and third-order, quasi-conservative, and fully conservative schemes are thereby developed for general geometries where flow directions can be approximately aligned with coordinate lines in supersonic regions The fully conservative schemes are developed by modifying an existing finite-volume algorithm, while the quasi-conservative schemes are developed by solving the transformed full potential equation directly with the addition of the second- and third-order artificial viscosities at supersonic points, and the corresponding first- and second-order shock-point operators at shock points Author (GRA)

N83-25682# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SPECIALISTS' MEETING ON PREDICTION OF AERODYNAMIC LOADS ON ROTORCRAFT
H R VELKOFF (Ohio State Univ, Columbus) Feb 1983 14 p refs Meeting held in London, 17-18 May 1982
(AGARD-AR-189, ISBN-92-835-1445-9) Avail NTIS HC A02/MF A01

While a broad overview of work being done on (1) rotor blade aerodynamic characteristics, (2) wakes and aerodynamic effects of rotorcraft and wind turbines, and (3) rotor airloads predictions programs was presented, a serious concern remains that the intent of the conferenceas was not fully met Few papers evidenced experimental correlations of the aerodynamic forcing functions that were at a level similar to the extensive models and codes discussed Most of the data used for evaluations were structural response data or were dependent on that response Codes and analysis were not adequately verified Adequate data bases for verification are not generally available and usually lack important such as flow velocities, pressures, or other measurements taken simultaneously Experimental efforts were often run independently of the analytical programs and often do not meet the needs of the programs A R H

N83-26815*# 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 May 1983 12 p refs Proposed for presentation at the AIAA Appl Aerodyn Conf, Danvers, Mass, 13-15 Jul 1983
(NASA-TM-85641, NAS 1 15 85641) Avail NTIS HC A02/MF A01 CSCL 01A

A time marching finite difference code, XTRAN3S that solves the three dimensional transonic small perturbation equation for flow over isolated wings was 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 M sub infinity = 0 700 show good agreement between calculated and experimental values A comparison of steady data at M sub infinity 0 825 shows poor agreement between calculations and experiment Program difficulties were encountered with swept and tapered configurations S L

N83-26816*# Pratt and Whitney Aircraft Group, East Hartford, Conn Commercial Engineering
MODEL AERODYNAMIC TEST RESULTS FOR A REFINED ACTUATED INLET EJECTOR NOZZLE AT SIMULATED TAKEOFF AND CRUISE CONDITIONS Final Report
D P NELSON Jun 1983 80 p refs
(Contract NAS3-22738)
(NASA-CR-168051, NAS 1 26 168051, PWA-5768-29) Avail NTIS HC A05/MF A01 CSCL 01A

Wind tunnel model tests were conducted to demonstrate the aerodynamic performance improvements of a refined actuated inlet ejector nozzle Models of approximately one-tenth scale were configured to simulate nozzle operation at takeoff, subsonic cruise, transonic cruise and supersonic cruise Variations of model components provided a performance evaluation of ejector inlet and exit area, forebody boattail angle and ejector inlet operation in the open and closed mode Approximately 700 data points were acquired at Mach numbers of 0, 0 36, 0 9, 1 2, and 2 0 for a wide range of nozzle flow conditions Results show that relative to two ejector nozzles previously tested performance was improved significantly at takeoff and subsonic cruise performance, a C sub f of 0 982, was atttained equal to the high performance of the previous tests The established advanced supersonic transport propulsion study performance goals were met or closely approached at takeoff and supersonic cruise Author

N83-26818*# McDonnell-Douglas Corp, St Louis, Mo
AIRCRAFT AERODYNAMIC PREDICTION METHOD FOR V/STOL TRANSITION INCLUDING FLOW SEPARATION
B R GILMER, G A MINER, and D R BRISTOW Moffett Field, Calif NASA Ames Research Center Apr 1983 93 p refs
(Contract NAS2-11161)
(NASA-CR-166467, NAS 1 26 166467) Avail NTIS HC A05/MF A01 CSCL 01A

A numerical procedure was developed for the aerodynamic force and moment analysis of V/STOL aircraft operating in the transition regime between hover and conventional forward flight The trajectories, cross sectional area variations, and mass entrainment rates of the jets are calculated by the Adler-Baron Jet-in-Crossflow Program The inviscid effects of the interaction between the jets and airframe on the aerodynamic properties are determined by use of the MCAIR 3-D Subsonic properties are determined by use of the MCAIR 3-D Subsonic Potential Flow Program, a surface panel method In addition, the MCAIR 3-D Geometry influence Coefficient Program is used to calculate a

matrix of partial derivatives that represent the rate of change of the inviscid aerodynamic properties with respect to arbitrary changes in the effective wing shape Author

N83-26819*# Pennsylvania State Univ , University Park
END WALL FLOW CHARACTERISTICS AND OVERALL PERFORMANCE OF AN AXIAL FLOW COMPRESSOR STAGE Final Report
N SITARAM and B LAKSHMINARAYANA Washington NASA Feb 1983 141 p refs
(Contract NSG-3032)
(NASA-CR-3671, NAS 1 26 3671, PSU/TURBO-82-5) Avail NTIS HC A07/MF A01 CSCL 01A

This review indicates the possible future directions for research on endwall flows in axial flow compressors Theoretical investigations on the rotor blade endwall flows in axial flow compressors reported here include the secondary flow calculation and the development of the momentum integral equations for the prediction of the annulus wall boundary layer The equations for secondary vorticity at the rotor exit are solved analytically The solution includes the effects of rotation and the viscosity The momentum integral equations derived include the effect of the blade boundary layers The axial flow compressor facility of the Department of Aerospace Engineering at The Pennsylvania State University, which is used for the experimental investigations of the endwall flows, is described in some detail The overall performance and other preliminary experimental results are presented Extensive radial flow surveys are carried out at the design and various off design conditions These are presented and interpreted in this report The following experimental investigations of the blade endwall flows are carried out (1) Rotor blade endwall flows The following measurements are carried out at four flow coefficients (a) The rotor blade static pressures at various axial and radial stations (with special emphasis near the blade tips) (b) The hub wall static pressures inside the rotor blade passage at various axial and tangential stations (2) IGV endwall flows The following measurements are carried out at the design flow coefficient (a) The boundary layer profiles at various axial and tangential stations inside the blade passage and at the blade exit (b) Casing static pressures and limiting streamline angles inside the blade passage B W

N83-26820*# United Technologies Corp , Stratford, Conn
EXPERIMENTAL STUDY OF MAIN ROTOR/TAIL ROTOR/AIRFRAME INTERACTIONS IN HOVER. VOLUME 1: TEXT AND FIGURES
D T BALCH, A SACCULLO, and T W SHEEHY Jun 1983 491 p refs
(Contract NAS2-10770)
(NASA-CR-166485, NAS 1 26 166485, SER-510112-VOL-1) Avail NTIS HC A21/MF A01 CSCL 01A

To assist in identifying and quantifying the relevant parameters associated with the complex topic of main rotor/fuselage/tail rotor interference, a model scale hover test was conducted in the Model Rotor Hover Facility The test was conducted using the basic model test rig, fuselage skins to represent a UH-60A BLACK HAWK helicopter, 4 sets of rotor blades of varying geometry (i e , twist, airfoils and solidity) and a model tail rotor that could be relocated to give changes in rotor clearance (axially, laterally, and vertically), can't angle and operating model (pusher or tractor) The description of the models and the tests, data analysis and summary (including plots) are included The customary system of units gas used for principal measurements and calculations Expressions in both SI units and customary units are used with the SI units stated first and the customary units afterwords, in parenthesis S L

N83-26821*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EFFECTS OF VARYING PODDED NACELLE-NOZZLE INSTALLATIONS ON TRANSONIC AEROPROPULSIVE CHARACTERISTICS OF A SUPERSONIC FIGHTER AIRCRAFT
F J CAPONE and D E REUBUSH May 1983 337 p refs
(NASA-TP-2120, L-15525, NAS 1 60 2120) Avail NTIS HC A15/MF A01 CSCL 01A

The aeropropulsive characteristics of an advanced twin engine fighter designed for supersonic cruise was investigated in the 16 foot Transonic Tunnel The performance characteristics of advanced nonaxisymmetric nozzles installed in various nacelle locations, the effects of thrust induced forces on overall aircraft aerodynamics, the trim characteristics, and the thrust reverser performance were evaluated The major model variables included nozzle power setting, nozzle duct aspect ratio, forward, mid, and aft nacelle axial locations, inboard and outboard underwing nacelle locations, and underwing and overwing nacelle locations Thrust vectoring exhaust nozzle configurations included a wedge nozzle, a two dimensional convergent divergent nozzle, and a single expansion ramp nozzle, each with deflection angles up to 30 deg In addition to the nonaxisymmetric nozzles, an axisymmetric nozzle installation was also tested The use of a canard for trim was also assessed S L

N83-26822*# Lockheed-Georgia Co , Marietta
EXPERIMENTAL STUDIES OF THE SEPARATING CONFLUENT BOUNDARY-LAYER. VOLUME 1: SUMMARY Final Report
J A BRADEN, R R WHIPKEY, G S JONES, and D E LILLEY NASA Washington Jun 1983 165 p refs
(Contract NAS1-16028)
(NASA-CR-3655, NAS 1 26 3655, LG-82-ER-0184) Avail NTIS HC A08/MF A01 CSCL 01A

Test descriptions and results are documented from an experimental, low speed study of the separating confluent boundary layer on a NASA GAW-1 (General Aviation) high lift airfoil The airfoil was tested in a variety of high lift configurations comprised of leading edge slat and trailing edge flap combinations The primary test instrumentation was a two dimensional, laser velocimeter (LV) system operating in a backscatter mode Surface pressures and corresponding LV-derived, boundary layer profiles are given in terms of velocity components, turbulence intensities and Reynolds shear stresses as characterizing confluent boundary layer behavior up to and beyond stall Comparisons are given between LV-derived profiles and associated boundary layer parameters and those obtained from more conventional instrumentation such as pitot static traverses, Preston tube measurements and hot wire surveys A descriptive summary of the experimental set up along with limited test results are presented Pertinent comparisons of the results are made where possible with those from other sources Author

N83-26824# Aeronautical Research Labs , Melbourne (Australia)
PROGRAMS FOR THE TRANSONIC WIND TUNNEL DATA PROCESSING INSTALLATION. PART 10: SIX COMPONENT MEASUREMENTS UPDATED
J B WILLIS 1982 33 p refs
(AD-A122248, ARL-AERO-TECH-MEMO-341-PT-10, AR-002-900-PT-10) Avail NTIS HC A03/MF A01 CSCL 09B

The current version of the program used for 6 component measurements using strain gauge balances and the PDP8/I installation in the Transonic Wind Tunnel is described Changes to the original program include on-line display, model weight correction, and operation with the Pollock strain gauge equipment A R H

N83-26825# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
COMPUTATION OF INCOMPRESSIBLE POTENTIAL FLOW OVER AN AIRFOIL USING A HIGH ORDER AERODYNAMIC PANEL METHOD BASED ON CIRCULAR ARC PANELS Ph.D. Thesis
J DEJONG Aug 1982 269 p refs
(AD-A124896, AFIT/DS/AA/82-1) Avail NTIS HC A12/MF A01 CSCL 12A

A new two dimensional panel method has been developed This method uses a new approximating element, the circular arc, and a new singularity representation, the sine series, and all integrations are performed analytically for maximum computational efficiency The method was applied to a circular cylinder and to several different types of airfoils, and a number of characteristics which define the method were varied to determine their effects on the solution Major conclusions from this study were that the method produced very accurate solutions over the major part of the airfoil, error reduction occurred as both the number of panels and the number of terms in the series were increased, the effect of point source location was large but was local and could be controlled, the method was generally insensitive to minor variations in panelling, and the accuracy of the solution increased as panel curvature was increased from relatively flat to circular GRA

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents

A83-33545#
ADVANCED NAVIGATION SYSTEMS AND FUEL CONSERVATION
C H SIMPSON (Air Canada, Montreal, Canada) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol 29, March 1983, p 14-16

Attention is confined to the savings that can be realized from improvements in operating procedures and navigation procedures, including advanced navigation systems The Flight Management System is linked to the avionic flight control system on the L-1011-500 Tristar The computer receives information from the engines, the central air data system, and the navigation receivers It processes the information in accordance with a predetermined program and sends control signals to the autopilot and auto-throttle system The way in which the Inertial Navigation System (Omega) works to ensure direct routings is discussed The importance of air traffic controllers understanding that speed control is far more important than vectors in conserving fuel is stressed C R

A83-33625#
IMPACT DAMPING AND AIRPLANE TOWING
C MATUK Lulea, Hogskola, Doctoral Thesis, 1982, 179 p Research supported by the Forsvaret Materielverk refs

Three problems are treated The first concerns the impact of a linearly elastic hammer on a linearly viscoelastic plate The Laplace transform method is used, and the results are seen as having application to the design of impact protection devices The second problem has to do with the towing of targets by wires during aircraft accelerations in a straight path Again the Laplace transform method is used, and the results can serve as conservative estimates to avoid failure of the wire The third problem concerns the towing of targets by wires during semicircular aircraft turns The results here are obtained by means of the finite difference method and are checked through full-scale tests These results can be used in predicting the target path and avoiding wire failure during semicircular turn maneuvers C R

A83-33767
FLIGHT OPERATIONS: A STUDY OF FLIGHT DECK MANAGEMENT
C A OWENS New York, Van Nostrand Reinhold Co, 1982, 200 p

After presenting a development history of cockpit design, including pilot tasks, control devices, instrumentation, and avionics, for aircraft employing flight crews of two or more, attention is given to topics associated with the flight operations of modern commercial aircraft These include pilot activities and responsibilities (especially with respect to air traffic control, weather conditions, and fuel and cargo loads), the distribution of flight tasks among pilot, copilot, navigator and flight engineer, and crew selection and training criteria Consideration is also given to the variety of documents relating to aircraft operation and navigation, typical management practices in the takeoff, climb, cruise, descent and landing portions of a flight, and the unique requirements of critical phases of flight with respect to unfavorable weather conditions and emergencies due to malfunction O C

A83-36042*# Dayton Univ, Ohio
NUMERICAL SIMULATION OF AIRFOIL ICE ACCRETION
C D MACARTHUR (Dayton, University, Dayton, OH) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 21st, Reno, NV, Jan 10-13, 1983 40 p refs
(Contract NAG3-65)
(AIAA PAPER 83-0112)

A mathematical model of glaze and rime ice accretion on a two-dimensional airfoil is presented The model employs standard methods for calculating the flow field and cloud droplet trajectories This data is used as input to a thermodynamic analysis of the ice accretion process which includes liquid runback The structure of the model allows for dynamic updating of the droplet collection efficiency and heat and mass transfer processes as the accreted ice shape changes This results in the improved shape prediction over previously described methods Simulations made with the model are compared to experimental results obtained for a NACA 0012 airfoil in the NASA/Lewis Icing Research Tunnel The agreement with experiment is found to be generally satisfactory for some cases, but a need for improvements is indicated by others Suggestions for improvements are made Author

A83-36043*# Toledo Univ, Ohio
NUMERICAL SIMULATION OF ELECTROTHERMAL DE-ICING SYSTEMS
K J DE WITT, T G KEITH, D F CHAO, and K C MASIULANIEC (Toledo, University, Toledo, OH) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 21st, Reno, NV, Jan 10-13, 1983 7 p NASA-supported research refs
(AIAA PAPER 83-0114)

Transient simulations of de-icing of composite aircraft components by electrothermal heating have been computed for both one and two-dimensional rectangular geometries The implicit Crank-Nicolson formulation is used to insure stability of the finite-differenced heat conduction equations and the phase change in the ice layer is simulated using the Enthalpy method Numerical solutions illustrating de-icer performance for various composite aircraft blades and environmental conditions are presented Comparisons are made with previous studies and with available experimental data Initial results using a coordinate mapping technique to describe the actual blade geometry are discussed Author

A83-36911#
NET-SKIRT ADDITION TO A PARACHUTE CANOPY TO PREVENT INVERSION
G W H STEVENS Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 578, 579

Previously cited in issue 01, p 6, Accession no A83-10412

A83-36951#
CONCEPTS FOR A FUTURE JOINT AIRLIFT DEVELOPMENT PROGRAM
W G MOORE, JR and J F SHEA AIAA, ASCE, TRB, ATRIF, and CASI, International Air Transportation Conference, Montreal, Canada, June 1-3, 1983 4 p
(AIAA PAPER 83-1591)

It is pointed out that since World War II the U S has had the most effective airlift capability in the world in both peace and war There are, however, signs of deterioration with respect to this capability The U S military has had great difficulty in gaining congressional acceptance of a timely program to modernize and improve the U S airlift force The U S civil airlines are faced with an apparent inablity to assure continued preeminence of the U S civil airlift structure Almost 25 years have passed since the current U S airlift policy was approved by the President of the U S , and it is felt that a new statement of Presidential policy is needed It is believed to be necessary for the President, with congressional approval, to initiate a joint civil-military program for the development of an efficient and effective airlift system able to serve both the nation's civil needs and the military emergency requirements
G R

A83-36952#
WORLDWIDE AVIATION OUTLOOK
B J ELLE (International Civil Aviation Organization, Montreal, Canada) AIAA, ASCE, TRB, ATRIF, and CASI, International Air Transportation Conference, Montreal, Canada, June 1-3, 1983 12 p
(AIAA PAPER 83-1597)

The paper presents forecasts of scheduled passenger and freight traffic for the period 1982-1992 The approach and basic assumptions are described and forecast results are presented for six major regions of the world The overall average growth rate for scheduled passenger-kilometres over the 10-year period is forecast at 7 0 percent per annum and the rate for scheduled freight tonne-kilometres is forecast at 7 5 percent per annum The paper also discusses the dependence of traffic developments on changes in the competitive and regulatory environment and, finally, presents some statistical evidence of the importance of airline profitability for future traffic growth
Author

A83-36953#
GUIDANCE CONTROL SYSTEMS FOR AIRCRAFT ON AIRPORT SURFACES
D M ARNTZEN (Chicago Bureau of Engineering, Chicago, IL) and M E WILFERT (Douglas Aircraft Co , Long Beach, CA) AIAA, ASCE, TRB, ATRIF, and CASI, International Air Transportation Conference, Montreal, Canada, June 1-3, 1983 9 p refs
(AIAA PAPER 83-1579)

Since the conduction of the first flights, aviation has been concerned with overcoming the effects of poor visibility Suitable approaches for doing this during flights have been developed on the basis of a utilization of electronic systems, such as the Automated Radar Terminal System (ARTS-3) However, corresponding solutions have not been implemented to assist the pilot on the ground in maneuvering from the runway to the terminal In the U S visual aids such as edge lights and center line lights are all that are provided for the pilot Such a system cannot warn the pilot of other aircraft in the area A ground movement control system used at Heathrow is considered, along with a Surface Traffic Control System (STRACS) studied by the Port Authority of NY and NJ Attention is given to surface movement guidance needs and recommendations for a surface guidance system The FAA is currently deploying Airport Surface Detection Equipment (ASDE-3) to replace visual observations with an electronic picture
G R

A83-36954#
USAF MOBILITY REQUIREMENTS
D D BROWN (USAF, Military Airlift Command, Scott AFB, IL) AIAA, ASCE, TRB, ATRIF, and CASI, International Air Transportation Conference, Montreal, Canada, June 1-3, 1983 6 p refs
(AIAA PAPER 83-1588)

This paper discusses how, as a result of United States armed forces modernization and growth, the mobility requirements have increased much faster than our capability to deliver them to the battlefield Various alternatives have been developed in organic military capability to include roles of the Air Force Reserve and Air National Guard, as well as the significant impact of the Civil Reserve Air Fleet (CRAF) to meet our national mobility requirements In addition, the military and civil air transportation industry must work more closely together to increase future air transportation capability with a minimum of cost to all interested parties
Author

N83-25683# Comptroller General of the United States, Washington, D C
A STRATEGY IS NEEDED TO DEAL WITH PEAKING PROBLEMS AT INTERNATIONAL AIRPORTS
24 Mar 1983 66 p
(GAO/GGD-83-4, B-208444) Avail NTIS HC A04/MF A01

The role that controlling the timing of flight arrivals could play in coping with the problem of peaking--multiple arrivals of international flights within a limited time period--which causes traveler delays in clearing the Federal inspection precess is examined It was concluded that because of competition, international relations, and other implications of controlling the timing of flight arrivals this course of action should only be considered when all else fails in coping with peaking problems There is a need to establish criteria for identifying current and anticipated peaking problems affecting international travelers and a concomitant need to gauge the current and potentially enhanced capacity of the Federal inspection operations to overcome these problems Only then will there be a logical basis for determining the need to control flight arrivals as part of an overall strategy to speed the entry of international travelers
S L

N83-25684# Army Research and Technology Labs , Fort Eustis, Va Applied Technology Labs
VERIFICATION TESTING OF AN AH-1S WIRE STRIKE PROTECTION SYSTEM (WSPS)
L T BURROWS Dec 1982 38 p
(AD-A123188, USAAVRADCOM-TR-82-D-36) Avail NTIS HC A03/MF A01 CSCL 13I

The Applied Technology Laboratory conducted developmental and performance verification tests to determine the suitability for AH-1S application of a Wire Strike Protection System (WSPS) designed and fabricated by Bristol Aerospace Limited and Bell Helicopter Textron, Inc The WSPS tested consisted of an upper cutter, a telescopic sight unit deflector, a chin cutter above the 20mm gun, a lower cutter, and a forward windshield deflector Using the NASA-Langley Research Center's Impact Dynamics Research Facility, an AH-1S helicopter fitted with the WSPS was subjected to pendulum swing tests into the objective wire, which is a steel, seven-strand, 3/8-inch-diameter cable having an 11,500-pound tensile strength The WSPS successfully demonstrated its capability to sever the objective wire in all tests, during which impact velocity, impact angle, aircraft pitch attitude, and aircraft impact area were varied During the WSPS installation it was determined that some WSPS components were not necessary, and these were not necessary, and these were excluded from the system tested During the test program it was concluded that a small cutter should be added to the system to prevent a wire from hanging up on the air data sensor boom, however, timing did not permit the fabrication and test of such a component
GRA

N83-25685# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
ACES II NEGATIVE GZ RESTRAINT INVESTIGATION M.S. Thesis
D G LEUPP Dec 1982 103 p refs
(AD-A124713, AFIT/GE/EE/82D-45) Avail NTIS HC A06/MF A01 CSCL 01C

Seven human subjects, and 5th and 95th percentile male manikins were subjected to -Gz conditions on a man-rated centrifuge to test the restraint effectiveness of the ACES II restraint system used on the A-10, F-15, and F-16 The restraint was tested with shoulder straps locked, unlocked, and unlocked with the addition of a tiedown strap connected between the lap belt and the floor A -1 Gz condition was created by inverting the centrifuge cab for 30 seconds Human subjects were exposed to levels of -1 5 and -2 Gz for 20 and 10 seconds respectively by rotating the centrifuge arm Manikins were similarly exposed to levels up to -5 Gz Off-seat displacement was measured directly by a unique spring-loaded transducer mounted in the seat pan Lap belt and tiedown strap forces, and tracking and ejection task performance were also measured GRA

N83-25686# INFOCOM, Crawley (England)
FOREIGN TECHNOLOGY ALERT - BIBLIOGRAPHY: TRANSPORTATION SAFETY Final Report, Jan. 1980 - May 1982
G WILKINSON 1982 50 p
(PB83-101659, INFO-FT/82-03) Avail NTIS HC A03/MF A01 CSCL 01B

Abstracts from the NTIS bibliographic data base relating to ground and air transportation safety are presented in this copyrighted bibliography which describes work originating from countries outside the USA Most reports are in their native language, but titles are annotated to advise readers of non-English texts A proportion of foreign language documents have author abstracts and summaries in English Major subject headings include traffic engineering and safety, accident research and investigation, hazards and accident prevention, human factors, pedestrian safety, motor vehicles, motor cycles, pedal cycles, traffic control and aviation safety, and rescue systems Each of the 19 sections is cross-referenced, there is also an author index and useful subject index based on major descriptors GRA

N83-26827# National Transportation Safety Board, Washington, D C Bureau of Accident Investigation
AIRCRAFT ACCIDENT REPORT: IBEX CORPORATION GATES LEARJET 23, N100TA, ATLANTA, NEAR SAVANNAH, GEORGIA, 6 MAY 1982
8 Apr 1983 58 p refs
(PB83-910401, NTSB-AAR-83-01) Avail NTIS HC A04/MF A01 CSCL 01C

On May 6, 1982, at 1155 28 eastern daylight time (edt), while in cruise flight on Airway J79-121 en route to Orlando, Florida, from Teterboro, New Jersey, the flightcrew of N100TA, an IBEX Corporation Gates Learjet 23, was cleared by the Jacksonville Air Route Traffic Control Center to descend from its altitude of Flight Level 410 to Flight Level 390 The flightcrew acknowledged the clearance, and air traffic control observed the radar target descend About 2 minutes later, the airplane crashed into the Atlantic Ocean, from a steep, high speed descent about 12 miles from Savannah, Georgia The air atraffic controller made several unsuccessful attempts to contact the airplane The pilots had reported no difficulties in any of their radio transmissions The pilot, copilot, and the two passengers on board were killed The National Transportation Safety Board determines that the probable cause of the accident was an uncontrolled descent from cruise altitude for undetermined reasons, from which a recovery was not or could not be effected Author

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

A83-35087#
NEW ADVANCES IN WIDE BAND DUAL POLARIZATION ANTENNA ELEMENTS FOR EW APPLICATIONS
G MONSER (Raytheon Co, Electromagnetic Systems Div, Goleta, CA) IN Antenna Applications Symposium, Monticello, IL, September 23-25, 1981, Proceedings Urbana, IL, University of Illinois, 1982, 10 p

The present investigation is concerned with the results of a project which was conducted to achieve multioctave integrated, dual-polarized, array elements for EW array applications A need existed for wideband, dual-polarized arrays with a number of properties These properties are related to a bandwidth which is greater than 2 octaves, certain amplitude and phase tracking specifications, array coverage, an element efficiency of 75 percent (minimum), and an element power handling capacity of 100 watts The array developed to satisfy the requirements is shown in a photograph Eight elements were used for developing polarization parallel to the array, and nine elements were employed for developing polarization orthogonal to the array G R

A83-35088#
A RAPID-TUNING HIGH-POWER POD-MOUNTED VHF ANTENNA SYSTEM
B HODGSON (American Electronic Laboratories, Inc, Montgomeryville, PA) IN Antenna Applications Symposium, Monticello, IL, September 23-25, 1981, Proceedings Urbana, IL, University of Illinois, 1982, 16 p

This paper describes a high-power jamming antenna system The incorporation of a microprocessor in the RF coupler gives the system a very rapid frequency-hopping capability, enabling it to be time-shared between a number of threats The antenna is electrically very small (approaching one-twentieth of a wavelength at the lowest operating frequency), but gives good omni-directional patterns up to 70 MHz The system has an instantaneous bandwidth of approximately 1 percent, and a maximum efficiency of 40 percent Author

A83-35089#
MULTIMODE PLANAR SPIRAL FOR DF APPLICATIONS
D D CONNELL and B J LAMBERTY (Boeing Aerospace Co, Seattle, WA) IN Antenna Applications Symposium, Monticello, IL, September 23-25, 1981, Proceedings Urbana, IL, University of Illinois, 1982, 15 p Research supported by the Boeing Aerospace Co refs

It is pointed out that the several modes available in multiarm log-spiral antennas can be useful in wide-angle direction-finding applications The research undertaken in connection with the present investigation was conducted because the available data base on multiarm spirals is sparse The computations presented were performed by using the Wirant computer code Wirant is a moment-method code which uses constant-current basis functions with point marching Input impedance and radiation patterns have been computed and compared to measured data for a 6-arm planar spiral antenna The discussed study showed that the Wirant moments code can be used to accurately predict patterns and impedance of all possible modes in multiarm spirals G R

A83-35090#
A NETWORK FORMULATION FOR PHASED ARRAYS - APPLICATION TO LOG-PERIODIC ARRAYS OF MONOPOLES ON CURVED SURFACES
R J COE and D E YOUNG (Boeing Aerospace Co., Seattle, WA) IN Antenna Applications Symposium, Monticello, IL, September 23-25, 1981, Proceedings Urbana, IL, University of Illinois, 1982, 27 p refs

In the present investigation, a combination of electromagnetic modelling techniques and network theory are used to calculate the performance of a log-periodic monopole array containing driven elements as well as parasitic elements The performance of several log-periodic monopole arrays on a conducting conical surface are also obtained by representing the conical surface as a wire mesh An impedance matrix formulation of combined antenna and feed network is illustrated Both antenna and feed are represented by multiport Thevenin equivalent networks The application of network techniques to antenna-feed system modelling is illustrated Attention is given to array geometry, the impedance matrix of an log-periodic monopole array (LPMA), the impedance matrix of feed LPMA with parasitic elements, the radiation pattern, the performance function, and the input impedance G R

A83-35192
COMPARATIVE ANALYSIS OF A PHASE AND AN AMPLITUDE PROCESSOR FOR AMPLITUDE MONOPULSE SYSTEMS
A I SINSKY and E A LEW (Bendix Corp., Communications Div., Baltimore, MD) IEEE Transactions on Antennas and Propagation (ISSN 0018-926X), vol AP-31, May 1983, p 519-522 Sponsorship U S Department of Transportation
(Contract DOT-FA01-81-C-10041)

The theoretical performance of an amplitude monopulse processor is compared with that of a phase monopulse processor in the presence of thermal noise Both processors use the sum and difference beam antenna model Both processors exhibit a bias error at signal-to-noise ratios below 20 dB The phase processor demonstrates a smaller standard deviation in the angle estimate for target angles in the vicinity of the monopulse boresight Author

A83-35273
A THEORETICAL FRAMEWORK FOR ANALYSIS OF LATERAL POSITION ERRORS IN VOR JET-ROUTE SYSTEMS
D A HSU (Wisconsin, University, Milwaukee, WI) Journal of Navigation (ISSN 0020-3009), vol 36, May 1983, p 262-268

The applicability of a second-order differential equation in the physics of mechanical vibration is investigated as a model for aircraft lateral position errors obtained from the VOR environment Navigational interpretations of the parameters in the model analogous to a vibrating mechanical system are constructed Solutions to the second-order differential equation are described, and the properties and phenomena implied by the model are discussed In extending the theoretical reasoning, phenomena embedded in the aggregated data are discovered Ways are also found to explain the most salient features of VOR position errors based on the suggested model The steps required for the future empirical confirmation, clarification, and calibration of parameter values are outlined C R

A83-35274
ON THE USE OF HEIGHT RULES IN OFF-ROUTE AIRSPACE
R L FORD (Royal Signals and Radar Establishment, Malvern, Worcs, England) Journal of Navigation (ISSN 0020-3009), vol 36, May 1983, p 269-287 Research supported by the Civil Aviation Authority

The standard height rules applied in off-route airspace are considered in order to assess the degree of intrinsic safety they provide, that is, the reduction of conflicts without action being taken by pilots or ATC The standard employed is the conflict rate that would obtain if the aircraft were uniformly randomly distributed in the height dimension and flying straight and level on tracks distributed uniformly and randomly It is shown that, unless significant height-keeping errors are present, the application of the standard rules can lead to a reduction in the intrinsic safety An alternative height rule ostensibly having more desirable characteristics is examined on the same basis C R

A83-35275
COMPUTER MODEL OF A COLLISION-AVOIDANCE SYSTEM FOR AIR TRAFFIC CONTROL
S MORLEIGH Journal of Navigation (ISSN 0020-3009), vol 36, May 1983, p 288-301

The investigation presented here assumes that the airborne system is provided with accurate information concerning the relative position and velocity of any other aircraft within a range of 25 n mi Attention is restricted to aircraft flying in controlled airspace, within which it is mandatory for a flight plan to be approved by ATC before an aircraft is allowed to take off The computer model is found to operate satifactorily over a wide range of potential conflict situations The results obtained for 'converging' conflict situations are improved if the aircraft involved both participate in the maneuver C R

A83-35599
OMEGA APPLICATION IN THE INDONESIAN REGION [UTILISATION DE L'OMEGA DAANS LA REGION INDONESIENNE]
P GUILLARD, A RENARD, and H ALZIAL (Crouzet, Valence, Drome, France) Navigation (Paris) (ISSN 0028-1530), vol 31, April 1983, p 172-182 In French

The equipment, capabilities, and performance of the Omega navigation system for the A 300 aircraft newly delivered to the Indonesian region are detailed Complete digital control was installed to be compatible with the A 300 avionics and to enhance the otherwise bad propagation characteristics of the area The on-board system consists of the receiver/processor, the command and display post, and an antenna The processor contains five programmable maps and one block processor, and can handle ground links furnishing heading, airspeed, wind velocity, and links with the autopilot The memory stores 29 waypoints in the Indonesian region, safekeeping them between two flights A control unit allows the pilot to retrieve and program information and commands into the processor Details of the data processing program are reviewed, noting the shift to real time analysis of all available Omega data to improve accuracy With activation of an Australian station in 1982, good signals were received from Reunion and Japan, a medium level from Liberia, and a weak signal from Norway, with a listening position near Djakarta being considered M S K

A83-36122
PERFORMANCE CAPABILITIES OF PHOTOGRAPHIC FLIGHT NAVIGATION AND SENSOR ORIENTATION SYSTEMS [DAS LEISTUNGSVERMOEGEN VON BILDFLUGNAVIGATIONS- UND SENSORORIENTIERUNGSSYSTEMEN]
F L J H CORTEN (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) Bildmessung und Luftbildwesen (ISSN 0006-2421), vol 51, May 1983, p 82-102 In German Translation refs

Advanced methods and instruments for navigation and inflight determination of the elements of exterior orientation of a sensor are reviewed Basic principles and characteristics are addressed, including the physics of coupled navigation systems, of systems for determining positions, and of moving objects The performance parameters of various systems are compared, including VLF Omega, microwave reflection systems, and Doppler radar Methods of determining height above ground and sea level and of measuring differences in height are examined, as are methods for orientation under a variety of external conditions Finally, issues of cost effectiveness and applicability are addressed C D

A83-36470#
DESIGN FOR TESTING OF A LOW ALTITUDE NIGHT-IN-WEATHER ATTACK SYSTEM
K M MARCROFT (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 131-133
(AIAA PAPER 83-1061)

The need for system integration in the task of designing the next generation night-in-weather (NIW) attack system for the US Air Force is examined This integration will be needed to preprocess the large amount of diverse information necessary to carry out a low-altitude NIW attack mission in a high-threat environment and to manage the compressed time lines associated with low-altitude attack It is noted that, if an integrated system includes flight critical elements, it must be designed and tested to ensure that it is fail-safe through the third failure (fail op/fail op/fail safe) It is concluded that current design criteria and testing procedures are not sufficient to field successfully an integrated system of this type, and that new designs that include testability from inception and allow for retesting through the aircraft's operational life as system changes are made will be required B J

A83-36625
GE'S APG-67 - FIGHTER RADAR WITH A FUTURE
G WARWICK Flight International (ISSN 0015-3710), vol 123, June 11, 1983, p 1797, 1800-1802

The GE APG-67 fighter aircraft radar system is described The radar is being installed in the F-20 fighter, and uses the X-band and a side-looking phased-array antenna The digital pulse Doppler radar consists of four line-replaceable units that weigh a total of 270 lb and fill 3 28 cu ft of space The four units comprise the flat-plate, slotted-array antenna, the X-band travelling wave tube transmitter, a radar data computer, and the radar target data processor Operating in the 9 7-9 9 GHz interval, the transmitter produces a 3 5 kW peak power and 2 0 kW average power beam and requires only forced-air cooling The coherence of the look-down pulse permits signal processing to discern moving targets on the ground due to Doppler shifts of the returning signal Ground test requirements for the first production radars include 200 hr MBTF in the laboratory M S K

N83-25687# Comptroller General of the United States, Washington, D C
FAA'S PLAN TO IMPROVE THE AIR TRAFFIC CONTROL SYSTEM. A STEP IN THE RIGHT DIRECTION BUT IMPROVEMENTS AND BETTER COORDINATION ARE NEEDED
GAO 16 Feb 1983 63 p
(GAO/AFMD-83-34, B-206887) Avail NTIS HC A04/MF A01

A modernization plan that describes specific improvements in facilities and equipment needed in the air traffic control system was developed It was recommended that an integrated long range plan addressing all aspects of the National Airspace System including use of the Nation's airspace and airports be developed Preliminary findings from ongoing airport and airspace reviews should be coordinated with equipment and facility decisions in the modernization plan The modernization plan should be updated to identify priorities, subsystem costs, and interdependency of projects Other recommendations are aimed at reducing acquisition costs of the enroute replacement computers and strengthening the management and development of automation and communications systems to alleviate problems identified and statisfy the increased management demands of the system S L

N83-25688# Defense Mapping Agency Aerospace Center, St Louis, Mo
PRECISION NAVIGATIONAL FILMSTRIPS FOR USE IN DOD AIRCRAFT
R BOZICH Sep 1982 15 p
(AD-A124761) Avail NTIS HC A02/MF A01 CSCL 17G

The Defense Mapping Agency Aerospace Center (DMAAC) has been producing high resolution precision aircraft navigation filmstrips since 1969 These filmstrips are used in various type projection systems within Department of Defense (DoD) aircraft to provide the pilot/flight crew with a screen display of position and progress relative to the real world in real time Superimposed on the projected chart image is an aircraft position symbol that appears to move across the display screen in the direction and at a speed proportionate to that being flown over the ground DMAAC has produced numerous filmstrips for several operational aircraft today and is currently producing filmstrips for test and evaluation in new aircraft systems which will require support well into the 1980s GRA

N83-25691# Naval Postgraduate School, Monterey, Calif Dept of Systems Technology
SH-3 HELICOPTER/GLOBAL POSITIONING SYSTEM INTEGRATION ANALYSIS M.S. Thesis
R H HART Oct 1982 60 p refs
(AD-A125005) Avail NTIS HC A04/MF A01 CSCL 17G

The Global Positioning System (GPS), the transmitted navigational signal, and the overall acquisition approach are explained Navigational receiver components are functionally described and the hierarchy of platform integration and capability is discussed Specifically explored is the integration of GPS into the Sikorsky SH-3 Helicopter Performance comparisons of the medium versus high dynamic receiver, based solely on preliminary simulation data, indicate that at this time the medium dynamic receiver is the optimum configuration Elimination of he doppler radar in lieu of the five channel receiver would only be possible after through over-water testing of the high dynamic set The actual velocity accuracy of GPS receivers in a hovering helicopter is the main question yet to be answered The overall mission effectiveness of the GPS equipped SH-3 Helicopter should be significantly improved because of an accurate, stand-alone navigation system Author (GRA)

N83-26828# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
INVESTIGATION OF A THIRD ORDER BARO-DAMPED VERTICLE CHANNEL OF INS M.S. Thesis
A RIAZ Dec 1982 157 p refs
(AD-A124882, AFIT/GE/EE/82D-55) Avail NTIS HC A08/MF A01 CSCL 17G

The optimization of the three gains of a third-order baro-inertial vertical channel has been formulated as a stochastic optimal control problem, with the objective of minimizing the mean squared altitude error due to the noise induced altitude error and a disturbance of known magnitude For a vehicle carrying out a TERCOM-update immediately following a vertical descent, and being subjected to a disturbance input to the vertical channel, optimum gains are presented and the performance is analyzed through a simulated flight in a Monte Carlo analysis Performance comparisons between the optimized gains and the classical gains are also presented The results show a significant performance improvement over the classical gains for a vehicle carrying out the TERCOM-update Author (GRA)

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology

A83-33506* California Univ , Los Angeles
COUPLED FLAP-LAG-TORSIONAL DYNAMICS OF HINGELESS ROTOR BLADES IN FORWARD FLIGHT
P P FRIEDMANN and S B R KOTTAPALLI (California, University, Los Angeles, CA) American Helicopter Society, Journal (ISSN 0002-8711), vol 27, Oct 1982, p 28-36 Army-supported research refs
(Contract NSG-1578)

The aeroelastic stability and response problem of the coupled flap-lag-torsional dynamics of an isolated hingeless rotor blade in forward flight is considered Linear, quasi-steady aerodynamics below stall is included The spatial dependence of the partial differential nonliner equations of motion is discretized using a multimodal Galerkin method The nonlinear time dependent equilibrium position (steady state response) about which the equations are linearized is obtained by solving a sequence of linear periodic response problems (quasilinearization) Results illustrating blade behavior in forward flight for both soft-in-plane and stiff-in-plane designs are presented Quasilinearization provides a clear indication of the cases when nonlinear terms due to moderate deflections are important The results indicate that nonlinearities affect system stability much more than system response This implies that for obtaining blade vibrations and loads, approximate analytical models based on linearized formulations could be employed, whereas for determining blade stability a more accurate nonlinear analysis would be required Author

A83-33546#
THE DASH 8 DEVELOPMENT PROGRAM
C J AUSTIN (Havilland Aircraft of Canada, Ltd , Downsview, Ontario, Canada) (Flight Test Symposium, Dorval, Quebec, Canada, Mar 17, 1982) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol 29, March 1983, p 17-24

In describing the interior arrangements, it is pointed out that a standard movable bulkhead will make it possible to alter the ratio of passengers to freight The engine, the PW120 turboprop engine, was chosen with fuel efficiency a prime consideration An account is given of the steps taken to ensure aerodynamic cleanliness for high cruise efficiency Strict controls on weight have held the increase in this area to 30 lb over one year of design development Kevlar/nomex structures are employed through most of the interior furnishings and floors C R

A83-33548#
CANADIAN FORCES TRACKER AIRCRAFT FULL-SCALE FATIGUE TEST AT THE NATIONAL AERONAUTICAL ESTABLISHMENT
D L SIMPSON, G S CAMPBELL, D P WILLIAMS, G F W MCCAFFREY, J F DEWAAL, A C WALKER, and B E SHAVER (National Aeronautical Establishment, Structures and Materials Laboratory, Ottawa, Canada) (Canadian Symposium on Aerospace Structure and Materials, 1st, Toronto, Canada, June 15, 1982) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol 29, March 1983, p 35-57 refs

A number of topics from this test are discussed A description is given of the software system used for load command and system safety The selection of the test load spectrum using fleet counting accelerometer data as a basis is reviewed, with attention given to the data rejection criteria A simple whiffletree and contour board load application system employing only four command channels for six servo-hydraulic actuators is discussed It is noted that this system has proved to be very successful from the viewpoint of both reliability and load distribution Large high wing aircraft present certain problems when tested using the 'pivoted fuselage' configuration adopted for this test Some of these difficulties are described, and recommendations are made for future tests A status report on the test is provided which includes details of the failures to date and plans for the post-test analysis and tear-down inspection C R

A83-33621
PERFORMANCE FLIGHT TESTING
H SMITH, ED (Pennsylvania State University, University Park, PA) Blue Ridge Summit, PA, Tab Books, Inc , 1982, 143 p

In the early stages of flight testing, the aircraft is very gently maneuvered to determine its degree of stability and control Once the aircraft is proved to perform safely, it is carefully tested to see if it meets the performance that was expected of it when it was designed This procedure is, therefore, appropriately termed, 'performance flight testing' This book describes a series of tests by which most of the performance information normally required for aircraft operation can be obtained The tests are designed to be carried out by the average light aircraft pilot or someone with equal aviation background No special equipment is required other than a stopwatch and a basic electronic calculator Attention is given to the effects of the atmosphere, general flight test procedures, airspeed calibration, stall speed, takeoff performance, climb performance, cruise performance, and descent and landing performance G R

A83-33627
TECHNOLOGY STATUS FOR AN ADVANCED SUPERSONIC TRANSPORT
W T ROWE (Douglas Aircraft Co , Long Beach, CA) Society of Automotive Engineers, West Coast International Meeting, San Francisco, CA, Aug 16-19, 1982 9 p refs
(SAE PAPER 820955)

An assessment is undertaken of the development status of a proprietary SST propulsion, structural design, materials, and aerodynamics research program The Mach 2 2-cruise speed SST design considered incorporates a novel wing planform which results in a 45 percent lift-to-drag ratio improvement over the Concorde SST, and employs superplastic forming and diffusion bonding methods in the fabrication of a 78 percent Ti alloy structure Composites are used in all secondary structures A reoptimization of the engine cycle, which includes variable features, improves fuel efficiencies in the subsonic cruise regime It is noted that jet noise suppression techniques are able to keep noise levels down to those of wide-bodied subsonic transports O C

A83-33628* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
APPLICATIONS OF ADVANCED UPPER SURFACE BLOWING PROPULSIVE-LIFT TECHNOLOGY
J A COCHRANE, D W RIDDLE (NASA, Ames Research Center, Quiet Short-Haul Aircraft Office, Moffett Field, CA), and S YOUTH (Boeing Commercial Airplane Co , Preliminary Design Dept , Seattle, WA) Society of Automotive Engineers, West Coast International Meeting, San Francisco, CA, Aug 16-19, 1982 13 p
(SAE PAPER 820956)

The success of the Quiet Short-Haul Research Aircraft led to studies of this technology for a business jet and a Short-Haul Transport The studies showed that the Short-Haul Transport could operate from a 762 0-m runway with 95 passengers at low noise levels Design range was 500 n mi but with maximum fuel load the runway length is only increased to 883 9 m while the range is increased to more than 1000 n mi Two business jet designs were studied, one design was based on a 457 2-m field length and the other was designed for a 760 0-m field length The business jet designed for a 457 2-m field length can also be loaded to maximum fuel capacity In this case the range increases from 500 n mi to 1400 n mi while the runway length increases from 457 2 m to 632 5 m The business jet studies showed that the application of advanced propulsive-lift technology to this class aircraft can result in payload-range-speed performance comparable to current aircraft with about one-half the runway length requirement Author

A83-33629
PROP-FAN POWERED AIRCRAFT - AN OVERVIEW
S G LUDEMANN (United Technologies Corp , Hamilton Standard Div , Windsor Locks, CT) Society of Automotive Engineers, West Coast International Meeting, San Francisco, CA, Aug 16-19, 1982 11 p refs
(SAE PAPER 820957)

The design features and performance characteristics of prop-fan rotors are considered in light of fuel consumption reduction requirements, with attention to the development status of prop-fan technology being investigated at NASA-Lewis, NASA-Ames, and NASA-Dryden Flight Test Center The aircraft types for which prop-fans are being considered are short and medium range passenger aircraft, large cargo aircraft, and military patrol aircraft Emphasis is given to performance studies concerned with propulsion efficiency, far field and aircraft interior noise levels, and block fuel savings O C

A83-33952
MATERIALS IN THE MIRROR OF AVIATION CRITERIA [WERKSTOFFE IM SPIEGEL DER LUFTFAHRTKRITERIEN]
E LOECHELT (Vereinigte Flugtechnische Werke GmbH, Bremen, West Germany), H KELLERER (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany), and L BRENNER (Dornier GmbH, Friedrichshafen, West Germany) IN Highly stressed materials, with aviation considered as an example Oberursel, West Germany, Deutsche Gesellschaft fuer Metallkunde, 1982, p 3-31 In German

A primary consideration in the aviation industry with respect to materials and structural design is related to an employment of materials having minimum weight and providing a high safety level The present investigation is concerned with individual strength criteria and the use of specific materials for applications related to the aircraft structure A number of European aircraft of current interest are considered, taking into account a short-range transport aircraft for 15 passengers, a multipurpose helicopter using glass fiber-reinforced plastic materials for the rotor blades, the military aircraft Tornado with a structural section made largely of titanium, a medium-range military transport aircraft, the Airbus A310, and the Alpha Jet which uses carbon-fiber reinforced plastic Attention is given to the economics of a use of novel light materials, safety criteria, aluminum materials, an evaluation of titanium alloys, examples for an employment of steel, and the prospects offered by fiber-reinforced materials G R

A83-34312
THE RESPONSE OF AIRCRAFT TO PULSE EXCITATION
P K R BHARGOV and H R SRIRANGARAJAN (Aeronautical Development Establishment, Structures and Materials Div , Bangalore, India) Computers and Structures (ISSN 0045-7949), vol 17, no 3, 1983, p 335-338

The response of aircraft and landing gear, idealized as a two-degree of freedom nonlinear system, to pulse excitation is analyzed using the Runge-Kutta algorithm In addition, the application of a microcomputer for analyzing nonlinear vibration problems is evaluated Results show that the response decreases as the value of epsilon increases, where epsilon is a nonlinear-spring parameter It is demonstrated that a microcomputer is useful in analyzing these types of problems, even though it is slow, since it eliminates turn around time N B

A83-35138#
MICROPROCESSOR-BASED OPTIMAL CONTROLLERS FOR A HELICOPTER TURRET CONTROL SYSTEM
N COLEMAN (U S Army, Armament Research and Development Command, Dover, NJ) and N K LOH (Oakland University, Rochester, MI) IN Annual Allerton Conference on Communication, Control, and Computing, 19th, Monticello, IL, September 30-October 2, 1981, Proceedings Urbana, IL, University of Illinois, 1982, p 659-668 refs

The design and implementation of microprocessor-based discrete-time optimal controllers for the XM-97 helicopter gun-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 overshoot, settling time, and shot pattern dispersion Author

A83-35315
CF34 UPGRADES CHALLENGER CAPABILITIES
D M NORTH Aviation Week and Space Technology (ISSN 0005-2175), vol 118, May 16, 1983, p 63-65, 69

The evaluation of flight performance presented here is based on a comparison between the new Challenger CL-601 and the Challenger CL-600 It is noted that the drawback to the 600 had to do with range, not with overall handling characteristics, which are considered excellent Flying at a long-range cruise of Mach 0 74 and its higher 42,250-lb gross weight, the range of the Challenger 601 is approximately 3500 n mi The Challenger 601s all have the fuselage fuel tank installed during production With this tank, the fuel capacity is increased from 14,900 lb to 16,725 lb The most obvious difference between the two models is the installation of 4-ft winglets on the newer aircraft These winglets afford a cruise efficiency increase of 3-4 percent Another important change is the engine nacelles on the 601 The interior dimensions of the two models are identical It is pointed out that the 601's auxiliary power unit was moved forward to counter some of the additional weight of the CF34 engines C R

A83-35623
SAAB-FAIRCHILD 340 - TRANSATLANTIC FRONTRUNNER
Air International (ISSN 0306-5634), vol 24, June 1983, p 267-271, 272, 274, 295

A discussion is presented concerning the aircraft design and construction program management arrangements devised by two aircraft manufacturers, Saab-Scania of Sweden and Fairchild Industries of the U S , in order to produce the Saab-Fairchild 340 regional airliner This aircraft employs two 1630-shp turboprop engines and seats 30-40 passengers Significant use is made of metal-to-metal and aluminum honeycomb bonding, together with sandwich composite materials Use is also made of a fuly digital, fail-passive Flight Guidance and Autopilot system which employs dual microprocessor computations The low wing, which has an aspect ratio of 11, is based on a novel NASA airfoil profile which yields improved lift/drag ratios in takeoff and climb together with reduced cruise drag O C

A83-35624
AIRCRAFT DESIGN PHILOSOPHY. I - LEE BEGIN OF NORTHROP
R BRAYBROOK Air International (ISSN 0306-5634), vol 24, June 1983, p 296-302

Contemporary tactical aircraft designers must be able to consider not only novel design possibilities in their work, but also performance requirements that include, in addition to performance demands, reliability and maintenance manpower figures In addition, attention must be given to pricing policy regarding the recovery of development funds, and to offset programs that restrict the impact of a given system's purchase on the balance of payments of the recipient nation The F-5/F-20 and F-18 development programs are taken as exemplary cases of these rules Consideration is given to trends in such fighter aircraft performance factors as rate of climb, thrust/weight ratio, maximum instanteous turn rate, and maximum payload as a ratio of takeoff weight The most impressive current aircraft in these respects are the F-16, F-18, F-20, and Mirage 2000 O C

A83-35772#
BRING COHESION TO HANDLING-QUALITIES ENGINEERING
R H HOH (Systems Technology, Inc , Hawthorne, CA) Astronautics and Aeronautics (ISSN 0004-6213), vol 21, June 1983, p 64-69 refs

Handling-quality deficiencies afflicting aircraft represent problems which are difficult to deal with This difficulty is largely related to the dependence of handling-quality evaluations on an interpretation of pilot rating data The present investigation provides an interpretation of the process of developing flying-quality criteria

and its problems 'Handling qualities' are defined as 'characteristics of a vehicle which make it satisfactory, adequate, or inadequate in terms of its response to control by a human operator in the presence of varying levels of atmospheric disturbances and outside visual cues' Pilot opinion is quantified from a decision-tree type of rating scale The relations of this scale, called the Cooper-Harper pilot rating, to the considered definition are examined It is found that the assurance of good handling qualities for modern aircraft requires a combination of unified analysis and experimental techniques combined with excellent communication among flight test engineers, pilots, and other persons involved G R

A83-35947
FULL-SCALE MEASUREMENTS OF BLADE-VORTEX INTERACTION NOISE
D A BOXWELL and F H SCHMITZ (U S Army, Aeromechanics Laboratory, Moffett Field, CA) American Helicopter Society, Journal (ISSN 0002-8711), vol 27, Oct 1982, p 11-27 refs

Full-scale far-field acoustic data on four different two-bladed rotors encountering blade-vortex interaction are compared The UH-1H helicopter was tested with its standard NACA 0012 airfoil rotor Data are also presented for the AH-1S helicopter configured with its standard 540 rotor, the Kaman K747 rotor, and the OGEE tip rotor The data were reduced using 'time-windowing' of the impulsive noise event, thus enhancing the signal-to-noise ratio of the in-flight data Strong pressure gradients, isolated in the UH-1H and AH-1S 540 rotor signatures, strongly influenced the subjective annoyance of the rotor The peak amplitudes and power spectrum of the K747 and OGEE rotors were about equal and generated less annoyance than the standard AH-1S or UH-1H rotors

Author

A83-35948* California Univ , Los Angeles
COUPLED FLAP-LAG-TORSIONAL DYNAMICS OF HINGELESS ROTOR BLADES IN FORWARD FLIGHT
P P FRIEDMANN and S B R KOTTAPALLI (California, University, Los Angeles, CA) American Helicopter Society, Journal (ISSN 0002-8711), vol 27, Oct 1982, p 28-36 Army-supported research refs
(Contract NSG-1578)

The results presented in connection with the current investigation are based on a relatively comprehensive analysis of the coupled flap-lag-torsion dynamics of an isolated hingeless rotor blade in forward flight Two elastic modes for each of the flap, lag, and torsion degrees of freedom were used A convenient numerical method is implemented for obtaining the nonlinear periodic blade response It is concluded that the presented numerical methods provide a very effective means for determining both aeroelastic stability and response Quasi-linearization gives a clear indication of the cases when nonlinear terms due to moderate deflections are important It is found that these terms can be both stabilizing and destabilizing Forward flight seems to be stabilizing the blade for a considerable number of cases considered, particularly when the blade is soft-in-plane G R

A83-35949
A TUBULAR BRAIDED COMPOSITE MAIN ROTOR BLADE SPAR
M L WHITE (Kaman Aerospace Corp , Bloomfield, CT) American Helicopter Society, Journal (ISSN 0002-8711), vol 27, Oct 1982, p 45-48 refs

In connection with efforts to enhance helicopter blade operational chracteristics and to reduce manufacturing costs, the preliminary design and process development was undertaken of a composite improved main rotor blade for the OH-58 helicopter This design is unique in that the blade spar is fabricated by mechanical tubular braiding Mechanical braiding is an established textile process for weaving a tubular fabric which has been employed for more than a century in fabricating products such a rope, hose, and cable assembly overlays Recently, it has been adapted to composite fabrication, predominantly in light duty or nonstructural applications such as aircraft ducting Attention is given to the technical approach, the blade configuration, development testing, and costs It is concluded that mechanical braiding is a viable manufacturing technology for helicopter main rotor blade spars This technology will permit significant manufacturing cost reduction G R

A83-35950
EVALUATION OF THE EFFECT OF VOIDS IN COMPOSITE MAIN ROTOR BLADES
D G ORLINO (U S Army, Applied Technology Laboratory, Fort Eustis, VA), R J SHUFORD, and W W HOUGHTON (U S Army, Army Materials and Mechanics Research Center, Watertown, MA) American Helicopter Society, Journal (ISSN 0002-8711), vol 27, Oct 1982, p 49-56

The design and fabrication of the Improved Main Rotor Blade, designated K-747, as a replacement for the Bell Model AH-1S Cobra, was undertaken in connection with mission requirements necessitating higher armament payloads, and, thus, a need to improve rotor lifting capacity The required 6-percent increase in hover gross weight appeared to be obtainable by replacing the main rotor blades with new blades having increased aerodynamic efficiency In order to assess void growth in composite main rotor blades, it was thought desirable to subject one K-747 main rotor blade to 28 million cycles (1440 flight hours) of spectrum testing If no sign of degradation or void growth occurred, a reasonable level of confidence in the structural integrity of the blade could be established Attention is given to a specimen description, the application of fatigue loads, the conducted fatigue test, and the employed nondestructive inspection techniques G R

A83-36065
LIGHT AIRCRAFT AND SAILPLANE STRUCTURES IN REINFORCED PLASTICS
R TETLOW Materials and Design (ISSN 0261-3069), vol 4, Feb -Mar 1983, p 657-662 refs

Newer materials for the aircraft designer include those utilizing carbon fiber in its various forms and, to a lesser extent, Kevlar These materials, with high specific strength (ultimate strength/density) and high specific stiffness (modulus/density) offer special possibilities for the aircraft designer However, the cheaper, less structurally attractive glass is the material which has been most widely used This is particularly true in the case of sailplanes Unidirectional reinforced plastic structural materials are compared with Sitka Spruce and an aluminum alloy Wing structures, fuselage structures, and control surfaces are considered Attention is given to the shear moduli for various materials, the optimum stress levels for simply supported compression panels, the optimum stress levels for a wide column compression panel, and wing loading levels

G R

A83-36074
THE HISTORY OF V/STOL AIRCRAFT
J J SCHNEIDER (Boeing Vertol Co , Philadelphia, PA) Vertiflite (ISSN 0042-4455), vol 29, Mar -Apr 1983, p 22-29

The development of VTOL and STOL aircraft, excluding helicopters, is traced from its beginnings through the early 1950's The general classification of these aircraft in terms of thrust generation and of conversion from lift to cruising mode is presented, and the capabilities desired in a V/STOL aircraft are considered The evolution of V/STOL concepts, designs, and prototypes from antiquity through the infancy of powered flight to the 1940's and 1950's is recounted, including discussion of the work of Sikorsky and of Focke-Wulf in the late 1930's and early 1940's, the U S Navy POGO-VTOL program in the 1950's, the Army XV-1, 2, and 3 and Air Force X-13 and 14 aircraft, and the British Short SC 1

T K

A83-36075
THE SUPER STALLION
S P KRUEGER (United Technologies Corp , Sikorsky Aircraft, Stratford, CT) Vertiflite (ISSN 0042-4455), vol 29, Mar -Apr 1983, p 30-32, 41

The design features of the U S Navy/Marine Corps CH-53E (super stallion) helicopter are presented Modifications undertaken

in the previous design, the CH-53D, to increase payload from 20,000 to 32,000 pounds include the addition of a third T-64-type engine, a seven-blade, 79-foot-diameter rotor employing a high-stress Ti spars, a tail-pylon and tail-rotor configuration tilted 20 deg to port to provide both vertical and horizontal thrust, a new dual digital automatic flight-control system, and improved hydraulics Navy and Marine Corps operational requirements, including an airborne minesweeping configuration, MH-53E, are discussed T K

A83-36204#
SIMULATOR FIDELITY AND FLIGHT TEST DATA - IMPROVING THE FLIGHT PERFORMANCE OF THE B-52H WST PRODUCTION UNIT FLIGHT STATION SIMULATOR
D A SCAFETTA (Singer Co , Link Flight Simulation Div , Binghamton, NY) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 1-13 refs
(AIAA PAPER 83-1075)

A systematic method of analysis for comparing aircraft simulator flight performance against actual aircraft flight test data is presented as a means of improving the fidelity of the B-52H WST Production Unit Flight Station Simulator Verification of simulated aircraft performance as designed to reflect an airframe manufacturer's data package is established against flight test data as contained in the aircraft's Category II flight test report and flight performance manual Discussions are included on the design approaches used for the mathematical modeling of the engine and aerodynamic simulation models as an introduction to the data analysis method First, a detailed analysis of all available engine and aircraft flight test data is made Second, simulated engine performance is verified Third, simulated aircraft performance for the 'clean' aircraft configuration is verified Finally, a simulated aircraft performance for the 'dirty' aircraft configuration is verified by analyzing each aircraft drag component separately Based on the analysis, several engine and aerodynamic simulation model changes were made to the original design As a result, the flight performance of the B-52H WST Production Unit Flight Station Simulator matches aircraft flight test data Author

A83-36205#
INDOCTRINATION OF NAVY TEST PILOTS TO VECTORED THRUST FLIGHT IN THE X-22A IN-FLIGHT SIMULATOR
J L BEILMAN (Calspan Advanced Technology Center, Buffalo, NY) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 14-22 refs
(AIAA PAPER 83-1076)

A series of flight demonstrations has been conducted with the Navy X-22A V/STOL Research Aircraft at Buffalo, NY The purpose of the demonstrations is to introduce selected U S Naval Test Pilot School (TPS) student pilots to the use of thrust-vectoring as a means of flight control Beginning in 1981, the faculty of the Navy TPS designated four pilots from each TPS class to participate in the X-22A demonstration program Main elements of the Navy TPS/X-22A Special Project include a ground school on the X-22A, ground-based simulation using the X-22A itself coupled to a six-degree-of-freedom digital computer model, a one-hour flight under visual meteorological conditions, and a one-hour flight under simulated instrument meteorological conditions, using the Head-Up-Display and Microwave Landing System Attention is given to details regarding these elements, the provided lectures, and an evaluation of the results obtained with the program G R

A83-36206#
IN-FLIGHT SIMULATION AT THE U S. AIR FORCE AND NAVAL TEST PILOT SCHOOLS
L KNOTTS and M PARRAG (Calspan Advanced Technology Center, Buffalo, NY) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 23-31 refs
(AIAA PAPER 83-1078)

The earliest variable stability aircraft were created during the mid 1940's These aircraft, also known as in-flight simulators, have evolved from the original F4U Corsair with a servo controlled auxiliary rudder, to the USAF Total In-Flight Simulator, which has 6-degree of freedom simulation capability In-flight simulation was first used as a training tool at the U S Naval Test Pilot School in 1960 In 1963, in-flight simulation was added to the U S Air Force Test Pilot School curriculum All the variable stability aircraft used at the Test Pilot Schools are equipped with two sets of cockpit controls One set is used by the safety pilot, while the student test pilot or 'evaluation pilot' uses the second set A brief description is provided of each in-flight simulator currently used at the Naval and Air Force Test Pilot Schools Attention is also given to the variable stability flight program, and special projects performed by each class in addition to the routine variable stability flights G R

A83-36211*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
SPECTRAL DECONTAMINATION OF A REAL-TIME HELICOPTER SIMULATION
R E MCFARLAND (NASA, Ames Research Center, Moffett Field, CA) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 64-70
(AIAA PAPER 83-1087)

Nonlinear mathematical models of a rotor system, referred to as rotating blade-element models, produce steady-state, high-frequency harmonics of significant magnitude In a discrete simulation model, certain of these harmonics may be incompatible with realistic real-time computational constraints because of their aliasing into the operational low-pass region However, the energy is an aliased harmonic may be suppressed by increasing the computation rate of an isolated, causal nonlinearity and using an appropriate filter This decontamination technique is applied to Sikorsky's real-time model of the Black Hawk helicopter, as supplied to NASA for handling-qualities investigations Author

A83-36214#
ERROR SOURCES IN HYBRID COMPUTER BASED FLIGHT SIMULATION
R A WEEKS (Northrop Corp , Pico Rivera, CA) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 84-91
(Contract F33615-78-C-3608)
(AIAA PAPER 83-1090)

Man-in-the-loop real time simulation, with a sophisticated simulator, requires a large computation facility to provide the capability for effective and detailed mathematical modeling of the air vehicle and its subsystems Analog and digital computers can be employed for the performance of the required calculations Each computer type has certain advantages and drawbacks Many large simulation mechanizations run, therefore, in a hybrid fashion, where both analog and digital computing methods are employed The present investigation is concerned with errors and problems associated with both types of computation, taking into account also the communication link between analog and digital computations Typical errors encountered in analog, digital, and hybrid computation are listed in a table A linear airframe model was utilized for the study of the effects of error sources on solution accuracy G R

A83-36215#
USE OF FLIGHT TEST RESULTS TO IMPROVE THE FLYING QUALITIES SIMULATION OF THE B-52H WEAPON SYSTEM TRAINER
J WEISS (Singer Co , Link Flight Simulation Div , Binghamton, NY) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 92-113 refs
(AIAA PAPER 83-1091)

Correlating simulation results to flight test results proved to be a useful tool in assuring high-fidelity flight simulation for the B-52H Weapon System Trainer The particular correlation described in this paper was limited to the longitudinal flying qualities Analyses pertaining to the simulation of the engine, aircraft performance, and lateral-directional flying qualities were performed prior to the correlation The correlation demonstrated the significance of fuel loading and fuel slosh on certain flight test maneuvers It resulted in modifications to the design data pitching moment coefficient equation and stabilizer angle design These modifications improved the simulation results to the point where they closely matched with the flight test results Author

A83-36225#
FLIGHT FIDELITY TESTING OF THE F/A-18 SIMULATORS
T C SANTANGELO (U S Navy, Naval Air Test Center, Patuxent River, MD) and R T GALLOWAY (U S Navy, Naval Training Equipment Center, Orlando, FL) American Institute of Aeronautics and Astronautics, Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983 7 p refs
(AIAA 83-1094)

The development program for the first operational flight trainer (OFT) for the Navy F/A-18 aircraft is described, with a focus on flight-fidelity testing The problems inherent in constructing specifications and begining development before the configuration and flight characteristics of the F/A-18 were finalized are discussed The OFT design includes actual cockpit controls, a 3-window, 120x30-deg visual display driven by 3-channel VITAL-IV CGI system, a g-seat/g-suit/seat-shaker motion-cueing system, an instructor/operator station, and a host computer consisting of four SEL 32/77 CPU incorporating real-time input/output capability The techniques used to test the flight fidelity of the OFT are outlined, and the importance of quick access to flight-test results, pilot input, comprehensive database construction, and the use of defined test parameters is emphasized Future improvements such as automatic fidelity-testing functions built into the OFT and automatic data recording are proposed The designs of the weapons-tactics trainer and part-task trainer for the F/A-18 are also considered
T K

A83-36234*# Boeing Commercial Airplane Co , Seattle, Wash
PROGRESS IN PROPULSION SYSTEM/AIRFRAME STRUCTURAL INTEGRATION
J L WHITE, T L JANSSEN, and T F YANTIS (Boeing Commercial Airplane Co , Seattle, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p NASA-sponsored program refs
(AIAA PAPER 83-1123)

Attention is given to the improvements in mathematical modeling, and the emerging role of computer-related technology, in airframe structural technology advancements related to the engine/airframe integration requirements of such recent designs as the 747 airliner's JT9D turbofan engine nacelle Also noted are investigation results concerning propulsion system flight loads and their influence on thrust-specific fuel consumption deterioration, which has been addressed through the development of the novel structural concept of the 'load-carrying core cowl' engine nacelle structure Analytical studies on integrated system vibration include low frequency, nonsynchronous vibration analyses of large, high bypass turbofan engines that have been conducted by means of three-dimensional integrated finite element models O C

A83-36285*# Lockheed-Georgia Co , Marietta
AERODYNAMIC DESIGN OF PROPFAN POWERED TRANSPORTS
A S ALJABRI (Lockheed-Georgia Co , Marietta, GA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(Contract NAS2-11120)
(AIAA PAPER 83-1213)

A case study is presented of the design of efficient propfan transport aircraft configurations, employing standard subsonic and transonic computed codes that have been modified to account for slipstream effects After numerically simulating the aerodynamics of the interaction of the wing/nacelle configuration with the swirling slipstream, interference effects are assessed and design procedures are provided which may reduce adverse interference phenomena These procedures are demonstrated for the case of the design of a Mach 0 8-cruise turboprop aircraft
O C

A83-36406*# Goodyear Aerospace Corp , Akron, Ohio
1983 LTA TECHNOLOGY ASSESSMENT
R L ASHFORD (Westinghouse Electric Corp , TCOM, Columbia, MD), R G E BROWNING (Goodyear Aerospace Corp , Akron, OH), B B LEVITT (Summit Research Corp , Gaithersburg, MD), N J MAYER (NASA, Washington, DC), and D E WOODWARD (Association of Balloon and Airship Constructors, Alexandria, VA) American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, Long Beach, CA, May 10-12, 1983 44 p refs
(AIAA PAPER 83-1617)

Several aspects of LTA (lighter-than-air) technology development are reviewed Technological developments of classical airships through 1974 are examined A brief historical and technological summary of five specialized LTA equipment concepts is presented metal-clad airships, free balloons, semibuoyant vehicles, high-altitude platforms, and tethered aerostats Current LTA technology developments are reviewed with particular emphasis on VTOL airships capable of heavy lift and on long endurance types for coastal maritime patrol Finally, the future prospects of LTA system development are considered with attention given to manned conventional and hybrid vehicles, tethered vehicles, and RPVs B J

A83-36448
THE KA-26 HELICOPTER [VERTOLET KA-26]
N F SURIKOV, G I IOFFE, A A DMITRIEV, and E G PAK Moscow, Izdatel'stvo Transport, 1982, 224 p In Russian

Basic technical data on the design and flight characteristics of the multipurpose Ka-26 helicopter are presented Particular consideration is given to the cabin design, the hydraulic system, the powerplant, the control system, and the fuel system Applications of the helicopter are discussed (e g , load transport, forest patrol, ship use), and support systems are considered
B J

A83-36460#
XB-70 TECHNOLOGY ADVANCEMENTS
J W ROSS and D B ROGERSON (Rockwell International Corp , El Segundo, CA) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 19-38
(AIAA PAPER 83-1048)

Attention is given to the technological advancements in aerodynamics, structural design, and control systems, which were incorporated in the XB-70 in order to meet performance requirements The bomber's unique configuration comprised a two-position windshield, a canard for pitch control and trim, a large planform delta wing with 'elevons' (elevator/ailerons) for simultaneous pitch and roll control, folding wing tips, variable engine air inlet geometry, and a coordination of the engine inlet wedge shock with the delta wing's geometry to generate 'compression lift' The structural concept of the XB-70 employed, in addition to

stainless steel honeycomb construction, elements of titanium and tool steel Aircraft systems employed high temperature, high pressure hydraulic components and high temperature, high altitude ac electrical components O C

A83-36461#
VARIABLE SWEEP WING DESIGN
R W KRESS (Grumman Aerospace Corp , Bethpage, NY) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 43-61
(AIAA PAPER 83-1051)

The evolution of variable sweep aircraft design is traced from its beginnings in Germany near the end of World War II through US applications culminating in the sophistication of the F-14 system Heaviest treatment is given the F-14, most familiar to the author, and wherein variable sweep was 'worked' the hardest Foreign applications are also discussed briefly Author

A83-36462#
THE APPLICATION OF LOW-COST DEMONSTRATORS FOR ADVANCEAD FIGHTER TECHNOLOGY EVALUATION
G ROSENTHAL and G BRANDEAU (Fairchild Republic Co , Farmingdale, NY) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 63-71
(AIAA PAPER 83-1052)

A demonstrator aircraft, which unlike a prototype need not match the size, construction, systems, functions, specifications and performance envelope of a prospective production aircraft, is designed to provide high quality, systematic flight research data which can support the design and development of future aircraft at reduced risk In order to control the costs associated with the development of next-generation fighter aircraft, it is desirable that many competing system and concept categories be evaluated This may be achieved through the application of principles and program approaches that can reduce individual demonstrator program costs Attention is presently given to recent experience with a subscale flight demonstrator constructed with a view to the development of the Next Generation Trainer Aircraft O C

A83-36465#
AEROSPACE TECHNOLOGY DEMONSTRATORS/RESEARCH AND OPERATIONAL OPTIONS
A C DRAPER, M L BUCK, and D R SELEGAN (USAF, Aeromechanics Div , Wright-Patterson AFB, OH) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 89-102 refs
(AIAA PAPER 83-1054)

Attention is given to flight demonstrator programs relevant to the identification of designs which promise to bridge the gap between such current space vehicle programs as the Space Shuttle and the future Maneuverable Reentry Research Vehicle, Advanced Military Space Capability Vehicle, and the evolving family of Transatmospheric Vehicles These flight tested demonstrator vehicles have yielded useful design data concerning operational flexibility, integration and subsystem requirements, heat shield performance, crossrange maneuvering, accurate guidance to recovery point, weight minimization, and advanced materials and structures O C

A83-36466#
YAV-8B FLIGHT DEMONSTRATION PROGRAM
K V STENBERG (McDonnell Aircraft Co , St Louis, MO) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 103-112
(AIAA PAPER 83-1055)

The AV-8B Harrier II vertical and short takeoff and landing (V/STOL) aircraft is the product of over 25 years of development It effectively combines the proven vectored thrust concept of the AV-8A and its antecedents with modern U S technology Significant advances in aerodynamics, propulsion, structures and avionics have been incorporated into the AV-8B to double its payload-radius capability over the AV-8A and improve its operational readiness and effectiveness These technologies were first incorporated into the YAV-8B prototype aircraft and demonstrated through a flight test program, providing a sound technical basis for AV-8B full scale development and subsequent production programs Author

A83-36467#
THE F-16 - A TECHNOLOGY DEMONSTRATOR, A PROTOTYPE, AND A FLIGHT DEMONSTRATOR.
H J HILLAKER (General Dynamics Corp , Fort Worth, TX) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 113-120
(AIAA PAPER 83-1063)

Attention is given to the YF-16 Lightweight Fighter prototype program's demonstration of emerging design possibilities The YF-16 is also compared to the F-16 Advanced Fighter Technology Integration aircraft, which is demonstrating additional technologies under a more conventional set of program characteristics The YF-16 integrated such innovative design features as a blended wing/body configuration, controlled vortex flow-induced lift, fly-by-wire control, relaxed static stability, automatically variable camber, and a high-g cockpit design for high speed maneuvering An additional F-16 research variant, the F-16XL flight demonstrator, incorporates a large area cranked arrow wing planform which promises significant performance gains beyond those of current F-16s O C

A83-36468#
AFTI/F-111 MISSION ADAPTIVE WING TECHNOLOGY DEMONSTRATION PROGRAM
R HARDY (Boeing Military Airplane Co , Wichita, KS) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 121-126
(AIAA PAPER 83-1057)

The use of smooth, continuously variable camber leading and trailing edges controlled by digital computers can improve the range-payload, maneuverability, and platform stability of new airplanes A NASA Dryden F-111 is being modified to demonstrate this technology under an Air Force Flight Dynamics Laboratory contract The demonstration program has identified and solved detailed engineering problems and developed new automatic flight control modes Author

A83-36469#
X-29 INTEGRATED TECHNOLOGY DEMONSTRATOR AND ATF
G SPACHT (Grumman Aerospace Corp , Bethpage, NY) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 127, 128
(AIAA PAPER 83-1058)

The technologies included in the X-29 are discussed, and attention is given to how these technologies may benefit the next generation tactical aircraft Consideration is given to the following technologies the forward swept wing, the thin supercritical airfoil section, the variable incidence canard configuration to enhance supersonic maneuvering performance, and the capability to fly to plus or minus 90 deg angle of attack and safely recover It is concluded that the X-29 offers the opportunity for shortening the procurement cycle and enhancing the technologies available for the next generation tactical aircraft, this will provide to that aircraft the potential benefits of improved transonic and supersonic efficiency, improved maneuverability and reduced approach and landing speeds The implications of the X-29 technologies for the next generation tactical aircraft are briefly examined B J

A83-36472#
LARGE JET AIRCRAFT VALIDATION AND DEMONSTRATIONS - AN OVERVIEW OF BOEING EXPERIENCE
J E STEINER and L K MONTLE (Boeing Co , Seattle, WA) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 145, 147-166
(AIAA PAPER 83-1049)

Boeing experience with large jet aircraft validation and demonstrations is examined with particular attention given to the trend toward the use of simulation as a design and validation tool It is noted that the XB-47 integrated a new set of technology, while the X and YB-52s were used to refine details before entering a large production program The Dash 80 vehicle was intended to demonstrate Boeing convictions to the airlines and Wright Field The 727 could have used a prototype but time did not permit it, while the 737 could have benefitted from more component technology demonstration The first 747 was not a prototype (nor was one needed), the YC-14 integrated a new set of technology, the 757 and 767 were 'prototyped' by flying them on the ground in a complex digital simulation facility It is concluded that the circumstances were different in each case and general rules are not feasible Future challenges are identified, including the rise in program costs as a justification for a more accurate technological knowledge B J

A83-36473#
THE F-5 STORY - PROTOTYPE AND TECHNOLOGY DEMONSTRATOR
J T GALLAGHER and W E FELLERS (Northrop Corp , Aircraft Div , Hawthorne, CA) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 167-171
(AIAA PAPER 83-1062)

N-156 prototype technology is examined with reference to high thrust-to-weight turbojets, remote driven engine accessories, Whitcomb theory, wing and empennage surfaces, leading edge extensions, unimproved runways, and maintenance features Consideration is also given to the development of the F-5E and F-5F, the YF-17, and the F-20 B J

A83-36474#
AFTI/F-16 TECHNOLOGY DEMONSTRATOR
M E WADDOUPS (General Dynamics Corp , Fort Worth, TX) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 173-179
(AIAA PAPER 83-1059)

AFTI/F-16 is the first aircraft to begin flight testing out of a planned AFTI series of technology demonstrators sponsored by the Air Force Flight Dynamics Laboratory Four technology areas are being developed and integrated in the AFTI/F-16 testbed direct force and weapon line pointing, digital flight control system, integrated flight and fire control, and pilot-vehicle interface advances These are two program phases Phase I, Digital Flight Control System (DFCS), and Phase II, Automated Maneuvering Attack System (AMAS) More than 45 test flights have been carried out in the DFCS phase to demonstrate the triplex DFCS and its integration into the aircraft It is noted that AMAS is being inprepared for critical design review, and that a series of experiments is planned for the Phase II demonstrator to identify the role of automation in making single-seat attack feasible B J

A83-36915#
CONFIGURATION DEVELOPMENT OF A RESEARCH AIRCRAFT WITH POST-STALL MANEUVERABILITY
S RANSOM (Messerschmitt-Boelkow-Blohm, Vereinigte Flugtechnische Werke GmbH, Bremen, West Germany) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 599-605 Research sponsored by the Bundesministerium der Verteidigung refs

The configuration development of a small, highly maneuverable research aircraft is described The aircraft, of delta-canard layout, is designed specifically to investigate the subsonic unconventional maneuver flight envelope, which includes direct-force and post-stall flight modes Results from a low-speed wind tunnel investigation are presented, and their analysis shows that the inclusion in the layout of twin wing-mounted forward-swept vertical tail surfaces confers significant control and aerodynamic advantages Author

A83-36918#
GENERALIZED MAXIMUM SPECIFIC RANGE PERFORMANCE
E TORENBEEK and H WITTENBERG (Delft, Technische Hogeschool, Delft, Netherlands) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 617-622 refs

The conditions for maximum specific range are examined for a given aircraft/engine combination The optimum flight conditions are derived, taking into account the effects of compressibility on the airplane drag and the effects of engine rating, altitude, and speed on the engine characteristics Approximations for the drag and/or engine characteristics are introduced to obtain results for special cases It is shown that the optimum cruise condition is either a fixed point in the generalized drag polars (for the unconstrained case) or a combination of a fixed curve in this polar plot with constraints on T/delta or W/delta, where T is the net propulsive thrust, W is the aircraft all-up-weight, and delta is the relative atmospheric pressure For turbojet and turbofan aircraft the unconstrained and optimum cruise condition is essentially located in the drag rise, and the classical criteria are not accurate enough for this class of high-subsonic aircraft It is concluded that this method gives a useful tool for performance optimization in the preliminary design stage, particularly if a reliable estimate of the compressibility drag is available N B

A83-36919#
FLIGHT TESTS OF TOW WIRE FORCES WHILE FLYING A RACETRACK PATTERN
C MATUK (Lulea, Hogskola, Lulea, Sweden) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 623-627 Research supported by the Forsvaret Materielverk

Airplane towing of a target with a long wire in a racetrack pattern has been investigated First the theoretical background is presented and then the experiments are treated Twelve flights with different airplane speeds and turn radii are studied The force at the airplane end of the wire, and the airplane and the target paths are plotted The maximum force in the wire occurs after the airplane turn is finished This maximum value is due to whip effect The occurrence of maximum and minimum values for the vertical distance between airplane and target is demonstrated The experimental results are compared with theoretical results for the conditions of the experiments The overall agreement is considered satisfactory Therefore theoretical graphs on the maximum force in the wire as a function of airplane speed and turn radius can be used to avoid wire failure while flying a racetrack pattern Author

A83-36921#
IN-FLIGHT COMPUTATION OF HELICOPTER TRANSMISSION FATIGUE LIFE EXPENDITURE
K F FRASER (Department of Defence, Aeronautical Research Laboratories, Melbourne, Australia) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 633-640 refs

Previously cited in issue 03, p 323, Accession no A82-13872

N83-25692*# Lockheed Corp , Burbank, Calif
ADVANCED MANUFACTURING DEVELOPMENT OF A COMPOSITE EMPENNAGE COMPONENT FOR L-1011 AIRCRAFT Quarterly Technical Report, 1 Jul. - 30 Sep. 1978
13 Oct 1978 106 p
(Contract NAS1-14000)
(NASA-CR-172658, NAS 1 26 172658, LR-28743, DRL-003, QTR-11) Avail NTIS HC A06/MF A01 CSCL 01C

Work continued toward the development of tooling and processing concepts required for a cocured hat/skin cover assembly A plan was developed and implemented to develop the process for using preimpregnated T300/5208 with a resin content of 34 + or - 2 percent by weight Use of this material results in a simplified laminating process because removal by bleeding or prebleeding is no longer required The approach to this task basically consists of fabricating and testing flat laminated panels and simulated structural panels to verify known processing techniques relative to end-laminate quality The flat panels were used to determine air bleeding arrangement and required cure cycle Single and multihat-stiffened panels were fabricated using the established air bleeding arrangement and cure cycle with the resulting cured parts yielding excellent correlation of ply thickness with all surfaces clear of porosity and voids Author

N83-25693*# Lockheed Corp , Burbank, Calif
ADVANCED MANUFACTURING DEVELOPMENT OF A COMPOSITE EMPENNAGE COMPONENT FOR L-1011 AIRCRAFT Quarterly Technical Report, 1 Oct. - 31 Dec. 1978
22 Jan 1979 82 p
(Contract NAS1-14000)
(NASA-CR-172659, NAS 1 26 172659, LR-28843, DRL-003, QTR-12) Avail NTIS HC A05/MF A01 CSCL 01C

Work on process verification and tooling development continued The cover process development was completed with the decision to proceed with low resin content prepreg material (34 + or - 3% by weight) in the fabrication of production readiness verification test (PRVT) specimens and the full-scale covers The structural integrity of the cover/joint design was verified with the successful test of the cover attachment to fuselage ancillary test specimen (H25) Failure occurred, as predicted, in the skin panel away from the fuselage joint at 141 percent of the design ultimate load With the successful completion of the H25 test, the PRVT cover specimens, which are identical to the H25 ancillary test specimen, were cleared for production Eight of the twenty cover specimens were fabricated and are in preparation for test All twenty of the PRVT spar specimens were fabricated and also were prepared for test The environmental chambers used in the durability test of ten cover and ten spar PRVT specimens were completed and installed in the load reaction frames Author

N83-25694*# Lockheed Corp , Burbank, Calif
ADVANCED MANUFACTURING DEVELOPMENT OF A COMPOSITE EMPENNAGE COMPONENT FOR L-1011 AIRCRAFT Quarterly Technical Report, 1 Jan. 1979 - 31 Mar. 1979
20 May 1979 98 p
(Contract NAS1-14000)
(NASA-CR-172657, NAS 1 26 172657, QTR-13, LR-29058, DRL-003) Avail NTIS HC A05/MF A01 CSCL 01C

Work in process verification and tooling development continued The decision was made to redesign the ribs to a more producible design The bead was eliminated and the truss ribs changed to plain C sections The solid web rib stiffeners were eliminated as well as the beads and the webs are now reinforced with a syntactic core Syntectic is an epoxy containing glass microballoons Two cover specimens were successfully tested The first specimen (H27) was designed to verify the stability and compression strength of the cover when it is hot and wet Failure occurred at 120 percent of design ultimate load As the failure appeared to be fixture induced and was limited to one end of the panel, the remainder of the panel will be tested The second specimen (H28) was designed to verify the failsafe aspects of the design The test verified the design Preparation of the PRVT test facility is nearing completion and all ten spar durability specimens were installed in the test chambers S L

N83-25695*# Textron Bell Helicopter, Fort Worth, Tex
CORRELATION AND EVALUATION OF INPLANE STABILITY CHARACTERISTICS FOR AN ADVANCED BEARINGLESS MAIN ROTOR Final Report
W H WELLER May 1983 85 p refs
(Contract NAS2-11269)
(NASA-CR-166448, NAS 1 26 166448) Avail NTIS HC A05/MF A01 CSCL 01C

A program of experimental and analytical research was performed to demonstrate the degree of correlation achieved between measured and computed rotor inplane stability characteristics The experimental data were obtained from hover and wind tunnel tests of a scaled bearingless main rotor model Both isolated rotor and free-hub conditions were tested Test parameters included blade built-in cone and sweep angles, rotor inplane structural stiffness and damping, pitch link stiffness and location, and fuselage damping, inertia, and natural frequency Analytical results for many test conditions were obtained In addition, the analytical and experimental results were examined to ascertain the effects of the test parameters on rotor ground and air resonance stability The results from this program are presented herein in tabular and graphical form Author

N83-25696# Air Force Flight Dynamics Lab , Wright-Patterson AFB, Ohio
AIRCRAFT EQUIPMENT RANDOM VIBRATION TEST CRITERIA BASED ON VIBRATIONS INDUCED BY TURBULENT AIRFLOW ACROSS AIRCRAFT EXTERNAL SURFACES
J F DREHER 1983 13 p refs
(AD-A123281) Avail NTIS HC A02/MF A01 CSCL 01C

Vibrations within jet aircraft are caused by a number of phenomena The principal sources, generally are jet engine noise and turbulent airflow (pseudo-noise) which impinge on aircraft external surfaces, gust, landing, and takeoff loads, and on-board mechanical equipment such as engines and pumps This paper describes the structural vibrations induced by turbulent airflow and generalizes the findings to develop pertinent, adaptable random vibration test criteria for aircraft equipment These criteria are those recently proposed for inclusion in Method 514 of MIL-STD-810C, Environmental Test Methods Author (GRA)

N83-25697# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
EXPERIMENTAL TESTING OF FLYING QUALITIES THEORIES M.S. Thesis
N H KRYS Dec 1982 263 p refs
(AD-A124699, AFIT/GE/EE/82D-43) Avail NTIS HC A12/MF A01 CSCL 14B

An analog computer simulation was used to model the roll dynamics of the generic aircraft which had been evaluated on the variable stability NT-33A aircraft Sum of sine waves and random step functions were used as the two different command signals The purpose of this study was to determine what effect the nature of the command signal had on the pilot rating of the task simulation Author (GRA)

N83-25698# Army Aviation Engineering Flight Activity, Edwards AFB, Calif
CLIMATIC LABORATORY SURVEY HUGHES YAH-64 HELICOPTER Final Report, 2 Nov. - 16 Dec. 1981
G L BENDER, C F ADAM, and R T SAVAGE Mar 1982 260 p refs
(AD-A124670, USAAEFA-80-07) Avail NTIS HC A12/MF A01 CSCL 01C

Environmental testing of the YAH-64 helicopter was conducted in the McKinley Climatic Laboratory, Eglin Air Force Base, Florida The US Army Aviation Engineering Flight Activity was responsible for the evaluation of aircraft systems and the US Army Aviation Development Test Activity was responsible for the mission equipment evaluation The test consisted of 14 4 hours of aircraft

operating time between 2 November and 16 December 1981 Testing was accomplished at 125, 70, -25, and -50 F with the aircraft attached to the hangar floor At each temperature, testing consisted of preflight inspections, APU and engine starts, simulated mission profiles, engine shut down, and maintenance inspections Nine deficiencies were found which would preclude mission accomplishment (1) the fire control computer was unreliable, (2) the symbol generator required an excessive warm-up time at cold temperatures, (3) the heading and attitude reference system was unreliable, (4) the environmental control unit failed to provide adequate heating or cooling to the cockpit and avionics bays at -25 F, -50 F, and 125 F, (5) the TADS/PNVS and weapons systems did not function adequately at 125 F, (6) the APU aborted its start sequence because it could not accelerate the accessory gearbox to operating speed at -25 F and -50 F, (7) the hydraulic hand pump was ineffective at -25 F and -50 F, (8) the utility hydraulic manifold allowed the accumulator to bleed off at -25 F and -50 F, and (9) failure of the hydraulic flex lines at cold ambient temperatures GRA

N83-25699# Computational Mechanics Consultants, Knoxville, Tenn

AN ASSESSMENT OF FACTORS AFFECTING PREDICTION OF NEAR-FIELD DEVELOPMENT OF A SUBSONIC VSTOL JET IN CROSS-FLOW Final Report, Sep. 1981 - Jun 1982

A J BAKER and J A ORZECHOWSKI Warminster, Pa NADC Jun 1982 41 p refs

(Contract N62269-81-C-0395)

(AD-A124583, NADC-81177-60) Avail NTIS HC A03/MF A01 CSCL 01C

A three-dimensional parabolic Navier-Stokes numerical solution algorithm has been analyzed for prediction of the nearfield flow development of a VSTOL jet in subsonic crossflow The essential aspects of algorithm definition, with regards to initial and boundary condition specifications, has been summarized A momentum conserving pressure gradient computation has been developed to complete the problem definition and facilitate problem initialization A sequence of overlapping interaction solutions has been evaluated for prediction of a circular jet at gamma = 8 0 The results of the 3DPNS predictions shave compared qualitatively with the sparse available experimental data It is crucial that quality data be acquired to permit quantitative assessment of the results of this analysis procedure Author (GRA)

N83-25700# Bihrle Applied Research, Inc , Jericho, N Y

F-14 ROTARY BALANCE TESTS FOR AN ANGLE-OF-ATTACK RANGE OF 0 DEG TO 90 DEG Final Report

B BARNHART Warminster, Pa NADC Jan 1983 24 p

(Contract N62269-82-C-0233, WF41400000)

(AD-A124468, NADC-81293-60) Avail NTIS HC A02/MF A01 CSCL 14B

A 1/12-scale model of the F-14 was tested on the rotary balance located in the Langley Spin Tunnel Data were obtained for the basic airplane in the maneuver configuration with various control settings at three wing sweeps The data were supplied to the Naval Air Development Center on magnetic tape This report presents a description of these tests and the information supplied on the data tape, as well as a list of spin modes predicted for the F-14 utilizing the rotary balance data Author (GRA)

N83-25701# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering

AN EXPERIMENTAL/ANALYTICAL INVESTIGATION INTO THE PERFORMANCE OF A 20-PERCENT THICK, 8.5-PERCENT CAMBERED, CIRCULATION CONTROLLED AIRFOIL M.S. Thesis

J K HARVELL Dec 1982 84 p refs

(AD-A124732, AFIT/GAE/AA/82D-13) Avail NTIS HC A05/MF A01 CSCL 01C

This study was conducted to investigate the effect of two tangentially blown slots on the performance of a 20-percent thick, 8 5-percent cambered elliptical airfoil Lift, drag, and moment coefficients were obtained at a test Reynolds number of 9 5 x 100,000 for secondary slot locations of 73 5 and 83 5 deg Results show that the use of two tangentially blown slots enables the generation of higher lift coefficients at lower blowing rates This feature enables the test airfoil to equal the performance of single slotted blown airfoils at lower blowing rates therefore reducing the parasitic losses and resulting in higher lift/drag ratios A limited study of the ability of the (TRACON) program to predict circulation controlled airfoil performance was conducted The program failed to provide accurate predictions for the pressure distribution or force coefficients for the airfoil configuration of this study This study also found that using different geometry smoothing techniques in the region of the slot resulted in large variations in TRACON's performance predictions GRA

N83-25702# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering

DESIGN AND ANALYSIS OF A SUBCRITICAL AIRFOIL FOR HIGH ALTITUDE, LONG ENDURANCE MISSIONS M.S. Thesis

I AHMAD Dec 1982 132 p refs

(AD-A124757, AFIT/GAE/AA/82D-1) Avail NTIS HC A07/MF A01 CSCL 01C

An airfoil was designed using the 'inverse design' method The airfoil was tailored to meet the requirements of high altitude, long endurance missions The cruise Mach number was 0 65 so compressibility effects were included In the procedure used, a basic airfoil was generated to meet the thickness and moment requirements It was then refined to ensure desired behavior of the boundary layer at the operating angles of attack Computer codes designed by Richard Eppler were used for this study The airfoil was analyzed by using a viscous effects analysis program designed by Shang et al and a comparison was made with results obtained through Eppler's code GRA

N83-25703# Aeronautical Research Labs , Melbourne (Australia)

RESONANCE TESTS ON THE TAIL OF A CT4 AIRCRAFT

A GOLDMAN Sep 1982 27 p

(AD-A124566, ARL/STRUC-TM-345) Avail NTIS HC A03/MF A01 CSCL 01C

A resonance test has been carried out on the tail section of a CT4 aircraft Natural modes and frequencies of the tailplane were measured and these results are presented Author (GRA)

N83-25704# Systems Technology, Inc , Hawthorne, Calif

PROPOSED MIL STANDARD AND HANDBOOK: FLYING QUALITIES OF AIR VEHICLES. VOLUME 2 PROPOSED MIL HANDBOOK Final Report, Apr. 1980 - Jul. 1982

R H HOH, D G MITCHELL, I L ASHKENAS, R H KLEIN, R K HEFFLEY, and J HIDGKINSON (McDonnell Aircraft Co) Wright-Patterson AFB, Ohio AFWAL Nov 1982 899 p refs

(Contract F33615-80-C-3604, AF PROJ 2403)

(AD-A123726, AFWAL-TR-82-3081-VOL-2) Avail NTIS HC A99/MF A01 CSCL 01C

MIL-F-8785C, Military Specification -- Flying Qualities of Piloted Airplanes, has been reformatted into a MIL Standard and a supporting MIL Handbook This report is a draft of the proposed MIL Standard, which has been developed by Systems Technology, Inc , with the McDonnell Aircraft Company acting in a consulting role It is presented to industry and the United States armed forces for comments and proposed revisions The responsibility for the legal MIL Standard and Handbook rests within the armed forces This draft will be considered and form the basis for revisions, industry and government comments and a tri-service review in the process of developing the MIL Standard and Handbook Suggested values and background information are contained in this volume MIL-F-8785C and the backup documents to both it and its predecessor, MIL-F-8785B, were reviewed extensively Much of the material contained therein is still considered to be valid and relevant and has been retained in this document Author (GRA)

N83-25705# Army Aviation Engineering Flight Activity, Edwards AFB, Calif Directorate for Development and Qualification
AIRWORTHINESS AND FLIGHT CHARACTERISTICS TEST. PART 2. YAH-64 ADVANCED ATTACK HELICOPTER Final Report, 8-17 Dec. 1981
B D PICASSO, III, G T DOWNS, R M BUCKANIN, and J D OTTOMEYER Feb 1982 152 p refs
(AD-A125270, USAAEFA-80-17-2) Avail NTIS HC A08/MF A01 CSCL 01C

The Airworthiness and Flight Characteristics (A&FC) Evaluation Part 2, of the prototype YAH-64 helicopter (S/N 77-23258) was conducted at Palomar Airport, Carlsbad, California (elevation 328 ft) A total of 12 flights were conducted between 8 December and 17 December 1981 and 14 3 productive hours were flown Prior to this test significant design changes were incorporated in the flight control system, the digital automatic stabilization equipment (DASE) and the stabilator system to correct objectionable characteristics determined during the airworthiness qualification program Significant improvements in handling qualities were noted since the previous evaluation Uncommanded control inputs, caused by recentering of the SAS actuators, upon failure or disengagement of the DASE may cause a potentially hazardous situation The instrument flight characteristics of the YAH-64 are satisfactory in smooth air but have yet to be evaluated in turbulent conditions Manual programming of the stabilator in rearward flight did not significantly reduce objectional vibration at the pilot's station Results of this test have shown that both previously reported deficiencies and 14 shortcomings have been corrected One deficiency not previously observed, was identified the possibility of a false indication of dual engine failure following a single engine failure Two previously unreported shortcomings were also identified GRA

N83-25706# European Space Agency, Paris (France)
EVALUATION OF AERODYNAMIC DERIVATIVES FROM DO-28-TNT FREE-FLIGHT MODEL TESTS
M MARCHAND Apr 1983 40 p refs Transl into ENGLISH of "Bestimmung der Derivate eines Do-28-TNT Modells aus Freiflugversuchen', DFVLR, Brunswick Report DFVLR-FB-82-17, May 1982 Original report in GERMAN previously announced as N83-18711
(ESA-TT-784, DFVLR-FB-82-17) Avail NTIS HC A03/MF A01, original German version available from DFVLR, Cologne DM 16 50

Free flight tests were conducted on a Do-28-TNT model to determine the derivatives of longitudinal motion Preprogrammed control inputs were given to the elevator or the flaps during the free flight phase The mathematical model which included the frequency dependent effects of rapid flap deflection and the pitch rate measuring system is described Analysis reveals that the dynamics of the measuring circuitry must be considered in the mathematical model Changes in the resulting derivatives if the time constant of a filter located in the pitch rate channel was not known exactly, or was neglected were examined In order to determine pitching moment derivatives, a fast combined step input signal is best For the normal force derivatives a slower input with additional trimming by mass changes is preferable Comparison of the identifications performed with different mathematical models shows that for an investigation into the influence of nonstationary effects a significantly higher frequency excitation, in the range of 5 to 10 Hz, is necessary Author (ESA)

N83-26812# Air Force Flight Dynamics Lab, Wright-Patterson AFB, Ohio
STATISTICAL EXPERIMENTAL DESIGNS IN COMPUTER AIDED OPTIMAL AIRCRAFT DESIGN Final Report
K S NAGARAJA and R B RAM (State Univ of New York) *In* AFWAL A Collection of Papers in the Aerospace Sci p 648-670 Jun 1982 refs
Avail NTIS HC A99/MF A01 CSCL 01C

A review of the statistical experimental designs which are relevant to the selection process of the design variables is made Although several aerospace industries still use Latin Square techniques, the inherent shortcomings of the approach are not recognized Optimal aircraft designs which are derived from such a deficient method become suspect, and reliability and cost saving can both become unattainable An alternate approach, called D-optimal design, which has several advantages due to its reliability and efficiency, is discussed R J F

N83-26829*# Lightning Technologies, Inc, Pittsfield, Mass
AIRCRAFT LIGHTNING-INDUCED VOLTAGE TEST TECHNIQUE DEVELOPMENTS Final Report
K E CROUCH Jun 1983 71 p refs
(Contract NAS4-2930)
(NASA-CR-170403, NAS 1 26 170403, LT-82-132) Avail NTIS HC A04/MF A01 CSCL 01C

High voltage safety, fuels safety, simulation, and response/measurement techniques are discussed Travelling wave transit times, return circuit conductor configurations, LC ladder network generators, and repetitive pulse techniques are also discussed Differential conductive coaxial cable, analog fiber optic link, repetitive pulse sampled data instrumentation system, flash A/D optic link system, and an FM telemetry system are considered Author

N83-26830# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
DYNAMIC CHARACTERISTICS OF AERIAL REFUELING SYSTEMS M.S. Thesis
T J CARTER, III Dec 1982 91 p refs
(AD-A124770, AFIT/GAE/AA/82D-4) Avail NTIS HC A05/MF A01 CSCL 01B

Two aircraft refueling system configurations were simulated using HYTRAN, an existing transient flow analysis computer program Transient pressure response subsequent to downstream valve closure was investigated for the KC-135 and a laboratory test rig and compared to available experimental data and previous research Parametric studies were performed of system variables valve closure time, valve area versus time (closure curves), and variation in surge attenuation components (surge boot, accumulators) A typical closure curve for quick disconnects was approximated and verified The simulation results compared favorably with experimental data and previous work Transient pressure was found to be sensitive to accumulator or surge boot precharge pressure while changes in accumulator volume had little effect Variations in accumulator entry line diameter or length affected transient pressure and settling time Increased valve snubbing reduced maximum transient pressures Author (GRA)

N83-26831*# Boeing Commercial Airplane Co, Seattle, Wash
SELECTED ADVANCED AERODYNAMICS AND ACTIVE CONTROLS TECHNOLOGY CONCEPTS DEVELOPMENT ON A DERIVATIVE B-747 AIRCRAFT Summary Report, May 1977 - May 1979
NASA Washington Jun 1983 51 p refs
(Contract NAS1-14741)
(NASA-CR-3295, NAS 1 26 3295) Avail NTIS HC A04/MF A01 CSCL 01C

Analytical design and wind tunnel test evaluations covering the feasibility of applying wing tip extensions, winglets, and active control wing had alleviation to the model B747 are described Aerodynamic improvement offered by wing tip extension and winglet individually, and the combined aerodynamic and weight improvements when wing load alleviation is combined with the tip extension or the winglet are evaluated Results are presented in the form of incremental effects on weight mission range, fuel usage, cost, and airline operating economics Author

N83-26832# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio Mechanical Branch
EXPERIMENTAL ANALYSIS OF THE PERFORMANCE OF AN ANNULAR PERIPHERAL JET VEHICLE IN GROUND EFFECT Final Report, Aug. 1980 - Jan. 1982
R J ALMASSY Oct 1982 42 p refs
(Contract AF PROJ 2402)
(AD-A124949, AFWAL-TR-82-3043) Avail NTIS HC A03/MF A01 CSCL 01C

Two annular peripheral jet air cushion models were designed, fabricated and tested in-house at the Mobility Development Laboratory (AFWAL/FIEMB) at Wright-Patterson AFB, OH The vehicles were designed to attain maximum hover height at a fixed level of available power based on Barratt Theory, and achieve maximum static hover stability The assumptions and analytic development of Barratt Theory are discussed, as well as some design aspects to achieve vehicle cushionborn stability Test results indicated Barratt lift predictions to be slightly conservative Both vehicles were unstable at high hover power heights in their basic configurations The addition of several configurations of vertical strakes compartmenting the cushion area achieved varying improvements to vehicle stability The addition of full cushion depth cruciform strakes completely stabilized the vehicles Vehicle instability was concluded to be caused by aerodynamic activity in the cushion area induced by shear from high momentum jet airflow GRA

N83-26833# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
SURVIVABILITY OF INTERDICTION AIRCRAFT: SENSITIVITY TO TERRAIN FOLLOWING, COMMAND ALTITUDE, VELOCITY AND ELECTRONIC COUNTER MEASURES M.S. Thesis
M D REID Dec 1982 230 p refs
(AD-A124870, AFIT/GOR/MA/82D-2) Avail NTIS HC A11/MF A01 CSCL 01C

The FORTRAN program TERRAIN is a deterministic model of a tactical aircraft penetrating a Surface-to-Air (SAM) and Anti-Aircraft Artillery (AAA) threat TERRAIN generates a terrain following flight path profile based on specified flight parameters and then assesses the aircraft vulnerability in terms of exposure time and shots taken by individual threat site and the total defense Modifications were made to assess aircraft survivability (the probability of kill of the aircraft) and to calculate the effect on the probability of kill of electronic countermeasures The TERRAIN model is particularly sensitive to the selection of beddown, rate of fire for AAA, aircraft velocity, and aircraft commanded clearance altitude A comparison of the strengths and weaknesses of the original TERRAIN model, the modified TERRAIN model, and six other SAM/AAA models has been compiled A user's guide for the modified TERRAIN model is provided Author (GRA)

N83-26834# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT Semiannual Summary Report, 1 Jan. 1962 - 30 Jun. 1982
W J WILLIAMS 1 Nov 1982 158 p
(AD-A124966, NADC-13920-2) Avail NTIS HC A08/MF A01 CSCL 01A

This is a semiannual progress report, and it presents a specialized summary of the data in the counting accelerometer program Statistics describing Navy and Marine aircraft cumulative g-count exceedances are calculated and tabulated These tabulations are separated by calendar time and into four major categories of Fleet experience Navy Training, Navy Combat, Marine Training, and Marine Combat Load rate distributions in counts per 1000 hours are calculated for all g-levels Distribution statistics (mean, standard deviation, and skewness) are presented for most models GRA

N83-26835# Calspan Corp, Buffalo, N Y Flight Research Dept
LATERAL FLYING QUALITIES OF HIGHLY AUGMENTED FIGHTER AIRCRAFT, VOLUME 1 Final Report, Mar. 1980 - May 1982
S J MONAGAN, R E SMITH, and R E BAILEY Wright-Patterson AFB, Ohio AFWAL Jun 1982 85 p refs
(Contract F33615-79-C-3618)
(AD-A118070, CALSPAN-6645-F-8-VOL-1, AFWAL-TR-81-3171-VOL-1) Avail NTIS HC A05/MF A01 CSCL 01C

This in-flight simulation experiment, using the USAF NT-33 variable stability aircraft operated by Calspan, was undertaken to generate lateral-directional flying qualities data applicable to highly augmented fighter aircraft In particular, the effects of time delay and prefilter lag in the lateral flight control system were studied for representative Flight Phase Category A and C tasks The combined effects of those elements as well as the effects of nonlinear command gain and high Dutch roll damping were also evaluated Tasks included were actual target tracking, air refueling and precision landing as well as special Head-Up Display (HUD) tracking tasks Results indicated that a properly designed HUD bank angle tracking task is a valid flying qualities evaluation task Data show that lateral flying qualities are very sensitive to control system time delay and very short values of roll mode time constant typically result in poor lateral flying qualities Excellent separation of the data into flying qualities level is achieved for the Category A task data using time domain equivalent indicated by the data, sensitivity to equivalent time delay is a minimum at this value Volume I contains the body of the report, while Volume II consists of the Appendices GRA

N83-26836# Research Inst of National Defence, Linkoeping (Sweden)
SIMULATION PROGRAM OF ROTARY WINGS [PROGRAM FOER SIMULERING AV HELIKOPTERROTOR]
A WALLIN Dec 1982 31 p In SWEDISH
(FOA-C-30308-E1) Avail NTIS HC A03/MF A01

A computerized simulation program written in FORTRAN for producing images of rotary wings by means of an image-generating infrared camera is described The rotor image can be completed by adding a function representing the helicopter body Correlative noise, subdivided in rectangles, can be added to the image Author (ESA)

06

AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments

A83-36207#
ADVANCED DISPLAY TECHNIQUES FOR TRAINING THE MULTI-MEMBER TACTICAL AIR CREW
G ALBERS (General Electric Co, Simulation and Control Systems Dept, Daytona Beach, FL) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 32-34
(AIAA PAPER 83-1079)

The C-130 Weapon System Trainer Visual System developed for the Military Airlift Command at Little Rock AFB is described The 6-window, 10-window-position visual display system, driven by five 875-line, 1000 pixel/line CIG channels, is shown to meet the requirements for multimember-crew training field of view (from 30 x 40 to 36 x 48 deg), visual-cue content, environmental context, correlation with navigational aids, radar, and station-keeping devices, textural relief, resolution (better than 2 7 arc min), data-base geographic and logistic size (over 33,000 sq n mi), realistic night operation, night-vision goggle compatibility, and cost

effectiveness The solution of the problems associated with the CRT reproduction of night conditions is given special consideration T K

A83-36303#
MODERN TECHNOLOGY AND AIRBORNE ENGINE VIBRATION MONITORING SYSTEMS
D J RAY (Endevco, San Juan Capistrano, CA) and R L KALLIO (Boeing Commercial Airplane Co , Seattle, WA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p
(AIAA PAPER 83-1240)

An improved technique for measuring in-flight turbine engine vibration levels is described It is noted that the normally-used velocity coils are subject to wear and are orientation-dependent Newer aircraft are being equipped with piezoelectric accelerometers, which feature high impedance levels but are subject to high electrical noise levels The introduction of a digital tracking filter into digital signal processing avionics has permitted tracking the rotor speed with a microcomputer by using a narrowband response Noise is thereby eliminated, and the devices have been implemented in the engines on the 747, 757, and 767 aircraft The microprocessor can be programmed to receive multiple channels of tachometer data, as well as to hold preset vibration alarm levels that will lead to indication appearing on the flight deck when reached M S K

A83-36325#
ADVANCED TECHNIQUES FOR GAS AND METAL TEMPERATURE MEASUREMENTS IN GAS TURBINE ENGINES
E A PINSLEY (United Technologies Corp , Pratt and Whitney Group, West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p refs
(AIAA PAPER 83-1291)

In connection with a continuing improvement regarding the performance of new gas turbine designs, both gas and metal temperature measurements for the next generation of engines will have to be performed at increasingly higher temperature levels in regions where heat fluxes, g-loads, erosion rates, and sensitivity of measurement requirements to instrument installation perturbations will all increase The present investigation is concerned with the status of a number of advanced techniques for high temperature measurement currently in various stages of development and acceptance The devices considered for the measurement of metal temperatures include thin film thermocouples, pyrometers, and IR scanning cameras Approaches for determining gas temperatures are also discussed, taking into account Coherent Anti-Stokes Raman spectroscopy (CARS) and dynamic temperature sensors G R

A83-36326#
APPLICATION OF THIN FILM STRAIN GAGES AND THERMOCOUPLES FOR MEASUREMENT ON AIRCRAFT ENGINE PARTS
W R STOWELL and R A WEISE (General Electric Co , Cincinnati, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p
(AIAA PAPER 83-1292)

In connection with aerodynamic disturbances caused by wire strain gages on compressor blade air foils, a program was initiated to develop mesurement techniques which could provide dynamic strain information from blades in an operating test engine without affecting the response of the blades to their environment and without changing significantly the airflow Reliable gages could be developed for measurements at temperatures up to 1000 F (540 C) Attention is given to the development of gages which are reliable at metal temperatures of 1200 F (approximately 650 C) Reliable thermocouples for measurements on operating turbine buckets are also being developed It is intended to apply thin film thermocouples to turbine buckets in connection with a study involving the mapping of temperature profiles in the vicinity of air cooling holes on advanced bucket designs Attention is given to a thin film insulator, quality control, and aspects of thin film thermocouple development G R

A83-36327#
INSTRUMENTAL PROBLEMS IN SMALL GAS TURBINE ENGINES
J ALLAN, III (Garrett Turbine Engine Co , Phoenix, AZ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p
(AIAA PAPER 83-1293)

The small size, high rotational speeds, and unusual flowpath configurations associated with small gas turbine engine development programs make it necessary to develop instrumentation techniques and systems compatible with the special problems encountered in connection with the smaller engines Typical measurement techniques include blade tip clearance measurement systems, slip-ring systems, telemetry systems, and torque measurement systems A description is provided of the 'single-point probe' survey system This system represents a computer-controlled preprogrammed traversing actuator and data acquisition system which allows vane wake mapping and rotor performance mapping without the use of traditional wake rakes This method of performance mapping reduces flow blockage and flow disturbances and eliminates measurement inaccuracies associated with sensor-to-sensor variations G R

A83-36613
A TRUE AIR SPEED SENSOR FOR MINIATURE UNMANNED AIRCRAFT
J A C BEATTIE (Royal Aircraft Establishment, Farnborough, Hants , England) Aeronautical Journal (ISSN 0001-9240), vol 87, May 1983, p 173-175 refs

A prototype sensor with digital output is described Vortex shedding principles are exploited by using a bluff body with end-plates to produce a stable set of vortices alternately from the edges of the body Vortex production frequency is directly proportional to the speed of the fluid past the body A pair of printed thick film thermistors detect the vortices Tests show excellent linearity of response, although sensor geometry, and signal processing electronics can be improved Previously announced in STAR as N82-14086 Author

N83-25707*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
DESCRIPTION OF THE COMPUTATIONS AND PILOT PROCEDURES FOR PLANNING FUEL-CONSERVATIVE DESCENTS WITH A SMALL PROGRAMMABLE CALCULATOR
D D VICROY and C E KNOX May 1983 37 p refs
(NASA-TM-85642, NAS 1 15 85642) Avail NTIS HC A03/MF A01 CSCL 01D

A simplified flight management descent algorithm was developed and programmed on a small programmable calculator It was designed to aid the pilot in planning and executing a fuel conservative descent to arrive at a metering fix at a time designated by the air traffic control system The algorithm may also be used for planning fuel conservative descents when time is not a consideration The descent path was calculated for a constant Mach/airspeed schedule from linear approximations of airplane performance with considerations given for gross weight, wind, and nonstandard temperature effects The flight management descent algorithm and the vertical performance modeling required for the DC-10 airplane is described Author

N83-25709# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
MODELING THE HELMET-MOUNTED SIGHT SYSTEM M.S. Thesis
W R CLUBINE Dec 1982 201 p refs
(AD-A124681, AFIT/GE/EE/82D-24) Avail NTIS HC A10/MF A01 CSCL 17G

This report describes the development of an error model for the Helmet-Mounted Sight System This model is designed to generate the HMS aiming errors that are encountered when the

sight is used in the Navigation Update role This report details the research performed to identify, catagorize, and model the Helmet-Mounted Sight (HMS) errors The HMS error model includes error generated by the human operator, the HMS equipment, the vibration environment, canopy refraction, and the system boresighting procedure The final portion of this report demonstrates the performance of this model in a Monte Carlo simulation program Author (GRA)

N83-25710# Defence and Civil Inst of Environmental Medicine, Downsview (Ontario)
THEORY UNDERLYING THE PERIPHERAL VISION HORIZON DEVICE
K E MONEY Dec 1982 13 p refs
(AD-A124426, DCIEM-TC-82-C-57) Avail NTIS HC A02/MF A01 CSCL 01D

A simple statement of the Peripheral Vision Horizon Device (PVHD) theory is that the likelihood of pilot disorientation in flight can be much reduced by providing a new kind of artificial horizon that will provide orientation information to peripheral vision In considering the validity of this theory, three questions which are crucial are discussed (1) Why was the artificial horizon chosen, instead of some other flight instrument? (2) Why is peripheral vision used instead of foveal vision? (3) Is there convincing evidence that peripheral vision is particularly well suited to the processing of orientation information? GRA

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

A83-34253
THERMAL CYCLING IN COMPACT PLATE-FIN HEAT EXCHANGERS
T D EASTOP and G SINGH (Wolverhampton Polytechnic, Wolverhampton, England) IN Numerical methods in thermal problems Volume 2 Proceedings of the Second International Conference, Venice, Italy, July 7-10, 1981 Swansea, Wales, Pineridge Press, 1981, p 723-736 refs

Compact plate-fin heat exchangers of the considered type are used in the aircraft industry because of their small volume and weight The heat exchanger consists of a series of flat plates, sandwiching corrugated plates, and separated by spacer bars The heat exchanger considered in the present investigation is subjected to a sudden flow of hot air on one side of the exchanger with the air coolant side inlet temperature remaining constant Since this sudden increase in temperature occurs every time the aircraft takes off, the heat exchanger is subjected to a thermal cycle with a long time period A cross-flow plate-fin type heat exchanger with both fluids unmixed is analyzed numerically, taking into account the thermal storage of the fluids and the metal, but assuming that the fluid properties are constant G R

A83-35039
THE USE OF A STRUCTURAL MODEL FOR DETERMINING THE ADAPTABILITY CURVE FOR TURBINE DISKS IN STRESS CONCENTRATION ZONES [ISPOL'ZOVANIE STRUKTURNOI MODELI DLIA OPREDELENIIA KRIVOI PRISPOSOBLIAEMOSTI TURBINNYKH DISKOV V ZONAKH KONTSENTRATSII NAPRIAZHENII]
A E GINZBURG and E T KULCHIKHIN Problemy Prochnosti (ISSN 0556-171X), May 1983, p 38-40 In Russian refs

A method based on the adaptability theory is proposed for the analysis of turbine disks in the case where alternating-sign inelastic deformation occurs in the stress concentration zone Here, a curve calculated on the basis of a structural model for an elastoviscoplastic medium is used instead of the experimentally determined cyclic deformation curve The method can be used for the stress-strain analysis of gas-turbine disks loaded in accordance with a complex program (e g , cyclic loading with holds) V L

A83-35675
AR.318 - ITALY'S LOW-COST GA TURBOPROP
J MOXON Flight International (ISSN 0015-3710), vol 123, May 21, 1983, p 1398, 1399

Design and performance features of the AR 318 600 shp turboprop, targeted for production in 1985, are detailed The AR 318, the first turbine engine to be wholly built in Italy, has been designed for simplicity and low-cost manufacture It has a single shaft, a single-stage centrifugal compressor at one end driven by a two-stage turbine at the other, and a reverse flow annular combustion chamber An epicyclic gearbox transfers power to the propeller, and drives the oil pump, fuel control unit, the starter/generator, and the propeller control unit The dry weight is 310 lb and fuel consumption is 0 578 lb/hr per shp Further increases of power to 850 shp are projected with a new centrifugal compressor There is no provision for turbine blade cooling Overhaul life is expected to be 500 hr at first, and 3500 hr with experience M S K

A83-35790
TEMPERATURE AND COMPOSITION MEASUREMENTS IN A RESEARCH GAS TURBINE COMBUSTION CHAMBER
W P JONES and H TORAL (Imperial College of Science and Technology, London, England) Combustion Science and Technology (ISSN 0010-2202), vol 31, no 5-6, 1983, p 249-275 Research sponsored by Rolls-Royce, Ltd refs

Motivation regarding an improvement in the design of gas turbine combustion chambers is related to the need to achieve improved combustor exit temperature profiles, longer combustor life, and reduced combustion generated pollutant emission levels Better understanding of combustor operation is required to achieve these objectives and this in turn requires sufficiently detailed experimental data The present investigation is concerned with measurements in a model can-type combustion chamber intended to be representative of aircraft gas turbine combustors The fuel employed was gaseous propane Measurements are presented of O2, CO, CO2, H2, unburnt hydrocarbons, NOx, and temperature, taking into account the exit plane and various planes within the combustor at different air inlet temperatures G R

A83-35801
INTERNATIONAL SYMPOSIUM ON AIR BREATHING ENGINES, 6TH, PARIS, FRANCE, JUNE 6-10, 1983, SYMPOSIUM PAPERS
F S BILLIG, ED (Johns Hopkins University, Laurel, MD) New York, American Institute of Aeronautics and Astronautics, 1983, 733 p

Among the topics discussed in the present conference on airbreathing aircraft and missile propulsion systems are solid propellant ramjets, combustion instability in liquid-fueled ramjets, gas turbine engine combustion research trends, the effects of air, liquid and injector geometry variables on the performance of a plain jet airblast atomizer, the prediction of spray evaporation rates, the internal and external transonic flow fields of inlets, the localized stability of vortices, the lean extinction limit for pilot flame holders, and turbulent flame propagation in swirl-stabilized flames Also considered are boundary layer development in a supersonic intake, computational techniques for the design of ramjet engines, propulsion system performance, turbomachine flow field computation methods, NASA propulsion controls research, flight management concepts for fuel conservation, blade cascade aerodynamic losses, viscous transonic flow through cascades, a propulsion system simulation technique for scaled wind tunnel model testing, the calculation of secondary flows in an axial flow compressor, the effect of humidity on compressor performance, vectored thrust nozzles for future combat aircraft, centrifugal compressor impeller design, turbomachine heat transfer, and gas turbine rotating component life estimation methods O C

A83-35806*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
NEW TRENDS IN COMBUSTION RESEARCH FOR GAS TURBINE ENGINES
E J MULARZ (NASA, Lewis Research Center, Combustion Fundamentals Section, U S Army, Propulsion Laboratory, Cleveland, OH) IN *International Symposium on Air Breathing* Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 37-44 Army-supported research refs

Research on combustion is being conducted to provide improved analytical models of the complex flow and chemical reaction processes which occur in the combustor of gas turbine engines, in order to enable engine manufacturers to reduce the development time of these concepts The elements of the combustion fundamentals program is briefly discussed with examples of research projects described more fully Combustion research will continue to emphasize the development of analytical models and the support of these models with fundamental flow experiments to assess the models accuracy and shortcomings *Previously announced in STAR as N83-20947* Author

A83-35812#
THE EFFECT OF FUEL ATOMIZATION ON SOOT-FREE COMBUSTION IN A PREVAPORIZING COMBUSTOR
W BUSCHULTE (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer chemische Antriebe und Verfahrenstechnik, Hardthausen, West Germany) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 79-89 refs

A combustor system with combustion gas recirculation for soot-free combustion of hydrocarbon fuels with air is described The system itself contains - besides means for air supply and distribution and for fuel supply, atomization and distribution - a mixing tube for the introduction of recirculating combustion gas into the air-fuel-mixture stream promoting fuel evaporation and a flame tube for defining a properly sized reactor space Certain interrelationships between certain measures of the combustor elements are to be obeyed to achieve proper and stable operation Special importance for proper functioning was predicted by theory for the maximum droplet size in the fuel spray Experimental studies have been carried out to evaluate the influence of the droplet size in the spray on sootfreeness of combustion As well droplet size, fuel-air mixture ratio and fuel viscosity has been varied The results show a clearly defined influence of fuel droplet size As a subsidiary result viscosity effects on nozzle flow parameters and maximum droplet size development are described Author

A83-35820#
SEMI IMPLICIT CALCULATION METHOD OF THE FLOW FIELD IN A DUCT WITH THE FLAME STABILIZED BY A STEP
P MAGRE (ONERA, *Chatillon-sous-Bagneux, Hauts-de-Seine*, France) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 147-153 refs

A finite volume semiimplicit and fast numerical method for combustion flow prediction is applied to a problem involving the coupling of equations, with a view to ensuring computational stability After performing tests for the validation of computations without combustion for the cases of various geometrical configurations, the method's suitability for combustion flow phenomena is tested in the case of a premixed flame that is stabilized by a step It is found that, despite the turbulent combustion model's simplicity, the numerical method is able to provide a realistic simulation of combustion flow O C

A83-35829#
DESIGN AND DEVELOPMENT OF A SMALL GASTURBINE ENGINE: RESULTS TODAY - A BASIS FOR DESIGN CRITERIA OF A NEXT GENERATION
H FRICKE and P KOEGEL (KHD Luftfahrttechnik GmbH, Oberursel, West Germany) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 231-239

Attention is given to the aerodynamic, thermodynamic, and mechanical design features of the T 117 family of small turbojet engines, which employ a radial compressor and a single turbine stage and exhibit operating cost and reliability improvements over existing engines of comparable design The T 117 has been certified for flight after undergoing the flight trials of the CL 289 reconnaissance drone, for which it was designed A derivative of the T 117, the T 317, is being prepared for flight tests in a new generation trainer aircraft O C

A83-35830#
PRELIMINARY INVESTIGATION ON THE PERFORMANCE OF REGENERATIVE TURBOFAN WITH INTER-COOLED COMPRESSOR AND ITS INFLUENCE TO AIRCRAFT
Y MIURA (Metropolitan College of Technology, Tokyo, Japan) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 240-248 refs

A novel intercooler arrangement is proposed for a regenerative turbofan engine, which promises specific fuel consumption reductions without incurring thrust deterioration due to core jet velocity reduction and regenerating system pressure losses The intercooler heat sinks are cold ram air and fan duct air Calculations are presented for high and low bypass engines incorporating the present regenerator, and calculation results indicate increased thrust for the high bypass engine Favorable results are also obtained by a flight performance study of aircraft equipped with the regenerative turbofan O C

A83-35831#
ON THE PROPULSION SYSTEM OF THE NAL QUIET STOL RESEARCH AIRCRAFT
M MORITA, M SASAKI, M MAITA, K TAKASAWA, T TORISAKI, and M MATSUKI (Science and Technology Agency, National Aerospace Laboratory, Tokyo, Japan) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 249-257 refs

The Japanese National Aerospace Laboratory's Quiet Short Take-Off and Landing (NAL-QSTOL) experimental aircraft, whose first flight is scheduled for 1984, employs an upper surface-blowing propulsive lift system to achieve the life augmentation required for low speed STOL operation by means of the Coanda effect The NAL-QSTOL is powered by four high bypass ratio turbofan engines requiring a very complex installation system, with a confluent, long duct exhaust system and a bleed air schedule requiring up to 10 percent of the core airflow for such functions as boundary layer control, engine nacelle deicing, and cabin air conditioning O C

A83-35832#
THE PREDICTION OF PERFORMANCE OF TURBOJET ENGINE WITH DISTORTED INLET FLOW AND ITS EXPERIMENTAL STUDIES
D QIUTING, C MENGZI, S HUILI, and C FUQUN (Northwestern Polytechnical University, Xian, People's Republic of China) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 258-262 refs

A83-35833#
COST EFFECTIVE PERFORMANCE RESTORATION OF HIGH BY-PASS ENGINES
R JASPAL and G GREGG (General Electric Co , Cincinnati, OH) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 263-276 refs

This paper discusses the evolution of engine maintenance practices and the resultant effects on reduced shop visit rates and, hence, the engine direct maintenance costs Economic conditions have mandated a reduction in fuel and direct maintenance costs which have resulted in development of cost effective engine maintenance practices Methods developed for cost studies enabled module and engine overhaul time intervals and also extraordinary performance restoration shop actions to be defined for the General Electric CF6-50 engines Author

A83-35841#
SOME ASPECTS OF DEVELOPMENT OF POWER PLANT OPTIMUM CONTROL TO INCREASE AIRCRAFT FUEL EFFICIENCY
O K IUGOV (Gosudarstvennyi Institut Aviatsionnogo Motorostroeniia, Moscow, USSR) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 334-341

This paper outlines the basic principles for optimum power plant control at different stages of flight The range of flight is taken as an optimization criterion which represents operational effectiveness of the power plant To solve the problem the methods of optimization are used which are based on the Pontryagin maximum principle and nonlinear progamming methods Optimum control laws are implemented by introducing electronic power plant control systems and onboard digital computers Author

A83-35842*#
INLET, ENGINE, AIRFRAME CONTROLS INTEGRATION DEVELOPMENT FOR SUPERCRUISING AIRCRAFT
J H HOUCHARD, C M CARLIN, and E TJONNELAND (Boeing Military Airplane Co , Seattle, WA) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 342-356 refs
(Contract NAS1-16150)

In connection with a consideration of advanced military aircraft systems, attention is given to research for improving the technology of the design of supersonic cruise aircraft Syberg et al (1981) have shown that an analytic design method is now available to accurately predict the flow characteristics of axisymmetric supersonic inlets, including off-design angle of attack operation On the basis of information regarding the inlet flow characteristics, the control system designer can begin the inlet design and development, before wind tunnel testing has begun The present investigation is concerned with details and status of inlet control technology A detailed representation of a supersonic propulsion system is developed This development demonstrates the feasibility of the selected hybrid computational concept G R

A83-35843*# Analytical Mechanics Associates, Inc , Mountain View, Calif
FLIGHT MANAGEMENT CONCEPTS DEVELOPMENT FOR FUEL CONSERVATION
J A SORENSEN (Analytical Mechanics Associates, Inc , Mountain View, CA) and S A MORELLO (NASA, Langley Research Center, Flight Management Branch, Hampton, VA) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 357-366 refs

It is pointed out that increased airspace congestion will produce increased flight delay unless advanced flight management concepts are developed to compensate It has been estimated that a 5 percent reduction in delay is approximately equivalent, in terms of direct operating costs, to a 5 percent reduction in drag The present investigation regarding the development of the required flight management concepts is organized into three sections, related to background, current research, and future effort In the background section, a summary is provided of past technical effort concerning flight management The second section is concerned with on-going efforts to integrate flight management with ground-based flight planning, and with an advanced concepts simulator to test the new developments In the third section, attention is given to research concerning airborne flight management integration with other flight functions G R

A83-35846#
A DYNAMIC MODEL OF TURBOJET IN STARTING AT HIGH ALTITUDE
D -Y YAN and Z -F MAI (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 385-393 refs

A dynamical model for the starting of a turbojet engine is employed in the computation of the windmilling-to-idling transient process, where the model's establishment required both the definition of steady state mathematical models of components and the construction of a dynamic model for the entire powerplant system The steady state model presently used for the compressor in the low speed starting region is based on the theory of stage performance for axial compressors, together with the method of functional approximation by means of vectorial transformation The model is verified in light of the results of both performance tests and digital computations O C

A83-35847#
THE TRANSIENT PERFORMANCE OF TURBOJET ENGINES AND AXIAL COMPRESSORS
S M RAMACHANDRA, F I ABDELMALIK, and M A MUNTASSER (Alfateh University, Tripoli, Libya) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 394-398

Slam acceleration characteristics of turbojet engines determine the maneuvering performance of military aircraft and the emergency handling characteristics of civil aircraft A pair of coupled differential equations for the rotational speed and the mass flow rate of the turbojet engine is presented together with an algebraic equation for the compression pressure ratio, giving the overall system performance in terms of the component performance The differential equations have been solved analytically assuming an overall linear performance of the exit jet velocity, the exhaust plane pressure and the thrust It is found that the mass flow rate variation lags/leads in phase the rotational speed acceleration/deceleration for a non-stationary engine while for the case of the stationary engine, this phase reverses The thrust variation follows the mass flow rate variation in a similar manner An expression for the characteristic relaxation time of the engine mass flow rate response is given which is also nearly equal to that of the thrust relaxation time Author

A83-35848#
DEVELOPMENT OF A TURBOJET ENGINE SIMULATOR FOR SCALE MODEL WIND TUNNEL TESTING OF MULTI-MISSION AIRCRAFT
D J DUSA, C D WAGENKNECHT (General Electric Co , Cincinnati, OH), and T J NORBUT (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 399-407 refs

Conventional wind tunnel test techniques do not provide simultaneous simulation of inlet, airframe and exhaust system flowfields A propulsion simulator is a miniature jet engine which enables the correct, or near-correct, simulation of inlet and exhaust system flows simultaneously Work on the development of such a miniature jet engine began with the Multi-mission Aircraft Propulsion

Simulator (MAPS) in 1969 Encouraged by the successful demonstration of the MAPS system's prototype, the development of a Compact Multi-mission Aircraft Propulsion Simulator (C-MAPS) began in 1976 C-MAPS incorporates a four-stage compressor and a single turbine stage which is driven by an external high pressure air source Attention is presently given to C-MAPS's instrumentation, control console, performance maps, line losses, parasitic flows, and current development status O C

A83-35849#
A STUDY OF THE RESPONSE OF A TURBOJET ENGINE TO THE INLET TEMPERATURE TRANSIENTS
D K DAS (New York, State University, Utica, NY), N J SEYB (Rolls-Royce, Ltd , Compressor Research and New Projects Dept , Bristol, England), and A TRIPPI IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 408-415 refs

The effects of temperature transients on the stability limits of a turbojet engine fitted with a 15-stage axial flow compressor are studied by means of a modeling technique in which the engine is seen as a series of ducts whose flow is one-dimensional and unsteady A numerical technique based on the method of characteristics has been used to solve the conservation equations and the first order, ordinary differential equation introduced to model the compressor's dynamic response The model is applied to the simulation of engine response to the ingestion of planar entropy waves due to fast temperature ramps at the system inlet The events leading up to the engine's surge and stability limits, as predicted by the model, compare well with both qualitative and quantitative experimental values from the literature O C

A83-35854#
EFFECT OF SAND EROSION ON THE PERFORMANCE DETERIORATION OF A SINGLE STAGE AXIAL FLOW COMPRESSOR
W TABAKOFF and C BALAN (Cincinnati, University, Cincinnati, OH) IN *International Symposium on Air Breathing Engines, 6th*, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 458-467 refs
(Contract DAAG29-82-K-0029)

Aircraft engines operating in areas where the atmosphere is polluted with small solid particles are subjected to performance deterioration Improvement in performance deterioration can prolong the engine life and save operating expenses Such an improvement is possible only by understanding the basic mechanism of erosion and the associated performance degradation This paper presents experimental work carried out on two-dimensional compressor cascades along with a theoretical model to predict the performance deterioration of cascades subjected to erosion In addition investigations are carried out on a single stage axial flow compressor to study the effect of erosion on performance Author

A83-35856*# Purdue Univ , Lafayette, Ind
EFFECT OF HUMIDITY ON JET ENGINE AXIAL-FLOW COMPRESSOR PERFORMANCE
C M EHRESMAN, S N B MURTHY, and T TSUCHIYA (Purdue University, West Lafayette, IN) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 479-486 refs
(Contract NAG3-62, NAG3-204, F33615-78-C-2401)

Two problems related to the ingestion of humid air into jet engine axial compressors have been studied (1) the changes in the performance of the compressor in the absence of condensation and (2) the changes in the entry conditions to the compressor when condensation occurs Regarding the first, the extent of changes are predicted and also measured in the case of a six-stage compressor operated with air-methane gas mixture utilizing the similarities in the thermodynamic properties between water vapor and methane For the condensation process in an inlet, a model is described that takes into account the presence of micro particulates and the flow field changes in the vicinity of the inlet wall Finally, the effects of humidity on engine performance are discussed in relation to engine trim and control schemes Author

A83-35858#
STATISTICAL STUDY OF TBO AND ESTIMATION OF ACCELERATION FACTORS OF ASMT FOR AIRCRAFT TURBO-ENGINE
Y -M ZHANG (Shanghai Aviation Industry Corp , Shanghai, People's Republic of China) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 499-509 refs

BASIC computer language methods are presented for the analysis of aircraft engine TBO, together with reliability On the basis of both a linear cumulative damage principle and the equality of safety load factors, a method of estimating the acceleration factor of components whose operating lives are determined by creep rupture stress, low cycle fatigue, contact stress and high cycle fatigue is given The estimation of the optimal maximum acceleration factor is based on a least squares method, and shows that the accelerated simulation mission test controllable parameters will gain in engine acceleration factor O C

A83-35859#
VECTORED THRUST AFTERBODY NOZZLES FOR FUTURE COMBAT AIRCRAFT
M DREVILLON and R FER (SNECMA, Departement Aerodynamique, Moissy-Cramayel, Seine-et-Marne, France) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 510-518

Comparative experimental study results are presented for thrust vectoring afterbody nozzles applicable to future combat aircraft, where the baseline design is an axisymmetric nozzle mounted on a spherical flange at the end of the afterburner Static performance has been measured on a mock-up with pressure ratios of up to 8 1 Configurations representative of dry and afterburning engine operation have also been tested, with vectoring angles of up to 20 deg An analysis of internal flow characteristics and interference with afterbody flaps is undertaken, and consideration is given to the potential future applications of thrust vectoring nozzles O C

A83-35865#
CONTRIBUTION TO CENTRIFUGAL COMPRESOR IMPELLER DESIGN
V VANEK (Vyzkumny a Zkusebni Letecky Ustav, Prague, Czechoslovakia) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 563-570 refs

A part of centrifugal compressor impeller pre-development research program is described The investigation results of the set of radially bladed impellers designated the ARTI 305 are discussed The impellers were designed for identical initial and boundary conditions Space shapes of the impellers blading are different The impellers blading geometry is defined by two so-called deceleration coefficients Experimental investigation was arranged to verify the impeller design and manufacture method and influence of the impeller blading space shape on its performance map Author

A83-35866#
THE EFFECT OF VARIATION OF DIFFUSER DESIGN ON THE PERFORMANCE OF CENTRIFUGAL COMPRESSORS
A M EL SIBAIE (Ain Shams University, Cairo, Egypt) and M H NASSAR (Egyptian Air Force, Cairo, Egypt) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 571-578 refs

Attention is given to the effect of the number of diffuser vanes, vane curvature, and diffuser rotation, on the performance of a

centrifugal compressor applied to an aviation piston engine Diffuser vane number and curvature have direct effects on compressor stage performance and diffuser efficiency, where the controlling factor is the ratio of overlap area between two successive vanes and the number of diffuser vanes Diffuser efficiency and compressor pressure ratio increase with this ratio By rotating the diffuser with the same angular velocity as the impeller, a higher pressure ratio was obtained for the compressor, together with a wider mass flow rate range O C

A83-35869#
COMPONENT LIFE REDUCTION DUE TO USE OF AVGAS IN GAS TURBINE ENGINES
M L SIDANA and K SRINIVASA (Ministry of Defence, Directorate of Aeronautics, Bangalore, India) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 597-602

Attention is given to the effects of the use of AVGAS fuel engines designed for operation on AVTUR fuels, with the intention of assessing the effects of the fuel change on fuel pump and hot section component service lives Erosion rate, crack growth rate, and burn areas were monitored, and the effect of erosion on turbine blade fatigue and creep life was analyzed and found to be life-limiting Low lubricity and higher vapor pressure also adversely affected fuel pump life O C

A83-35870#
LIFE ESTIMATION METHODS OF GAS TURBINE ROTATING COMPONENTS
J S RAO (Bharat Heavy Electricals, Ltd , Hyderabad, India) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 603-610 refs

An expression is derived for the computation of the equivalent cyclic damage rate of compressor and turbine disk spacers and shafts subjected to low cycle fatigue, where the fatigue is due to the cyclic loading which arises with engine speed changes The expression allows gas turbine designers to predict the low cycle fatigue life of rotating components in light of the assumed flight envelope of an aircraft A method is also given for the assessment of compressor blade life, which is based on a residual strength plot derived from the rig fatigue testing of blades O C

A83-35871#
CONTAINMENT OF TURBINE ENGINE FAN BLADES
J M PAYEN (SNECMA, Departement Mecanique Avancee, Moissy-Cramayel, Seine-et-Marne, France) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 611-616

Presented are an analysis of the gas turbine engine fan blade fragmentation process, an evaluation of blade fragment energy, an investigation of the fan casing performation mode, and the development of a stressing method applicable to metal containment casings which makes use of Kevlar fabric The metal casing stressing model employed is based on the theory of dynamic shearing perforation Tests simulating blade fragment impacts on Kevlar fabric strips were used to investigate fabric behavior and to define a method for the computation of the number of fabric layers required to achieve containment O C

A83-35872#
A CONTRIBUTION TO AIRWORTHINESS CERTIFICATION OF GAS TURBINE DISKS
J DREXLER and J STATECNY (Vyzkumny a Zkusebni Letecky Ustav, Prague, Czechoslovakia) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 617-622

Airworthiness proof of gas turbine disks involves some specific problems connected with the experimental verification of the admissible probability of a hazardous effect due to an individual failure The authors' attempt is to present a simple method how to meet the airworthiness requirements in case that the disk blade fir-tree attachment number exceeds some tenths, the dominating damage mechanism being low cycle fatigue The structure of the method consists in taking the disk operation or test as an experiment being run simultaneously on a group of identical test specimens up to appearances of the cracked attachment cumulative numbers describing achievement of the disk limit state Author

A83-35879#
INVESTIGATION METHODS ON RESIDUAL STRESSES IN AERO ENGINES COMPONENTS
J KAFKA, F NECKAR (Ceske Vysoke Uceni Technicke, Prague, Czechoslovakia), D SMETANA, and P VOSTATEK (Motorlet, Prague, Czechoslovakia) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 677-683 refs

Methods and obtained results are presented for the measurements of residual stresses in surface layers of chromium steel and titanium alloy materials used in the fabrication of axial compressor vanes and impellers for a small turboprop engine The measurements were conducted in order to increase both service life and reliability and fabrication process productivity In the case of compressor vanes, the connection between residual stress magnitude and fatigue limit is established Surface layer residual stress magnitude and character, after titanium alloy milling and finishing operations, were measured through the destructive method of electrochemical removal from the specimen surface while recording deformation O C

A83-35880#
STRESS ANALYSIS OF CRITICAL AREAS OF LOW-PRESSURE COMPRESSOR-DISC ASSEMBLY OF A DEVELOPMENTAL AERO-ENGINE
R PADMANABHAN, K RAMACHANDRA, B J RAGHUNATH, and V MARUTHI (Gas Turbine Research Establishment, Bangalore, India) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 684-691

A series of three-dimensional photoelastic investigations has been conducted in order to estimate the strength reserve factors of compressor blades and disks which employ lugs for attachment Attention is given to the influence of untwisting torque of wide chord and large twist blades on the stresses at the concave and convex profile fillets of blade aerofoil roots, together with the combined effect of large axial loads, rim-bending loads, and hoop loads, on stress concentration factors around the cutouts in the compressor disk rims Concave profile stresses as high as 5 8 times greater than those theoretically obtained for the root fillets of first stage blades are noted It is also confirmed that the influence of lug axial loads on disk stress concentration factors, under normal operating conditions, is not as significant as the radial rim loads O C

A83-35881#
EXCITATION AND VIBRATION OF FLEXIBLE BLADED DISKS UNDER OPERATING AND SIMULATED OPERATION CONDITIONS
Z DOLEZAL (Vyzkumny a Zkusebni Letecky Ustav, Prague, Czechoslovakia) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 692-699 refs

Theoretical and experimental investigation results are presented for bladed disk assembly vibration characteristics, with attention to those of impellers The formulas obtained for the exciting rotating vectors connected with an engine's internal operating conditions are used for the prediction and analysis of forced vibration, and for the simulation of the operating excitation Knowing the excitation and dynamical property rotating vectors of a bladed disk, the

resonances occurring under the given operating conditions may be predicted Experimental results are given for the dynamic responses of impellers that prove the theoretical solution's validity O C

A83-35882#
VARIATION OF ROTOR BLADE VIBRATION DUE TO INTERACTION OF INLET AND OUTLET DISTORTION
S YOKOI, S NAGANO (Ishikawajima-Harima Heavy Industries Co , Ltd , Aero-Engine and Space Development Group, Tokyo, Japan), and T ABE (Japan Defense Agency, Technical Research and Development Institute, Tokyo, Japan) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 700-707

The variation of rotor blade vibration due to the interaction of inlet and outlet distortion is experimentally investigated by means of a two-stage fan with a typical circumferential distortion screen The vibration level of the first and second stage rotor blades, and the pressure distributions upstream and downstream of the second stage, were investigated and compared for various screen circumferential positions In the case of combined inlet distortions, the distortion levels significantly changed according to screen circumferential position In the case of combined inlet and outlet distortions, inherent inlet distortion was nearly compensated for by outlet distortion for any screen position, and also yielded a constant blade vibration level O C

A83-35883*# Princeton Univ , N J
DESIGN OF DRY-FRICTION DAMPERS FOR TURBINE BLADES
W ANCONA and E H DOWELL (Princeton University, Princeton, NJ) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 708-722 refs
(Contract NAG3-221)

A study is conducted of turbine blade forced response, where the blade has been modeled as a cantilever beam with a generally dry friction damper attached, and where the minimization of blade root strain as the excitation frequency is varied over a given range is the criterion for the evaluation of the effectiveness of the dry friction damper Attempts are made to determine the location of the damper configuration best satisfying the design criterion, together with the best damping force (assuming that the damper location has been fixed) Results suggest that there need not be an optimal value for the damping force, or an optimal location for the dry friction damper, although there is a range of values which should be avoided O C

A83-36236#
CRITERIA FOR OPTIMIZING STARTING CYCLES FOR HIGH PERFORMANCE FIGHTER ENGINES
J B DAVIS and R R POLLAK (United Technologies Corp , Government Products Div , West Palm Beach, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p
(AIAA PAPER 83-1127)

This paper summarizes some of the criteria that must be considered to optimize starting cycles for modern fighter aircraft engines Due to high performance compression system designs, the ability to start successfully has become more challenging The effects of major variables that influence starting ability are discussed together with a description of improved techniques that are now available to quantify these variables As a result of these development efforts and the advent of fully electronic control systems, a unique, closed-loop starting system that has been designed and developed to provide consistency to the starting cycle regardless of external or internal conditions of the engine are discussed Author

A83-36238#
SIMULATION OF ADVANCED ENGINE LUBRICATION AND ROTOR DYNAMICS SYSTEMS - RIG DESIGN AND FABRICATION
A PEDUZZI (United Technologies Corp , Government Products Div , West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p
(AIAA PAPER 83-1133)

Advanced technology dual rotor turbofan and turbojet engines will incorporate rotor support system features to increase rotor speed capability and engine thrust-to-weight ratio while reducing cost These features may include straddle-mounted rotors, high strain energy low pressure rotors and counter-rotating shafts with a load-carrying intershaft bearing A 'bladeless engine' rig incorporating the above features has been designed and fabricated, and test plans formulated The rig will be utilized to evaluate counter rotating intershaft bearing lubrication and breather system operation, low leakage intershaft seals, and dynamic operation of counter-rotating rotors including identification of critical speed modes, shaft deflection and bearing load sensitivity to rotor imbalance, as well as oil film damper operation Pre-test calibrations of damper springrate and high and low rotor resonant frequencies were conducted System endurance will be evaluated in a 150-hour cyclic endurance test Author

A83-36244#
EFFECT OF FUEL COMPOSITION ON NAVY AIRCRAFT ENGINE HOT SECTION COMPONENTS
R E VOGEL, S B REIDER (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN), and P A KARPOVICH (U S Naval Air Propulsion Center, Trenton, NJ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p Navy-supported research
(AIAA PAPER 83-1147)

Fuel composition is examined with a view to relaxing fuel specifications and thus increasing the supply of gas turbine fuel The tests are carried out on the T56 aircraft engine, whose combustion system is described The effect of variation in fuel properties is evaluated by testing 10 experimental fuels in a single-can combustion rig The rig simulates a 60-deg sector of the T56 engine combustion system from diffuser inlet to turbine inlet, this includes the compressor discharge passage, the diffuser air passage, the inner and outer cases, and the turbine inlet passage The T56-A-14 combustion system is found in general to be highly tolerant of broadened fuel specifications It is believed that the limitations imposed on the ignition/lean blowout capability could be removed or reduced by modifications to the fuel injector design The incidence of a strong statistical correlation between fuel properties and combustor performance is found to be much higher at low power (idle, altitude cruise) than that at high power (climbout, takeoff) Another finding is that low-power gaseous emissions are influenced by physical fuel properties (distillation, viscosity, freeze point, pour point) No significant fuel property-emission correlations are found at high power C R

A83-36250*# General Motors Corp , Indianapolis, Ind
ADVANCED PROPFAN ENGINE CHARACTERISTICS AND TECHNOLOGY NEEDS
R D ANDERSON, J C GILL, and A S NOVICK (General Motors Corp , Indianapolis, IN) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p
(Contract NAS3-23046)
(AIAA PAPER 83-1155)

A comparative study is presented for two of the advanced gas turbine engine designs developed in the course of a proprietary research effort for the NASA Advanced Propfan Engine Technology research program In these engines, a cycle pressure ratio of 32 5 1 and a 2500 F maximum turbine temperature provide fuel efficient operation in the 32,000-ft altitude, Mach 0 72 cruise speed regime stipulated Both of the engine configurations incorporate three spools, of which the compressors are dual-spool and the power turbines are free A major design challenge for axial

compressors in the 10,000-shp class was the maintenance of adequate blade heights in the later stages O C

A83-36251#
THE PERFORMANCE OF SINGLE-SHAFT GAS TURBINE LOAD COMPRESSOR AUXILIARY POWER UNITS
C RODGERS (Solar Turbines, Inc , Turbomach Div , San Diego, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p refs
(AIAA PAPER 83-1159)

Military and commercial aircraft operating from remote airfields can attain self-sufficiency with small onboard auxiliary power units (APU) When large amounts of pneumatic ground power are required for aircraft systems cooling at hot day conditions in addition to self-start capability, the optimum APU is that which can provide air for the environmental control system and to an air turbine starter Three gas turbine APU configurations are used to supply essentially 100 percent pneumatic power output They include the single-shaft gas turbine integral bleed (SSGTIB), the single-shaft gas turbine load compressor (SSGTLC), and the two-shaft gas turbine load compressor The SSGTIB has dominated the pneumatic APU field for two decades Recently, the SSGTLC has entered the U S pneumatic power APU market The SSGTLC has operational characteristics which are different from those of the SSGTIB Attention is given to relevant information on the SSGTLC APU characteristics This information can be used for secondary power tradeoff studies by the aircraft-user G R

A83-36252*# General Electric Co , Cincinnati, Ohio
THE AERODYNAMIC DESIGN AND PERFORMANCE OF THE GENERAL ELECTRIC/NASA EEE FAN
T J SULLIVAN (General Electric Co , Cincinnati, OH) and R D HAGER (NASA, Lewis Research Center, Cleveland, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p refs
(AIAA PAPER 83-1160)

The aerodynamic design and test results of the fan and quarter-stage component for the GE/NASA Energy Efficient Engine (EEE) are presented The fan is a high bypass ratio, single-stage design having 32 part-span shrouded rotor blades, coupled with a unique quarter-stage arrangement that provides additional core-stream pressure ratio and particle separation The fan produces a bypass pressure ratio of 1 65 at the exit of the low aspect ratio vane/frame and a core-stream pressure ratio of 1 67 at the entrance to the core frame struts The full-scale fan vehicle was instrumented, assembled and tested as a component in November 1981 Performance mapping was conducted over a range of speeds and bypass ratios using individually-controlled bypass and core-stream discharge valves The fan bypass and core-stream test data showed excellent results, with the fan exceeding all performance goals at the important engine operating conditions Author

A83-36253#
DESIGN AND PERFORMANCE OF A LOW ASPECT RATIO, HIGH TIP SPEED MULTI-STAGE COMPRESSOR
W A TESCH and R L PASE (United Technologies Corp , Government Products Div , West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p
(AIAA PAPER 83-1161)

The aerodynamic design and performance of a low aspect ratio, high tip speed multi-stage axial compressor for application in turboshaft engines is presented The axial compressor has been designed to be used in conjunction with a centrifugal stage to produce the required cycle pressure ratio Designed to produce above 7 to 1 pressure ratio, the compressor is comprised of five axial stages and features variable geometry to meet the off-design stability requirements The average aspect ratio and solidity are 1 2 and 1 6, respectively Considerations as a result of the presence of a centrifugal stage and the mechanical arrangement of the engine are discussed The compressor has been evaluated experimentally as a component rig powered by a 6000 hp electric motor Testing encompassed 153 hours of running over the entire anticipated operational regime At design speed, the compressor has demonstrated a peak adiabatic efficiency above 85 percent and a stall margin above 20 percent Author

A83-36254#
MAXIMUM LOADING CAPABILITY OF AXIAL FLOW COMPRESSORS
J K SCHWEITZER and J E GARBEROGLIO (United Technologies Corp , Government Products Div , West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p refs
(Contract F33615-76-C-2091)
(AIAA PAPER 83-1163)

A maximum loading prediction system for determining the design speed stall margin capability of axial flow compressors is presented The formulation of the primary correlations for this system is based on the analogy between a compressor cascade and a diffuser passage Semi-empirical corrections are applied to relate the initial cascade-derived maximum loading values to the real compressor environment Good agreement is demonstrated between the predicted and test stall margins for a wide range of both single- and multi-stage compressor geometries As the system is formulated on the basis of meanline parameters, a useful tool has resulted capable of guiding the selection of the primary compressor design variables early in the design phase Author

A83-36260#
A SURVEY OF TRENDS IN MODERN TURBINE TECHNOLOGY
K D MACH and D W ZABIEREK (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 3 p
(AIAA PAPER 83-1174)

In connection with the development of component technology, there exists a potential for dramatic increases in turbine performance Advances are needed with respect to materials, heat transfer, and aerodynamics An important contribution to the improvement of material characteristics can be provided by suitable coatings To survive in an environment of high-temperature gas, a material will need protection against oxidation, corrosion, and erosion Extensive development work with respect to coatings is, therefore, expected through the end of the century Except for coatings, turbine vanes and blades will continue to be made of metal for the next several years The most serious drawback of ceramics, brittleness, has not yet been overcome Of the metals, the refractories are the least developed for turbine applications with respect to conventional superalloys, very little room remains for further development Extensive studies and development work during the next decade will be concerned with heat transfer, cooling, and aerodynamic design G R

A83-36261#
CRUISE MISSILE PROPULSION VERSUS COMMERCIAL AIRLINER PROPULSION - DIFFERENT CHALLENGES CAN PRODUCE SIMILAR ENGINE CYCLES
L CRUZEN (Williams International, Walled Lake, MI) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p refs
(AIAA PAPER 83-1176)

A commercial turbofan engine, the JT8D, which is employed to power a number of airliners, is compared with F107 engines, which power the Air Force and Navy cruise missiles The design requirements for aircraft and cruise missile propulsion systems are examined It is found that a cruise missile and a commercial airliner engine do not share many of the major parameters which influence cycle selection The airliner application tends to call for higher bypass ratio and, consequently, for higher turbine inlet temperatures However, an inspection of relevant design data shows that JT8D and F107 cycle parameters are notably similar, although the JT8D-17 engine is about 24 times the size of the F107-WR-101 In this connection, questions arise regarding the reasons for the low bypass ratio employed by the JT8D-17 cycle

It is shown that the JT8D-17 characteristics are the results of evolutionary changes G R

A83-36282#
CONCEPTS FOR INCREASED POWER AND ENHANCED FUEL CONSERVATION WITH NEWLY PATENTED MULTIPLE POWER-CYCLE GAS TURBINE ENGINES
P K CORONEL AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p
(AIAA PAPER 83-1209)

Attention is given to recently pattented design innovations aimed at improving the fuel efficiency and power output of axial and centrifugal compressor-equipped gas turbine engines The systems disclosed integrally incorporate secondary power cycles containing heat absorption systems which convert unpressurized liquids into a pressurized power source, employing the heat energy normally lost through component cooling systems and the engine exhaust This heat energy is recycled to power a steam turbine, which in turn is employed in increasing the gas turbine's volume of preheated and compressed air In addition to greater propulsive and fuel efficiencies, a reduction of exhaust heat is envisaged O C

A83-36284#
ADVANCED TURBOPROP AND DUAL CYCLE ENGINE PERFORMANCE BENEFITS AND INSTALLATION OPTIONS ON A MACH 0 7 SHORTHAUL TRANSPORT AIRCRAFT
H W BENNETT (Rolls-Royce, Ltd , Derby, England), A P HAYS, and G L HERSTINE (Lockheed-California Co , Burbank, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(AIAA PAPER 83-1212)

The block fuel and direct operating costs of a 100 passenger aircraft powered by an advanced turbofan, turboprop, and a dual cycle engine were evaluated The locations of the turboprop engines were also evaluated based on aircraft weight, drag, and inlet recovery penalties Results show that the underwing mounted turboprop engine with offset gearbox and chin inlet was the optimum configuration The turboprop is found to have a block fuel advantage of 27 percent over the turbofan at the average stage length of 300 n mi and a 26 percent advantage at the design range of 1000 n mi The direct operating cost benefit was determined to be 16 percent at the average stage length The dual cycle engine exhibited a block fuel benefit of only 22 percent at the average stage length and 21 percent at the design range, while the direct operating cost benefit was 12 percent at the average stage length N B

A83-36286*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif
IN-FLIGHT ACOUSTIC TEST RESULTS FOR THE SR-2 AND SR-3 ADVANCED-DESIGN PROPELLERS
P L LASAGNA, K G MACKALL, and R B COHN (NASA, Flight Research Center, Edwards, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p refs
(AIAA PAPER 83-1214)

Several advanced-design propellers, previously tested in the wind tunnel at the Lewis Research Center, have been tested in flight at the Dryden Flight Research Facility The flight-test propellers were mounted on a pylon on the top of the fuselage of a JetStar airplane Acoustic data for the advanced-design SR-2 and SR-3 propellers at Mach numbers to 0 8 and helical-tip Mach numbers to 1 15 are presented, maximum blade-passage frequency sound-pressure levels are also compared Author

A83-36293#
THRUST REVERSER EXHAUST PLUME REINGESTION TESTS FOR A STOL FIGHTER MODEL
N F AMIN and C J RICHARDS (Northrop Corp , Hawthorne, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p
(AIAA PAPER 83-1229)

The development of advanced tactical fighter aircraft requiring short takeoff and landing capablity in order to operate from bomb damaged runways is being considered A STOL aircraft with a reversing nozzle may be needed to satisfy this requirement Thrust reversing represents an effective approach for decelerating an aircraft, both in-flight and during ground roll A potential problem associated with reversing thrust during aircraft ground roll is related to the ingestion of hot exhaust gases into the engine inlet The reingested gases can generate pressure and temperature distortion levels at the engine compressor face substantially above the engine distortion tolerance limits, resulting in possible engine damage It is found that for an effective thrust reverser design, it is necessary to develop a detailed exhaust plume reingestion test data base Attention is given to a novel flow visualization water and wind tunnel test program which was conducted to develop the required data base G R

A83-36294#
A MONTE CARLO SIMULATION OF THE ENGINE DEVELOPMENT PROCESS
W R ALLEY, JR and H D STETSON (United Technologies Corp , Government Products Div , West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p
(AIAA PAPER 83-1230)

A mathematical model of the engine development process has been formulated The model quantifies the elements that affect engine development, such as test vehicles, severity and length of tests and test schedule Problem occurrences, based on historic experience, are introduced at random by the model and the impact of these problems on the development program is assessed By iterating a given development plan, a statistical distribution of probable program results, including such information as program duration, problems found, and engine maturity at fleet introduction is obtained Modifying the development plan input and re-running the program generates a new set of probable program results which can be compared with the original results to evaluate the advantages and disadvantages of each plan A typical engine development program was modeled and several perturbations of the development plan were made and evaluated Author

A83-36295#
NONDESTRUCTIVE EVALUATION METHODS FOR IMPLEMENTATION OF DAMAGE-TOLERANT DESIGNED GAS TURBINE ENGINE COMPONENTS
V E PANHUISE (Garrett Turbine Engine Co , Phoenix, AZ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 5 p
(AIAA PAPER 83-1232)

In connection with the development of engines for the U S Air Force, use is made of the 'Engine Structural Integrity Program' (ENSIP) which is based upon damage-tolerant design assessments Using ENSIP, a critical rotating component is designed with the assumption that a flaw could be present in the component At certain time intervals, the component is inspected to detect flaws whose size exceeds a predetermined threshold If none is found, the part is returned to service However, if a flaw is detected, the component will be 'retired for cause' (RFC) A review is provided of the nondestructive evaluation (NDE) techniques used during ENSIP-designed component fabrication, taking into account also the methods by which the reliability of each technique are to be demonstrated G R

A83-36296#
AIRCRAFT ENGINE INLET PRESSURE DISTORTION TESTING IN A GROUND TEST FACILITY
R E ANDERSON (U S Naval Air Propulsion Test Center, Trenton, NJ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(AIAA PAPER 83-1233)

At first, the problem of inlet distortion as it affected the stability of a jet engine in a high performance aircraft was either underestimated or not understood Inlet pressure distortion phenomena can be divided into steady-state and time-variant categories A review is provided of various methods for producing each type Steady-state pressure distortion is the relatively constant pressure variation from the average pressure of the measurement plane A variation from the center to the outside diameter is called radial distortion, while circumferential distortion represents variation on any concentric circle Steady-state total pressure distortion for test purposes is generally produced by screens Attention is given to a distortion valve, distortion screens for steady-state pressure patterns, aspects of screen design, design revisions, the measurement of steady-state distortion, time-variant distortion, and random frequency generators G R

A83-36297#
DETERIORATION TRENDING ENHANCES JET ENGINE HARDWARE DURABILITY ASSESSMENT AND PART MANAGEMENT
R J BARRETT (United Technologies Corp , Government Products Div , West Palm Beach, FL) and W R HARRIS, JR (U S Naval Air Systems Command, Propulsion Div , Washington, DC) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p
(AIAA PAPER 83-1234)

The exposure of a new aircraft engine to the service environment can reveal engine hardware durability limitations not evident during the development or model acceptance phase of an engine program In connection with the recognition by the Navy of the need for an improved full-scale engine test to assure the long-range durability characteristics of the engine, a new approach for assessing engine hardware durability improvements was initiated in 1978 The approach included Accelerated Simulated Mission Endurance Test (ASMET) and fleet engine hot section hardware deterioration comparisons Part deterioration 'trending' was initiated during ASMET engine hot section inspections in order to establish a baseline of trending data for comparison with fleet hardware It is pointed out that jet engine hardware deterioration trending is now a proven method for enhancing long-term durability evaluation of new and improved hardware designs G R

A83-36298#
ACCELERATED MISSION TESTING OF THE F110 ENGINE
O T CASTELLS (General Electric Co , Evendale, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p
(AIAA PAPER 83-1235)

A summary of the new use of Accelerated Mission Testing (AMT), in the development of the F110 Engine (formerly F101 DFE), is presented A comparison of the AMT to previous qualification tests and to actual field service is presented This test approach has been now adopted as the official endurance qualification test for the USAF Author

A83-36299#
INTEGRATED PROPULSION-AIRCRAFT CONTROL EVALUATION FOR A CURRENT NAVY FIGHTER
R W VIZZINI (U S Naval Air Propulsion Test Center, Advanced Development Div , Trenton, NJ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(AIAA PAPER 83-1236)

It is pointed out that the Navy is actively engaged in the development of engine-mounted, fault tolerant Full Authority Digital Electronic Controls (FADEC) This technology base will lead to advanced propulsion control systems integrated with aircraft control systems to provide a wider range of aircraft-engine optimization than is available today The present investigation is concerned with the major benefits of an advanced control system integrated with the F-14 aircraft A TF30 engine with a dual-channel, fault tolerant FADEC has been interfaced to an Advanced Fuel Management (AFM) system It is shown that overall F-14 propulsion system reliability would be improved by at least a factor of two due to the integration of the FADEC/AFM configuration with the F-14 control system Other benefits included improved aircraft-engine performance and significant reductions in aircraft system weight, cost, and fuel consumption G R

A83-36300#
F/A-18A INFLIGHT ENGINE CONDITION MONITORING SYSTEM (IECMS)
P M DOANE (McDonnell Aircraft Co , St Louis, MO) and W R KINLEY (General Electric Co , Lynn, MA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p
(AIAA PAPER 83-1237)

An Inflight Engine Condition Monitoring System (IECMS) has been developed by General Electric and McDonnell Aircraft and is currently operational in all F/A-18 aircraft It is fully integrated with other systems on the aircraft, minimizing cost and weight The system activates cockpit cautions and sets maintenance codes whenever an engine exceedance is detected Engine data is automatically recorded up to 5 seconds before the exceedance and 35 seconds after In addition, engine life usage parameters, used for tracking remaining engine life, are calculated in flight Operational experience has shown benefits in reduced maintenance, lower support costs and accelerated maturing of the engine Specific cases illustrating these benefits are described A list of design considerations, based on IECMS experience, is presented for application to future systems Author

A83-36301#
FLIGHT/PROPULSION CONTROL SYSTEM INTEGRATION
L D EMERSON and W J DAVIES (United Technologies Corp , Pratt and Whitney Group, West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p
(AIAA PAPER 83-1238)

In connection with the introduction of redundant digital electronic systems to accomplish flight and propulsion control in modern military aircraft, opportunities arise for complete weapons systems integration Attention is given to system intercommunication, the communication of thrust request to the engine control on the electronic data bus, the engine condition monitoring system (ECMS), the electrical power system, and the design of hydraulic power systems on advanced aircraft and propulsion systems It is shown that integrated aircraft and propulsion control systems provide the key to many benefits for future aircraft Integrated communications lead to improved weapon system performance, increased reliability, ease of maintenance, and cost and weight benefits Shared electric and hydraulic power can provide similar benefits G R

A83-36302#
UNITED KINGDOM MILITARY ENGINE USAGE, CONDITION AND MAINTENANCE SYSTEMS EXPERIENCE
M F HURRY (Ministry of Defence/Procurement Executive/, London, England) and C M OCONNOR (Rolls-Royce, Ltd , Bristol, England) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p
(AIAA PAPER 83-1239)

The engine monitoring systems and programs used in the U K for military aircraft are reviewed An engine usage monitoring system was installed on numerous aircraft in 1975 and covers engine/airframe instrumentation, data acquisition, and ground data processing The data acquisition system is capable of multiplexing and digitizing signals at a rate of 32 twelve-bit words per second The taped data is processed on the ground by mainframe

computers The initial systems used sensors connected to microprocessors to monitor the LP shaft speed, the HP shaft speed, compressor delivery temperature, and compressor temperature, the exhaust gas temperature and duct pressure, the turbine cooling air temperature, the throttle valve angle, fuel flow, the engine control amplifier current, vibration, altitude, airspeed, ambient temperature, and the elapsed time A magnetic chip is employed for monitoring oil-wetted engine components M S K

A83-36304#
COMPARISON OF AN EXPERIENCE WITH FULL AUTHORITY DIGITAL ENGINE CONTROLS IN ROTARY WING AND JET-LIFT VSTOL AIRCRAFT
E S ECCLES (Dowty and Smiths Industries Controls, Ltd , Cheltenham, Glos , England) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p Research supported by the Ministry of Defence of England refs
(AIAA PAPER 83-1241)

The design differences and common features of the full authority digital engine control demonstrator systems mounted on the Gem engines in a Lynx helicopter and on the Pegasus engines in a Harrier aircraft are surveyed The Gem system contained its own power supply, while the Pegasus system was connected to the aircraft power supplies The Gem system, being on a helicopter, had lower static and dynamic pressures to contend with, but was required to be able to disconnect the engine from the rotor when a rapid onset of autorotation was encountered The loss of power from one engine was immediately followed by a drop in rotor speed and increased power demand on the other engine The engine power and the nozzle setting were controlled with the Harrier system, which has only one engine Limiters in both systems protected against overspeed and overtemperature It was concluded that a fully redundant system is necessary in the fixed-wing aircraft, while a single system or a system-and-a-half may be used in a helicopter due to life-cycle cost considerations M S K

A83-36314*# United Technologies Corp , East Hartford, Conn
IMPORTANCE OF INLET BOUNDARY CONDITIONS FOR NUMERICAL SIMULATION OF COMBUSTOR FLOWS
G J STURGESS, S A SYED, and K R MCMANUS (United Technologies Corp , Commercial Engineering Div , East Hartford, CT) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(Contract NAS3-23524)
(AIAA PAPER 83-1263)

Fluid dynamic computer codes for the mathematical simulation of problems in gas turbine engine combustion systems are required as design and diagnostic tools To eventually achieve a performance standard with these codes of more than qualitative accuracy it is desirable to use benchmark experiments for validation studies Typical of the fluid dynamic computer codes being developed for combustor simulations is the TEACH (Teaching Elliptic Axisymmetric Characteristics Heuristically) solution procedure It is difficult to find suitable experiments which satisfy the present definition of benchmark quality For the majority of the available experiments there is a lack of information concerning the boundary conditions A standard TEACH-type numerical technique is applied to a number of test-case experiments It is found that numerical simulations of gas turbine combustor-relevant flows can be sensitive to the plane at which the calculations start and the spatial distributions of inlet quantities for swirling flows G R

A83-36316*# Detroit Diesel Allison, Indianapolis, Ind
APPLICATION OF 3D AERODYNAMIC/COMBUSTION MODEL TO COMBUSTOR PRIMARY ZONE STUDY
R E SULLIVAN, R SUTTON, G MILES, E YOUNG (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN), and D BRIEHL (NASA, Lewis Research Center, Cleveland, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p
(Contract NAS3-22762)
(AIAA PAPER 83-1265)

A description is provided of the three-dimensional elliptic code for reacting flows used in the combustor design process during the program 'Small Gas Turbine Combustor Primary Zone Study' carried out by a U S company The code, designated MARC-I (multidimensional aerodynamic recirculating combustion-Version I) is an adaptation of the model described by Mongia et al (1979) The program has the objective to advance the technology of the small reverse-flow annular combustor design through an understanding of primary zone performance factors The MARC-I code was used for performance predictions of both original designs and later modifications A test program consisting of both primary zone sampling and overall combustor performance measurements was carried out It was, therefore, possible to compare the analytical predictions with actual test measurements G R

A83-36322#
RESULTS OF TESTS OF A RECTANGULAR VECTORING/REVERSING NOZZLE ON AN F100 ENGINE
G H MCLAFFERTY and J L PETERSON (United Technologies Corp , Pratt and Whitney Group, West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p
(AIAA PAPER 83-1285)

The present investigation is concerned with the results of a test program conducted on an F100 engine in a sea level test facility The tests take into account all engine/nozzle design operating modes including steady-state and transient engine and nozzle operation in the forward thrust, vectoring, and reversing modes throughout the engine power spectrum It was found that rectangular nozzle configurations can meet future requirements for performance and response The two-dimensional convergent-divergent nozzle design concept tested shows exceptional potential for continuing development Thrust management through exhaust nozzle thrust spoiling provides a 3X improvement in engine transient thrust response Utilizing IR camera temperature measuring techniques provides an order of magnitude improvement in nozzle thermal environment data G R

A83-36323*# Pratt and Whitney Aircraft Group, East Hartford, Conn
EJECTOR NOZZLE TEST RESULTS AT SIMULATED FLIGHT CONDITIONS FOR AN ADVANCED SUPERSONIC TRANSPORT PROPULSION SYSTEM
D P NELSON (United Technologies Corp , Pratt and Whitney Group, East Hartford, CT) and D L BRESNAHAN (NASA, Lewis Research Center, Cleveland, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p refs
(AIAA PAPER 83-1287)

Results are presented of wind tunnel tests conducted to verify the performance improvements of a refined ejector nozzle design for advanced supersonic transport propulsion systems The analysis of results obtained at simulated engine operating conditions is emphasized Tests were conducted with models of approximately 1/10th scale which were configured to simulate nozzle operation at takeoff, subsonic cruise, transonic cruise, and supersonic cruise Transonic cruise operation was not a consideration during the nozzle design phase, although an evaluation at this condition was later conducted Test results, characterized by thrust and flow coefficients, are given for a range of nozzle pressure ratios, emphasizing the thrust performance at the engine operating conditions predicted for each flight Mach number The results

indicate that nozzle performance goals were met or closely approximated at takeoff and supersonic cruise, while subsonic cruise performance was within 2 3 percent of the goal with further improvement possible N B

A83-36328#
CARS TEMPERATURE AND SPECIES MEASUREMENTS IN AUGMENTED JET ENGINE EXHAUSTS
A C ECKBRETH, G M DOBBS, J H STUFFLEBEAM (United Technologies Research Center, East Hartford, CT), and P A TELLEX (United Technologies Corp , Government Products Div , West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 14 p refs
(AIAA PAPER 83-1294)

Coherent anti-Stokes Raman spectroscopy (CARS) is a nonintrusive laser diagnostic technique for spatially- and temporally-precise measurements of temperature and species in practical combustion systems Over the last several years, the development of CARS has progressed from simple flames of increasing complexity to practical application in internal combustion engines and simulations of gas turbine combustors Here, the first application of CARS to an actual jet engine is described The CARS instrument constructed is capable of completely remote operation and permits instantaneous thermometry at a 20 Hz rate Its design and operation, as well as sample exhaust measurements, are presented Author

A83-36329#
DEVELOPMENT TRENDS IN ENGINE DURABILITY
W D COWIE and T A STEIN (USAF, Aeronautical Systems Div , Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p refs
(AIAA PAPER 83-1297)

The Air Force has approximately 38,000 aircraft propulsion units in the active inventory A 1977 study reports that over two thirds of an engine's 15-year life cycle cost is 'ownership costs' and that the ownership portion is rising It is believed that this situation is driven in large part by modern engines which lack desired structural durability In this connection, the Air Force is concerned with an identification and an understanding of design factors, which influence engine durability It has been found that operational engines resulting from past development programs have not had the durability characteristics necessary for efficient and cost effective operations It is now believed that an organized and systematic structural development process can help minimize service related surprises This realization led to the formulation of the Engine Structural Integrity Program (ENSIP) Attention is given to accelerated mission testing, an engine structural maintenance plan, and an implementation/rationale G R

A83-36339#
A JT8D LOW EMISSIONS COMBUSTOR BY RADIAL ZONING
M H ZEISSER and T G FOX (United Technologies Corp , Pratt and Whitney Group, East Hartford, CT) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p refs
(AIAA PAPER 83-1324)

A radially zoned, low emissions, can-annular combustion system, which has been developed for the JT8D-200 series engines, is examined This combustion system utilizes significantly different internal air and fuel flow patterns than previous combustors and attains very low levels of both emissions and smoke with relatively simple combustor and fuel injection hardware The improvements in performance are accomplished through the use of two distinct concentric combustion zones (radial zoning) which are formed by controlling airflow and fuel injector/combustor geometry A hybrid fuel injector is used to inject the fuel into each zone At low power, combustion occurs in the central core zone, while at high power both zones are utilized with the majority of the fuel being injected into the outer zone N B

A83-36340*# Oklahoma State Univ , Stillwater
THE PERFORMANCE OF AN ANNULAR VANE SWIRLER
D G LILLEY (Oklahoma State University, Stillwater, OK) and G F SANDER AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 14 p USAF-supported research refs
(Contract NAS3-74)
(AIAA PAPER 83-1326)

In connection with the desirability of optimizing the design of a gas turbine combustion chamber, there exists a need for a more complete understanding of the fluid dynamics of the flow in such chambers In order to satisfy this need, experimental and theoretical research is being conducted with the objective to study two-dimensional axisymmetric geometries under low speed, nonreacting, turbulent, swirling flow conditions The flow enters the test section and proceeds into a larger chamber Inlet swirl vanes are adjustable to a variety of vane angles The present investigation concentrates on the time-mean flow characteristics which are generated by the upstream annular swirler The investigation makes use of a five-hole pitot probe technique A theoretical analysis of swirl numbers associated with several idealized exit velocity profiles is included, and values of the ratio of maximum swirl velocity to maximum axial velocity at different swirl strengths are given for each case G R

A83-36346#
COMPOUND CYCLE TURBOFAN ENGINE
J G CASTOR (Garrett Turbine Engine Co , Phoenix, AZ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p
(Contract DARPA ORDER 3430, F33657-77-C-0391)
(AIAA PAPER 83-1338)

The paper discusses the design and development of critical technologies for a 'near-adiabatic' compound cycle turbofan engine (CCTE) The concept involves replacing the combustor of a conventional turbofan engine with a highly supercharged, high-speed, two-stroke, direct-injected diesel core Primary emphasis was on reducing specific fuel consumption to improve range x payload product Critical diesel core technology areas addressed were cylinder breathing/scavenging, fuel injection, combustion, materials and lubricants Author

A83-36347#
DEVELOPMENT AND APPLICATION OF A LIQUID-COOLED V-8 PISTON ENGINE FOR GENERAL AVIATION AIRCRAFT
D L BLACKALLER (Thunder Engines, Inc , Van Nuys, CA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p refs
(AIAA PAPER 83-1342)

A83-36357#
ACCELERATED SIMULATED MISSION ENDURANCE TEST OF A TURBOSHAFT ENGINE FOR MILITARY ATTACK HELICOPTER APPLICATION
S P DAVIS (General Electric Co , Aircraft Engine Business Group, Lynn, MA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p
(AIAA PAPER 83-1359)

A test was conceived to subject a factor development test engine to simultaneous vibration and power excursions During the period from March, 1981, through May, 1982, testing was performed on a T700-701 turboshaft engine mounted in a factory test cell The engine and externally mounted airframe hardware were from an AH-64A helicopter Attention is given to aspects of helicopter simulation, mission simulation, a facility description, details regarding the test method, and the test results It was found that the accelerated simulated mission endurance test (ASMET) conducted met the objectives of demonstrating equivalent 5000 field mission hour capability of the engine and attached aircraft components G R

A83-36367#
KC-135/CFM56 RE-ENGINE - THE BEST SOLUTION
S B KAZIN (General Electric Co , Cincinnati, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p
(AIAA PAPER 83-1374)

The KC-135A fleet of tankers was originally established to support the bomber force Since that time changes in force structure and basing have greatly increased the need for aerial refueling According to conservative estimates, there is a need for 1200 tankers with the capability of the current KC-135A The current KC-135A inventory is only 642 The least cost method of gaining the required additional capacity involves an improvement of the capability of existing aircraft This means that the same number of aircraft is to be employed, but each aircraft is to be more effective As the current engine of the aircraft limits aircraft utility, a new engine, the CFM56, is to be employed Since the engines comprise the largest flyaway cost element in the KC-135A modernization program, the program is often referred to as 'The KC-135 Reengine Program' However, the aircraft will also receive additional configuration modifications for enhanced capability
G R

A83-36368#
INTRODUCING THE ROLLS-ROYCE TAY
P J ASHMOLE (Rolls-Royce, Ltd , East Kilbride, Scotland) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 13 p
(AIAA PAPER 83-1377)

This paper covers the background to the launch of the Rolls-Royce Tay Turbofan emphasizing the use of a well proven core with the latest fan technology The basic design of the engine is described and the main performance parameters discussed This new development provides a thrust increase of the order of 25 percent, fuel burn reduction of 15 percent and reduction in noise of the order of 7 PNdB compared with existing Spey installations It is therefore an ideal powerplant to provide development potential for existing Spey powered aircraft offering also good re-engining possibilities on existing airframes The application of this engine to three different aircraft and the successful adoption of a common powerplant is covered, together with a brief review of aircraft performance improvements associated with this engine
Author

A83-36393*# Tuskegee Inst , Ala
A COMPREHENSIVE METHOD FOR PRELIMINARY DESIGN OPTIMIZATION OF AXIAL GAS TURBINE STAGES. II - CODE VERIFICATION
R M JENKINS (Tuskegee Institute, Tuskegee, AL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p refs
(Contract NSG-3295)
(AIAA PAPER 83-1403)

The present effort represents an extension of previous work wherein a calculation model for performing rapid pitchline optimization of axial gas turbine geometry, including blade profiles, is developed The model requires no specification of geometric constraints Output includes aerodynamic performance (adiabatic efficiency), hub-tip flow-path geometry, blade chords, and estimates of blade shape Presented herein is a verification of the aerodynamic performance portion of the model, whereby detailed turbine test-rig data, including rig geometry, is input to the model to determine whether tested performance can be predicted An array of seven (7) NASA single-stage axial gas turbine configurations is investigated, ranging in size from 0 6 kg/s to 63 8 kg/s mass flow and in specific work output from 153 J/g to 558 J/g at design (hot) conditions, stage loading factor ranges from 1 15 to 4 66
Author

A83-36394#
MONTE CARLO SIMULATION OF THE ENGINE DEVELOPMENT PROCESS
D G CULY and J J GOSSEN (Garrett Turbine Engine Co , Phoenix, AZ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 11 p Navy-sponsored research
(AIAA PAPER 83-1405)

The DEVSIM simulation program for generating a Monte Carlo simulation for predicting changes in an engine in its mature development as a result of unforeseen changes during the developmental process is described The model was formulated on the bases of a chronological sequence of events and on resource usage The Monte Carlo aspect of the program indicates if a problem has occurred, identifies the component responsible for the problem, and relates the engine maturity to the developmental effort The model accounts for reduced failure incidence for each engine component after redesign Input includes parts costs, test hours and equipment, and the number of engines put through each type of test A Weibull distribution was employed to describe the lifetime of specific parts DEVSIM was used in conjunction with a life cycle cost model in the cases of a new jet fighter engine at 70 pct of the power and at 70 pct of the scale of an existing design, and an engine that was a 30 pct derate of an already-developed engine
M S K

A83-36395#
THE IMPACT OF ENGINE USAGE ON LIFE CYCLE COST
W S WILLIS and T R SEWALL (General Electric Co , Evendale, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p
(AIAA PAPER 83-1406)

The impact of in-service usage of two types of military aircraft, a long-range subsonic bomber and a mixed mission supersonic fighter, on the life-cycle costs (LCC) are evaluated The critical factor examined was the time at intermediate power or above, and the total failure rates were projected based on the severity of the missions It was found that actual missions in peacetime training can exceed the design expectancies by a factor of two or three The LCC analyses were performed with computer programs including the operational severity model, the engine acquisition cost routine, the engine development cost model, an operating and support cost analysis program, and an LCC summation routine The tactical system had a more severe service life, although the stresses during training missions mandates that higher fatigue lifetimes be designed into both types of aircraft Component wear-out was identified as a more important LCC driver than part reliability, and it is suggested that spare engines and modules be provided to upgrade aircraft availability
M S K

A83-36396#
LCC EVALUATION OF ADVANCED ENGINE DAMAGE TOLERANCE GOALS FOR A HOT-SECTION DISK
R J REED, D T HUNTER (United Technologies Corp , Pratt and Whitney Group, West Palm Beach, FL), and R J HILL (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p USAF-sponsored research refs
(AIAA PAPER 83-1407)

Developments related to Air Force gas turbine engines are considered, taking into account the importance of reaching the lowest overall life cycle cost (LCC) by finding an optimum combination between the high strength capability of a critical material and its resistance to fatigue crack growth An important factor is a component design which includes consideration of crack growth characteristics and critical crack size Such a design is termed Damage Tolerant Design (DTD) Attention is given to the results of a life cycle cost evaluation to quantify the benefits of designing hot-section disks for damage tolerance The work reported was conducted under the Life Cycle Cost/Damage Tolerance Assessment program on hot-section damage tolerance, which is currently underway as an evolutionary outgrowth of several programs involving the Air Force and a U S aerospace company

The guidelines of the Retirement for Cause (RFC) system are also taken into account G R

A83-36397#
ASPECTS OF THE T56 POWER SECTION USAGE/OPERATING COSTS
C CURRY and J A KORN (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p refs
(AIAA PAPER 83-1408)

The power section of the Detroit Diesel Allison (DDA) T56 engine provides a unique opportunity to relate a variety of applications to cost of operation Parameters for cyclic and hot-time usage for both the turboprop and marine/industrial engines are quantitatively deduced and related to unscheduled engine removals and operating cost It was found that removal frequency of all systems correlated well with cyclic usage, but had no correlation with percent hot-time Operating costs also correlated well with cyclic engine usage, and it was found that changes in operational severity produced similar changes in operating costs for all systems Author

A83-36398#
DEVELOPMENT OF SIMULATED MISSION ENDURANCE TEST ACCELERATION FACTORS IN DETERMINING ENGINE COMPONENT SERVICEABILITY AND FAILURE MODE CRITICALITY
T R METZ and P J ZIMMERMAN (U S Naval Air Propulsion Test Center, Trenton, NJ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 6 p
(AIAA PAPER 83-1409)

The use of Accelerated Simulated Mission Endurance Testing (ASMET) is a cost effective method of verifying engine durability in projected aircraft weapon system application ASMET is a gas turbine engine durability test which simulates the aircraft mission in a test environment A test acceleration methodology has been developed utilizing mission profiles and mission mix to define composite profiles which do not lose mission orientation and still accelerate the damage processes Identifying the damage processes is critical since failure mode damage acceleration rates will differ with each failure mode These failure mode conditions are identified from the mission profile/mission mix and retained in the composite profile, while non-damaging mission aspects are deleted The composite profiles are then used as the ASMET cycle The ASMET acceleration factors are then determined as a ratio of mission profile/mission mix time to test composite time Author

A83-36400#
CONFIGURATION SELECTION AND TECHNOLOGY TRANSITION IN 5000 SHP CLASS ENGINES
D D KLASSEN (General Electric Co , Lynn, MA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p
(AIAA PAPER 83-1411)

The basis for the selection of the configuration for the next generation 5000 SHP class engine is presented Analysis of overall advantages, trade-offs and configurational alternatives were studied All available technology developments are considered with the objective of providing the best balance between performance, cost, and the field oriented requirements of reliability, maintainability and vulnerability In parallel with the configuration selection, transitioning of new technology from the component stands and drawing boards is described Component testing was conducted to demonstrate key features, technologies, and design improvements that were new, an extension of available technology, or an adaptation to engine constraints of features developed in generic technology programs with the key objective of reducing risk to the engine development program The interrelationship is presented of configuration selection and technology transition to form the best balance of performance, weight, and field serviceability for the next generation 5000 SHP aircraft engine for the 1990's Author

A83-36412#
FIGHTER ENGINE CYCLE SELECTION
G A PLOURDE, R E SIMS, and R A CEA (United Technologies Corp , Pratt and Whitney Group, West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p refs
(Contract N00019-80-C-0225, F33657-72-C-0242)
(AIAA PAPER 83-1300)

The Joint Advanced Fighter Engine (JAFE) Demonstrator Program approach to accommodating the uncertainty of engine cycle and size requirements is the subject of this paper Data is presented which shows that while the optimum engine cycle changes with mission requirements, the penalty associated with a nonoptimum engine cycle is small for a large range of cycle variables This allows for the confident selection of an engine for the JAFE Program and a future size adaptation through changes primarily to the low pressure spool Author

A83-36463#
PROPULSION PROTOTYPES AT GENERAL ELECTRIC
T F FOY (General Electric Co , Lynn, MA) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 73-82 10 p
(AIAA PAPER 83-1053)

Development histories are presented for proprietary programs of military gas turbine engine development, with comparisons being conducted to indicate the unique character of each such effort The engines in question are the YJ101, which served as prototype for the F404, the F101/DFE, which was the prototype of the F110 engine, the GE12 technology demonstrator for the T700, and the TF34 engine The development programs fall into the categories of prototype, technology demonstrator and/or full scale development Attention is given to engine program management interaction with airframe development O C

A83-36464#
TECHNOLOGY AND ENGINE DEMONSTRATOR PROGRAMS
W R ALLEY, JR (United Technologies Corp , Government Products Div , West Palm Beach, FL) IN Aircraft Prototype and Technology Demonstrator Symposium, Dayton, OH, March 23, 24, 1983, Proceedings New York, American Institute of Aeronautics and Astronautics, 1983, p 83-87
(AIAA PAPER 83-1064)

The paper discusses the merits and complementary aspects of technology and engine demonstrator programs Technology demonstrators prove readiness of technology transfer to an operational system whereas engine demonstrator programs are used to prove system capability for full scale development Both types of programs contribute to new weapon systems Examination of the F100 demonstrator and Advanced Turbine Engine Gas Generator (ATEGG) programs gives some insight into the complementary aspects and payoff for using both types of programs as part of the engine development process Author

A83-36612
ADVANCED PROPULSION CONTROLS - A TOTAL SYSTEM VIEW
P H YOUNG (Rolls-Royce, Ltd , London, England) Aeronautical Journal (ISSN 0001-9240), vol 87, May 1983, p 165-172

The necessity of designing engine control systems integrally with the total propulsion control system is explored, with attention given to the effectiveness of electronic control systems The control system links the pilot to the propulsion system, airframe systems, and the cockpit displays The use of electronic controls with their inherent high defect rates requires built-in test capabilities in order to assure flight safety as well as the ability to continue to a main base for repairs Each function of the digital control system must be designed in consideration of its effect on the other functions controlled Additionally, safeguards must be included to prohibit

the engine from malfunctioning if a pilot command is received which exceeds the operational envelope Further discussions are presented on a typical airframe/engine interface, the full authority with no mechanical reversion FADEC system, the minimum requirements of the FADEC system, and system design principles M S K

A83-36791#
FORCED AND SELF-EXCITED VIBRATIONS OF GAS-TURBINE ASSEMBLIES WITH PERFECT AND PERTURBED SYMMETRY [DRGANIA WYMUSZONE I SAMOWZBUDNE PODZESPOLOW TURBINY GAZOWEJ O SCISLEJ I ZABURZONEJ SYMETRII]
E STANKIEWICZ Instytut Lotnictwa, Prace (ISSN 0509-6669), no 91, 1982, p 3-27 In Polish

An analysis is presented of the dynamic characteristics of gas-turbine assemblies possessing axisymmetry, and of the effect of perturbations of this symmetry on the level of forced vibrations and the possibility of self-excited vibrations Symmetry-group theory is used in the analysis in view of the importance of the frequency degeneracy of such vibrations B J

A83-36792#
MATHEMATICAL MODELS OF THE ACOUSTIC PROPERTIES OF PROPELLERS [MODELE MATEMATYCZNE WLASCIWOSCI AKUSTYCZNYCH SMIGIEL SAMOLOTOWYCH]
A CHYLA Instytut Lotnictwa, Prace (ISSN 0509-6669), no 91, 1982, p 29-62 In Polish refs

The features of propeller noise are discussed with reference to existing airworthiness regulations Various mathematical models that can be used to describe the noise generated by propeller aircraft are examined in detail, and data obtained using these models are compared with experimental data B J

A83-36793#
ELECTROHYDRAULIC FUEL-FLOW REGULATOR FOR GAS-TURBINE-ENGINE CONTROL SYSTEMS [ELEKTROHYDRAULICZNY STEROWNIK PRZEPLYWU DO UKLADOW REGULACJI SILNIKOW TURBINOWYCH]
W BALICKI Instytut Lotnictwa, Prace (ISSN 0509-6669), no 91, 1982, p 63-72 In Polish refs

An experimental electrohydraulic fuel-flow control device is described which operates according to the principle of constant pressure head across a metering orifice of variable area The area of this orifice is regulated by a mechanism the input quantities of which are signals of the position angle of the control lever and of the stagnation pressure of air at the inlet, and the signal generated by the electronic unit controlling the driving motor of the mechanism The signal of pressure-head variation across the metering orifice produces a variation in the discharge of the piston pump supplying the control device In the case of manual (emergency) control, the measured flow rate is a function of the position angle of the control level and the air pressure head In the case of automatic control, this flow rate is a function determined by the operation of the electronic unit and its output signal B J

A83-36912#
V/STOL STATUS FROM THE ENGINE TECHNOLOGY VIEWPOINT
G M LEWIS and W J LEWIS (Rolls-Royce, Ltd , Bristol, England) Journal of Aircraft (ISSN 0021-8669), vol 20, July 1983, p 580-586

Previously cited in issue 05, p 656, Accession no A82-16913

A83-36925#
AN UPDATE ON HIGH OUTPUT LIGHTWEIGHT DIESEL ENGINES FOR AIRCRAFT APPLICATIONS
M E MOYNIHAN, S G BERENYI, and A P BROUWERS (Teledyne Continental Motors, General Products Div , Muskegon, MI) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 18 p refs
(AIAA PAPER 83-1339)

In connection with fuel-related developments, there is renewed interest within the aviation industry for new, fuel efficient, multifuel power plants NASA funded several engine manufacturers to conceptually design new aircraft engines using projected advanced technologies One company elected to evaluate the diesel engine cycle with respect to its capability to satisfy a number of specified minimum requirements Using past engines as guidelines, an extensive parametric study was made to first determine the basic overall engine type and next to apply new technologies to achieve a truly advanced engine The five engines designs which ultimately evolved share a number of common features These features are partly related to the use of a radial engine configuration, a two-stroke cycle, a low effective compression ratio, minimum cylinder cooling, a high-pressure fuel injection system, and a high-pressure ratio, high efficiency turbocharger Questions regarding the market acceptance of the diesel engine are also explored G R

N83-25711*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
NASA PROPULSION CONTROLS RESEARCH
F TEREN 1983 11 p refs Presented at the 6th Intern Symp on Air Breathing Engines, Paris, 6-11 Jun 1983, sponsored by International Society on Air Breathing Engines and Association Aeronautique et Astronautique de France
(NASA-TM-83343, E-1558, NAS 1 15 83343) Avail NTIS HC A02/MF A01 CSCL 21E

Multivariable control theory is applied to the design of multiple input and output engine controls Highly-accurate, real-time engine simulations are utilized for control development and checkout Electro-optical control components are developed for use in electronic control systems having fiber optic data links Integrated controls are developed for VSTOL and Rotorcraft propulsion systems Post-stall models of engine systems are developed to aid in understanding and control of post-stall engine behavior Author

N83-25712*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
DESIGN ANALYSIS OF A SELF-ACTING SPIRAL-GROOVE RING SEAL FOR COUNTER-ROTATING SHAFTS
E DIRUSSO May 1983 12 p refs
(NASA-TP-2142, E-1253, NAS 1 60 2142) Avail NTIS HC A02/MF A01 CSCL 11A

A self-acting spiral groove inter-shaft ring seal of nominal 16 33 cm (6 43 in) diameter for sealing fan bleed air between counter-rotating hafts in advanced turbofan engines was analyzed The analysis focused on the lift force characteristics of the spiral grooves A NASA Lewis developed computer program for predicting the performance of gas lubricated face seals was used to optimize the spiral groove geometry to produce maximum lift force Load capacity curves (lift force as function of film thickness) were generated for four advanced turbofan engine operating conditions at relative seal speeds ranging from 17,850 to 29,800 rpm, sealed air pressures from 6 to 42 N/sq cm (9 to 60 psi) absolute and temperatures from 95 deg to 327 C (203 deg to 620 F) The relative seal sliding speed range was 152 to 255 m/sec (500 to 836 ft/sec) The analysis showed that the spiral grooves are capable of producing sufficient lift force such that the ring seal will operate in a noncontacting mode over the operating range of typical advanced turbofan engines Author

N83-25713# Dayton Univ , Ohio Research Inst
HIGH FREQUENCY FATIGUE OF TURBINE BLADE MATERIAL Final Technical Report, Oct. 1979 - Jul. 1982
R C GOODMAN and A M BROWN Wright-Patterson AFB, Ohio AFWAL Oct 1982 119 p refs
(Contract F33615-79-C-5108, AF PROJ 2418)
(AD-A124585, UDR-TR-82-104, AFWAL-TR-82-4151) Avail NTIS HC A06/MF A01 CSCL 21E

This increased fatigue crack growth rate at elevated temperature due to high frequency loading is examined The crack growth rate is found to depend upon major cycle stress intensity factor, hold-time and minor cycle frequency, and amplitude for a given temperature The elevated tests also demonstrate a transition from

creep crack growth dominant to fatigue crack growth dominant at values of minor cycle amplitude above a threshold value A model for determining the crack growth rate is developed GRA

N83-25714# RAND Corp , Santa Monica, Calif
DEVELOPMENT AND PRODUCTION COST ESTIMATING RELATIONSHIPS FOR AIRCRAFT TURBINE ENGINES Interim Report
J L BIRKLER, J B GARFINKLE, and K E MARKS Oct 1982 81 p refs
(Contract F49620-82-C-0018)
(AD-A123753, RAND/N-1882-AF) Avail NTIS HC A05/MF A01 CSCL 05A

This document describes a recent study of cost estimating relationships for new military aircraft turbine engine development and production programs It presents equations for estimating development and production costs and time of arrival for U S military turbojet and turbofan engines The study derives new cost estimating relationships from an expanded data base and uses new diagnostic statistics to screen the relationships and to evaluate the characteristics of the preferred set Section two of this note identifies the data used, explains the criteria and rationale for selecting explanatory variables, and describes recently developed regression diagnostics Section three presents the preferred set of relationships Comments on these results, a comparison with DAPCA equations, suggestions for the use of the cost estimating relationships and directions for possible future research are discussed in Section four Supporting statistics for the predictive models are available in the Appendix Author (GRA)

N83-25715# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div
GENERALIZATION OF THE AIR-JET PROPULSION SYSTEMS, THE 'N' FLOW TURBO-JET ENGINE
V STANCIU 9 Dec 1982 12 p refs Transl into ENGLISH from Buletinul Inst Politehnic 'Gheorghe Gheorghiu-Dej' Bucuresti, Ser Mech (Romania), v 43, no 2, 1981 p 77-84
(AD-A123932, FTD-ID(RS)T-1561-82) Avail NTIS HC A02/MF A01 CSCL 21E

The possibility of investigating the performance of airspace propulsion systems on the basis of the characteristics and performance of a generalized propulsion system is considered with emphasis on the performance of the 'n' flow turbojet engine Out of the analysis of the performance of this engine, the known solutions are obtained by participation the turbojet engine with simple flow, the turbojet engine with turboflow, and the turbopropulsion engine The advantages of using a turbojet engine with triple flow are considered The generalized turbojet engine has a specific performance superior to that of existing engines (higher specific force and lower specific fuel consumption) at the same frontal section

N83-26791# Air Force Aero Propulsion Lab , Wright-Patterson AFB, Ohio Ramjet Technology Branch
COAXIAL DUMP COMBUSTOR INVESTIGATIONS Final Report
R R CRAIG, J E DREWRY, and F D STULL *In* AFWAL A Collection of Papers in the Aerospace Sci p 145-156 Jun 1982 refs
Avail NTIS HC A99/MF A01 CSCL 21E

An experimental investigation was conducted involving coaxial dump combustors with two different types of flameholders (annular and Y) installed at the dump station in an attempt to correlate combustor performance with previous nonreacting flowfield results Flameholder blockage, combustor length, exit area ratio, inlet temperature, and chamber pressure were varied for both wall injection and premixed fuel conditions Lean blowout limits, combustion efficiency, combustor total pressure drop, and wall static pressure distributions were obtained from these runs using JP-4 fuel In addition, a limited amount of surface heating patterns and combustion oscillation data were obtained Author

N83-26798# Air Force Aero Propulsion Lab , Wright-Patterson AFB, Ohio Turbine Engine Div
THE USE OF VORTEX GENERATORS AS INEXPENSIVE COMPRESSOR CASING TREATMENT Final Report
C H LAW, A J WENNERSTROM, and W A BUZZELL *In* AFWAL A Collection of Papers in the Aerospace Sci p 358-371 Jun 1982 refs
Avail NTIS HC A99/MF A01 CSCL 20E

This paper describes an inexpensive form of casing treatment which was found to increase both efficiency and stall margin in an axial compressor stage and which could be easily and cheaply retrofitted to existing engines The method consists of placement of a row of vortex generators on the outer casing of an axial compressor, upstream of the rotor Design techniques are described An experimental investigation is also described in which vortex generator tip treatment was applied to a single stage axial compressor Gains in compressor and stall margin were observed Author

N83-26838*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
DYNAMIC DISTORTION IN A SHORT S-SHAPED SUBSONIC DIFFUSER WITH FLOW SEPARATION
R STUMPF, H E NEUMANN, and C C GIAMATI 1983 20 p refs Presented at the 19th Joint Propulsion Conf , Seattle, 27-29 Jun 1983, sponsored by AIAA, SAE and ASME
(NASA-TM-84312, E-1695, NAS 1 15 84312) Avail NTIS HC A02/MF A01 CSCL 21E

An experimental investigation of the time varying distortion at the diffuser exit of a subscale HiMAT forebody and inlet was conducted at Mach 0 9 in the Lewis 8 by 6 foot Supersonic Wind Tunnel A transitory separation was detected within the subsonic diffuser Vortex generators were installed to eliminate the flow separation Results from a study of the instantaneous pressure variations at the diffuser exit are presented The time unsteady total pressures at the diffuser exit are computer interpolated and presented in the form of a movie showing the transitory separation Limited data showing the instantaneous distortion levels is also presented Author

N83-26839*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
THRUST PERFORMANCE OF A VARIABLE-GEOMETRY, DIVERGENT EXHAUST NOZZLE ON A TURBOJET ENGINE AT ALTITUDE
D M STRAIGHT and R R COLLOM Jun 1983 39 p refs
(NASA-TP-2171, E-1451, NAS 1 60 2171) Avail NTIS HC A03/MF A01 CSCL 21E

A variable geometry, low aspect ratio, nonaxisymmetric, two dimensional, convergent-divergent exhaust nozzle was tested at simulated altitude on a turbojet engine to obtain baseline axial, dry thrust performance over wide ranges of operating nozzle pressure ratios, throat areas, and internal expansion area ratios The thrust data showed good agreement with theory and scale model test results after the data were corrected for seal leakage and coolant losses Wall static pressure profile data were also obtained and compared with one dimensional theory and scale model data The pressure data indicate greater three dimensional flow effects in the full scale tests than with models The leakage and coolant penalties were substantial, and the method to determine them is included Author

N83-26840# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
APPLICATION OF THE VORTEX-LATTICE METHOD TO PROPELLER PERFORMANCE ANALYSIS M.S. Thesis
M I MASQUELIER Jul 1982 115 p refs
(AD-A124837, AFIT/GAE/AA/81D-19) Avail NTIS HC A06/MF A01 CSCL 12A

The objective of this thesis is to examine the feasibility of applying a vortex lattice method to propeller performance analysis This method allows the calculation of spanwise and chordwise pressure distributions on thin propeller blades of arbitrary planform

The research for this project involves the application of a vortex lattice method to a propeller with twisted, non-cambered, constant chord blades The analysis assumes incompressible, inviscid flow over thin sections The helical wake is modeled as a series of straight vortex filament segments A computer code has been developed which uses a vortex lattice method to predict performance for propellers Results are shown for several operating conditions, using various angle of attack distributions, numbers of blades on the propeller, and advance ratios Similar results are shown using the blade-element theory for comparison Results indicate that this vortex lattice method is applicable to initial propeller performance analysis Author (GRA)

N83-26841# Naval Postgraduate School, Monterey, Calif Dept of Aeronautics

FINITE ELEMENT PROGRAM FOR CALCULATING FLOWS IN TURBOMACHINES WITH RESULTS FOR NASA TASK-1 COMPRESSOR M.S. Thesis

J A FERGUSON, III Oct 1982 248 p refs

(AD-A124987) Avail NTIS HC A11/MF A01 CSCL 20D

A general mesh generation code (MESHGEN) and finite element flow solver (TURBO) for calculating the flow development through axial turbomachines are fully documented The finite element approach followed Hirsch and Warzee Excellent results were obtained for the NASA Task-1 compressor operating with subsonic flow conditions Construction of the code will allow straightforward extension to transonic flows, turbine stages and multiple stage machines Author (GRA)

N83-26842# Rolls-Royce Ltd , Derby (England)

METHOD OF STUDYING THE OPERATING TEMPERATURE OF GAS TURBINES

Y N DOTSENKO and I P PELEPEICHENKO 13 Jul 1982 10 p refs Transl into ENGLISH of Samoletostr - Tekh Vozdush Flota (USSR), v 45, 1979 p 20-25

(PNR-90159, TRANS-15857/TLT-00841) Avail NTIS HC A02/MF A01

A method for obtaining the temperature of gas turbine aircraft engines using two bulb-thermometers with different thermal inertia characteristics is presented The thermal balance equations for a bulb inside a protective shield are developed Temperature of the gas outside the shield is calculated by allowing for convective heat transfer with the gas and radiant heat exchange with the shield, and for the inertia of one of the thermometers Maximum relative error is 8%, compared with 34% for single thermometer methods Author (ESA)

N83-26843# Royal Inst of Tech , Stockholm (Sweden) Dept of Aeronautics

EXPERIMENTAL STUDY OF STRENGTH AND EXISTANCE DOMAIN OF GROUND-TO-AIR INLET VORTICES BY GROUND BOARD STATIC PRESSURE MEASUREMENTS

S O RIDDER and I SAMUELSSON 1982 27 p refs

(PB83-144865, KTH-AERO-TN-62, TRITA-FPT-042) Avail NTIS HC A03/MF A01 CSCL 21E

When an air inlet is aspirating in close proximity to the ground plane and the inlet under some flow conditions This vortex could cause problems with foreign object ingestion that might damage the blading of the engine In this investigation the strength and existence domain of the inlet vortex has been studied in a low speed wind tunnel by measurements of the ground plane time average static pressure below the inlet GRA

08

AIRCRAFT STABILITY AND CONTROL

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

A83-33900

USING ADAPTIVE CONTROL TO SYNTHESIZE INVARIANT AND PARTIALLY AUTONOMOUS AUTOMATIC STABILIZATION SYSTEMS

B N PETROV, B V VIKTOROV, F A MIKHAILOV, and V L POKHVALENSKII Automation and Remote Control (ISSN 0005-1179), vol 43, no 11, Apr 20, 1983, pt 2, p 1448-1459 Translation refs

A method is developed for increasing the operating accuracy of a multivariable automatic stabilization system, which utilizes special compensating signals that adaptively implement the two-channel design This adaptive compensation procedure can also be used to ensure the autonomy of the state vector of some relevant subsystems when applied to the control of multivariable systems The operation of this adaptive algorithm only requires controlling the forced component of the total motion of the system and therefore assumes fast decay of the natural modes This approach to the construction of the adaptation procedure is found to substantially reduce the number of parameters that need to be adjusted The compensation procedure is applied to the automatic angular stabilization of an aircraft in the longitudinal plane Results of experimental studies show that these invariance-generating methods are sufficiently effective in practice when real effector devices are used N B

A83-34854

COMPUTER STUDIES OF ACV HEAVE PERFORMANCE AS A FUNCTION OF VENT VALVE CONTROL PARAMETERS

J R AMYOT (National Research Council, Ottawa, Canada) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 30-36 refs

A hybrid computer model of the heave dynamics of an air cushion with a segmented skirt and an automatic vent valve control system was used to investigate the effects of control gain and valve set point variations on the hull's response to step changes in ground level Results have shown that there is an optimum value of control gain and the valve set point position can be set to zero to minimize flow power requirements without significantly changing the dynamical performance Author

A83-35121#

APPLICATION OF MAXIMUM LIKELIHOOD ESTIMATION TO THE IDENTIFICATION OF THE STABILITY DERIVATIVES OF A WIDE BODY TRANSPORT AIRCRAFT

K M SOBEL and E Y SHAPIRO (Lockheed-California Co , Burbank, CA) IN Annual Allerton Conference on Communication, Control, and Computing, 19th, Monticello, IL, September 30-October 2, 1981, Proceedings Urbana, IL, University of Illinois, 1982, p 339-347 refs

Maximum likelihood estimation is applied to data obtained from a simulation of the lateral dynamics of an L-1011 aircraft at a cruise flight condition The model includes a stability augmentation system (SAS), actuator dynamics, sensor noise, and random gust effects The relative importance of the various stability derivatives and the results of the identification procedure are discussed Author

A83-35773#
AIRCRAFT ACTIVE CONTROLS - NEW ERA IN DESIGN
C HWANG and D F KESLER (Northrop Corp, Aircraft Div, Hawthorne, CA) Astronautics and Aeronautics (ISSN 0004-6213), vol 21, June 1983, p 70-79, 85 refs

The control systems of the modern aircraft accept, in addition to pilot's commands, also sensor information reflecting flight condition and dynamic response The response may include rigid-body rates, accelerations, and control-surface positions Sensor information feeds back through a number of networks to effect positive control This 'active control' of structural dynamic behavior and its effect upon the flight-control system has been relatively new to the structural community In connection with these and other modern developments, many new requirements are being imposed upon aircraft control-system designers An overview is provided concerning the new developments affecting aircraft control-system design Attention is given to a classification of active-control systems, a flutter-suppression model, a Nyquist analysis for a forward-swept-wing aircraft, the organization of a digital adaptive control system, the integration of active control into the flight control system, and a wing load alleviation system
G R

N83-25716# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate
A PRELIMINARY ASSESSMENT OF HELICOPTER/VSTOL HANDLING QUALITIES SPECIFICATIONS
K GOLDSTEIN 4 Nov 1982 120 p refs
(Contract WF41400000)
(AD-A124667, NADC-81023-60) Avail NTIS HC A06/MF A01 CSCL 01C

The flying quality characteristics of four state-of-the-art rotary wing aircraft have been compared to the present day helicopter and VSTOL flying qualities criteria Hover control power and dynamic stability characteristics were analyzed for the longitudinal, lateral and directional axes For forward flight, static and dynamic stability characteristics were analyzed for the longitudinal and lateral-directional axes Results in terms of the applicability/utility of the MIL-H-8501A criteria are presented for each of the above flying qualities areas
Author (GRA)

N83-25717# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
INVESTIGATION OF AN IMPROVED FINITE ELEMENT MODEL FOR A REPAIRED T-38 HORIZONTAL STABILIZER FLUTTER ANALYSIS USING NASTRAN M S. Thesis
G G LONDON, JR Dec 1982 47 p refs
(AD-A124741, AFIT/GAE/AA/82D-19) Avail NTIS HC A03/MF A01 CSCL 20D

This thesis investigated the use of an improved finite element model of a T-38 horizontal stabilizer for flutter analysis using NASTRAN The procedure for evaluating the effect of repairs on the flutter speed is developed and its sensitivity to several modeling assumptions and practices is presented The procedure is to be used by Air Force engineers to evaluate repair limits of T-38 stabs The results show that the current repair limits have little or no effects on the flutter conditions, therefore, the procedures presented in this investigation should be used to establish new repair limitations
GRA

N83-25718# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
GUST RESPONSE PREDICTION OF AN AIRFOIL USING A MODIFIED VON KARMAN-POHLHAUSEN TECHNIQUE M.S. Thesis
R G DOCKEN, JR Dec 1982 81 p refs
(AD-A124716, AFIT/GAE/AA/82D-9) Avail NTIS HC A05/MF A01 CSCL 20D

An analytical study is presented regarding the theoretical behavior of an airfoil in a pitching airflow The theoretical development includes the momentum-integral equation for boundary layers in unsteady flow and the von Karman-Pohlhausen integral method for unsteady flow A computer program was written to model this and was applied to a symmetric Joukowski airfoil The results of this study show a linear relationship between the increase in the stall angle of attack and the non-dimensional pitch rate
GRA

N83-25719# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
FLUTTER PREDICTION IN FORWARD-SWEPT WINGS BY ASSUMED MODES AND STRIP THEORY M S Thesis
W I SHELTON, JR Dec 1982 59 p refs
(AD-A124715, AFIT/GAE/AA/82D-27) Avail NTIS HC A04/MF A01 CSCL 01A

The roots are then plotted and the flutter or divergence speeds determined It was found that flutter speed increased and divergence speed decreased with increasing forward sweep as expected Also, quasi-steady aerodynamics do not accurately predict flutter and the approximation to unsteady aerodynamics does not accurately predict divergence It is necessary to combine these two methods in order to obtain a complete analysis of the wing's aeroelastic instabilities
GRA

N83-26844*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
DETERMINATION OF STABILITY AND CONTROL PARAMETERS OF A GENERAL AVIATION AIRPLANE FROM FLIGHT DATA
I ABBASY Mar 1983 45 p refs
(NASA-TM-84635, NAS 1 15 84635) Avail NTIS HC A03/MF A01 CSCL 01C

Values for the stability and control parameters for a general aviation airplane were determined from flight data Lateral and longitudinal transient maneuvers were analyzed by the equation error and output error methods There was a good agreement between the parameters extracted from flight data and those predicted by wind tunnel
Author

N83-26845*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
A FLIGHT-TEST AND SIMULATION EVALUATION OF THE LONGITUDINAL FINAL APPROACH AND LANDING PERFORMANCE OF AN AUTOMATIC SYSTEM FOR A LIGHT WING LOADING STOL AIRCRAFT
S C BROWN, G H HARDY, and W S HINDSON Jun 1983 59 p refs
(NASA-TM-84270, A-8993, NAS 1 15 84270) Avail NTIS HC A04/MF A01 CSCL 01C

As part of a comprehensive flight-test program of STOL operating systems for the terminal area, an automatic landing system was developed and evaluated for a light wing loading turboprop aircraft The aircraft utilized an onboard advanced digital avionics system Flight tests were conducted at a facility that included a STOL runway site with a microwave landing system Longitudinal flight-test results were presented and compared with available (basically CTOL) criteria These comparisons were augmented by results from a comprehensive simulation of the controlled aircraft which included representations of navigation errors that were encountered in flight and atmospheric disturbances Acceptable performance on final approach and at touchdown was achieved by the autoland (automatic landing) system for the moderate winds and turbulence conditions encountered in flight However, some touchdown performance goals were marginally achieved, and simulation results suggested that difficulties could be encountered in the presence of more extreme atmospheric conditions Suggestions were made for improving performance under those more extreme conditions
Author

N83-26846*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
PILOT HUMAN FACTORS IN STALL/SPIN ACCIDENTS OF SUPERSONIC FIGHTER AIRCRAFT
S B ANDERSON, E K ENEVOLDSON, and L T NGUYEN May 1983 12 p refs Presented at the AGARD Conf Flight Mech Sys Design Lessons from Operational Exper , Athens, 10-13 May 1983
(NASA-TM-84348, A-9297, NAS 1 15 84348) Avail NTIS HC A02/MF A01 CSCL 01C

A study has been made of pilot human factors related to stall/spin accidents of supersonic fighter aircraft The military specifications for flight at high angles of attack are examined Several pilot human factors problems related to stall/spin are discussed These problems include (1) unsatisfactory nonvisual warning cues, (2) the inability of the pilot to quickly determine if the aircraft is spinning out of control, or to recognize the type of spin, (3) the inability of the pilot to decide on and implement the correct spin recovery technique, (4) the inability of the pilot to move, caused by high angular rotation, and (5) the tendency of pilots to wait too long in deciding to abandon the irrecoverable aircraft Psycho-physiological phenomena influencing pilot's behavior in stall/spin situations include (1) channelization of sensory inputs, (2) limitations in precisely controlling several muscular inputs, (3) inaccurate judgment of elapsed time, and (4) disorientation of vestibulo-ocular inputs Results are given of pilot responses to all these problems in the F14A, F16/AB, and F/A-18A aircraft The use of departure spin resistance and automatic spin prevention systems incorporated on recent supersonic fighters are discussed These systems should help to improve the stall/spin accident record with some compromise in maneuverability
Author

N83-26847# Federal Aviation Agency, Atlantic City, N J
DIGITAL FLIGHT CONTROL SYSTEM VALIDATION
D ELDREDGE, J E REED, E HITT (Battelle Columbus Labs , Ohio), J WEBB (Battelle Columbus Labs , Ohio), and D MULCARE (Lockheed-Georgia Co) Jun 1982 19 p refs Presented at the 1982 Am Control Conf , Arlington, Va , Jun 1982
(AD-A124506, FAA-CT-82-54) Avail NTIS HC A02/MF A01 CSCL 01C

The introduction of advanced technologies, new design concepts, and sophisticated high integrity integrated software-based digital flight control and avionics systems has confronted the FAA with the task of reviewing, revising, and updating its airworthiness assessment criteria in these areas The FAA needs to establish and maintain systems engineering expertise as well as a capability to establish/evaluate validation/verification procedures for software-based digital systems In order to accomplish this objective, the FAA must have expertise in fault-insertion techniques, emulation, automated reliability analyses, failure modes and effects analyses, fault-tree graphics, and other analytical tools In addition, these skills are needed in order to interpret and evaluate data and information submitted, during the certification, process, in compliance with RTCA DO-178 and FAA Advisory Circular 25 1309-XX This paper discusses techniques, methodologies, data, and information required for digital flight control and avionics systems validation
Author (GRA)

N83-26848# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
HIGH-GAIN ERROR ACTUATED FLIGHT CONTROL SYSTEMS FOR CONTINUOUS LINEAR MULTIVARIABLE PLANTS M.S. Thesis
L THOMAS Dec 1982 151 p refs
(AD-A124871, AFIT/GAE/EE/82D-1) Avail NTIS HC A08/MF A01 CSCL 01C

The theory of high-gain error actuated feedback control, developed by Porter and Bradshaw, is applied to the design of various lateral-directional decoupling flight control systems for an advanced aircraft The controllers developed in this report utilize output feedback with proportional plus integral control to produce desirable closed-loop responses with minimal interactions between outputs Because of the structure of the system, measurement variables in addition to the outputs are necessary to apply this method The report examines controller design robustness by varying the flight conditions or maneuver commands from the ones the controller is specifically designed for, and then judges system performance The results show that the controller is robust with respect to varying flight conditions, but is not robust with respect to varying maneuver commands This report also examines the effect of first-order actuator dynamics in the system model Actuator dynamics are shown to significantly effect the control system response, indicating that a simplified model, without actuators, is not desireable in one's control design scheme Also a computer program to determine transmission zeros and decoupling zeros is developed
Author (GRA)

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

A83-34429
AN ALGORITHM OF FLIGHT SIMULATION ON A DYNAMIC STAND OF SUPPORT TYPE [ALGORITM IMITATSII POLETA NA DINAMICHESKOM STENDE OPORNOGO TIPA]
V V ALEKSANDROV, I V DYLEVSKII, V D ZIMENKOV, I G TIKHANINA, and O D CHUGUNOV Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela (ISSN 0572-3299), Mar -Apr 1983, p 30-37 In Russian refs

The problem of flight simulation is formulated for an operator in the cockpit of a dynamic simulator A composition method for solving this problem is proposed for a stand of support type with six degrees of freedom, and an algorithm implementing this method is described As an example, consideration is given to a digital system for the control of a dynamic simulator, and a block diagram of this system is presented It is noted that the simulation depends significantly on the kinematic scheme of the stand
B J

A83-35598
AISA - PROGRAM FOR AUTOMATED TREATMENT OF AERONAUTICAL DATA [AISA - PROGRAMME DE TRAITEMENT AUTOMATISEDE L'INFORMATION AERONAUTIQUE]
A LANGRAND (Direction Generale al'Aviation Civile, Service de l'Information Aeronautique, Athis Mons, Essonne, France) Navigation (Paris) (ISSN 0028-1530), vol 31, April 1983, p 162-171 In French

The French automated aircraft information service (AISA) capabilities, equipment, and products are described The system provides on-line access to a computer which holds notices to airmen, cartographic information, and cargo information The cartographics subsection provides automated map generation of aeronautical maps for pilot use The maps can be dimensioned to request, identify air routes, ground waypoints and landmarks, hold both typography and graphics and approach paths, and be amenable to interactive processing Notices to airmen are dispatched by teletype, through hard copy printed with a daisy wheel, or by transmission to a CRT display in the cockpit Weekly notices can also be issued and stored for inquiry Finally, the contract subroutine contains samples of up to 7000 bills of lading, procedures for contracting services, postal rates, etc, as well as daily shipment records The system will eventually be modified to allow interrogation/response from external consoles
M S K

A83-35625
U.S. SETS OWN STANDARDS FOR AIRPORT LIGHTING
A C SCHWARTZ Airport Forum (ISSN 0002-2802), vol 13, April 1983, p 65, 67-69

FAA regulations, the types of equipment, and the acceptance procedures for airport runway lighting systems are outlined Although several types of equipment installed on federally controlled runways are specified precisely with regards materials and dimensions, local airports are generally permitted to use equipment of their own choice so long as performance specifications are met Advisory circulars are distributed by the FAA to provide installers of runway lighting equipment with guides as to spacing, radio control, operation, and maintenance Additionally, the FAA issues a list of U S manufactured equipment which it certifies as meeting performance specifications, although it is noted that FAA officials attend only 15-20 pct of the actual tests of the equipment by manufacturers M S K

A83-35850#
PROPULSION SYSTEM SIMULATION TECHNIQUE FOR SCALED WIND TUNNEL MODEL TESTING
C C CASSMEYER (McDonnell Aircraft Co , St Louis, MO) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 416-421 refs

Propulsion simulators have been developed which allow propulsion system and airframe flowfields to be simultaneously simulated in a single wind tunnel model, thereby improving the accuracy of aircraft performance prediction It is observed that the most effective use of such propulsion simulator-equipped models will be on configurations having highly integrated and closely coupled propulsion systems The matching of the maximum propulsion simulator airflow with the maximum engine airflow is found to generally result in an 8-11 percent-scale model Testing with such models should not be used in an aircraft development cycle prior to the selection of such fundamental design features as engine cycle, airframe configuration, and propulsion system integration O C

A83-35863#
GROUND SIMULATION OF ENGINE OPERATION AT ALTITUDE
B A REESE (Arnold Engineering Development Center, Arnold Air Force Station, TN) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 537-552 refs

A discussion is presented concerning the contributions obtainable through ground-simulated high altitude testing of turbojet and turbofan aircraft engine operation, with attention to such criteria for test program success as the early involvement of test personnel in the engine development process, the justification of ground testing over flight testing, and adequate funding of the ground test effort Development status reports are given for the Aeropropulsion System Test Facility, which will begin its check-out operations in the Fall of 1984, and the Turbine Engine Load Simulator which has not yet received funding Detailed descriptions are given of the experimental facilities covered O C

A83-36073
ALL WEATHER HELIPORTS AND AIRWAY SYSTEM - THE FUTURE NEED
W F PAUL (United Technologies Corp , Sikorsky Aircraft, Stratford, CT) *Vertiflite* (ISSN 0042-4455), vol 29, Mar-Apr 1983, p 16-21

A plan for the development of a national system of heliports and helicopter airways to accommodate the growth foreseen in the U S civil helicopter fleet by 1990 is discussed The elements of the proposed system include allweather heliports located near the center of cities, realistic acoustic guidelines, noninterfering airways for helicopter use only, a navigation, communication, and air-traffic-control network based on NAVSTAR or a similar satellite system, improved forecasting of icing and thunderstorm conditions, helicopters capable of precision steep instrument approaches and takeoffs at very low speeds, and advanced ice protection for blades, windshields, and propulsion systems The strategy being pursued by the HAI Heliports and Airways Committee for the implementation of this plan is reviewed T K

A83-36216#
SIMULATOR PERFORMANCE DEFINITION BY CUE SYNCHRONIZATION ANALYSIS
S K BUTRIMAS and G B BROWDER (U S Navy, Naval Training Equipment Center, Orlando, FL) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 114-122
(AIAA PAPER 83-1092)

This paper describes by experimental example how a cue synchronization study should be performed on a major flight simulator system It presents dynamic performance measurements made at the Navy's Visual Technology Research Simulator (VTRS) facility, and shows timing interactions between critical subsystems of the Conventional Takeoff and Landing (CTOL) simulator It discusses how and why specifications and tests must be developed which determine the cue synchronization and performance requirements for simulation systems Author

A83-36217#
REAL TIME SIMULATION OF MISSION ENVIRONMENTS FOR AVIONICS SYSTEMS INTEGRATION
R A WEEKS (Northrop Corp , Pico Rivera, CA) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 123-129
(AIAA PAPER 83-1097)

This paper describes a real time simulation of mission environments for use in developing, synthesizing and analyzing complex avionics systems for fighter aircraft The problem is one of creating an operationally correct environment for a pilot to operate in such that he is properly task loaded Proper task loading insures the proper integration of the avionics subsystems (on an operation level) so as to verify that the mission objectives will be fulfilled Author

A83-36218*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
THE MAN-VEHICLE SYSTEMS RESEARCH FACILITY - A NEW NASA AERONAUTICAL R & D FACILITY
D C NAGEL and R J SHINER (NASA, Ames Research Center, Man-Vehicle Systems Research Div , Moffett Field, CA) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 130-139
(AIAA PAPER 83-1098)

A new flight simulation facility nearing completion at the NASA Ames Research Center is described The facility is intended to support aeronautical human factors research and consists of a new building, two full mission flight simulators and an air traffic control simulator Special features of the new facility are described which make it particularly well suited for human factors research Author

A83-36219#
DATA BASE CONSIDERATIONS FOR A TACTICAL ENVIRONMENT SIMULATION
C G HORATTAS and R P ADKINS (Goodyear Aerospace Corp , Akron, Oh) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 140-145 refs
(AIAA PAPER 83-1099)

This paper discusses data base requirements for simulating the sensor environment used in typical military aircraft Certain mission characteristics can be capitalized upon to effect some relief in the enormous demand on the data base coverage and

detail, while maintaining the high degree of realism and fidelity needed to provide adequate training Author

A83-36222*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
COMPENSATION FOR TIME DELAY IN FLIGHT SIMULATOR VISUAL-DISPLAY SYSTEMS
D F CRANE (NASA, Ames Research Center, Moffett Field, CA) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 163-171 refs
(AIAA PAPER 83-1080)

A piloted aircraft can be viewed as a closed-loop, man-machine control system When a simulator pilot is performing a precision maneuver, a delay in the visual display of aircraft response to pilot-control input decreases the stability of the pilot-aircraft system The less stable system is more difficult to control precisely Pilot dynamic response and performance change as the pilot attempts to compensate for the decrease in system stability, and these changes bias the simulation results by influencing the pilot's rating of the handling qualities of the simulated aircraft Delay compensation, designed to restore pilot-aircraft system stability, was evaluated in several studies which are reported here The studies range from single-axis, tracking-task experiments (with sufficient subjects and trials to establish statistical significance of the results) to a brief evaluation of compensation of a computer-generated-imagery (CGI) visual display system in a full six-degree-of-freedom simulation The compensation was effective - improvements in pilot performance and workload or aircraft handling-qualities rating (HQR) were observed Results from recent aircraft handling-qualities research literature which support the compensation design approach are also reviewed Author

A83-36224#
VISUALLY-COUPLED SYSTEMS AS SIMULATION DEVICES
M W HAAS (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) American Institute of Aeronautics and Astronautics, Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983 5 p
(AIAA 83-1083)

It is pointed out that the technology development of visually-coupled systems (VCS) began in 1966 VCS provide a way to improve weapon aiming accuracy and efficiency while enlarging the operational delivery envelope of the weapon system A VCS may derive control information from the operator and direct the weapon system, while simultaneously displaying weapon system information to the operator Control information is derived by a helmet-mounted sight and/or helmet-mounted oculometer Feedback information is provided by the helmet-mounted display The combination of the considered components is termed 'visually-coupled system' VCS technologies can also be used to provide low-cost visual systems for simulators, support research regarding critical issues of cockpit control, and display design and proper use of VCS components in the airborne environment The Visually-Coupled Airborne System Simulator was developed to study the utilization of the VCS in the simulator G R

A83-36353*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
NASA LOW-SPEED CENTRIFUGAL COMPRESSOR FOR FUNDAMENTAL RESEARCH
J R WOOD, P W ADAM, and A E BUGGELE (NASA, Lewis Research Center, Cleveland, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 12 p refs
(AIAA PAPER 83-1351)

A new centrifugal compressor facility being built by the NASA Lewis Research Center is described, its purpose is to obtain 'benchmark' experimental data for internal flow code verification and modeling The facility will be heavily instrumented with standard pressure and temperature probes and have provisions for flow visualization and laser Doppler velocimetry The facility will accommodate rotational speeds to 2400 rpm and will be rated at pressures to 1 25 atm The initial compressor stage for testing is geometrically and dynamically representative of modern high-performance stages with the exception of Mach number levels Design exit tip speed for the initial stage is 500 ft/sec with a pressure ratio of 1 17 The rotor exit backsweep is 55 deg from radial The facility is expected to be operational in the first half of 1985 Author

A83-36356#
PERFORMANCE CAPABILITY OF A COMPACT MULTIMISSION AIRCRAFT PROPULSION SIMULATOR
C D WAGENKNECHT, C J DUSA (General Electric Co, Cincinnati, OH), and T J NORBUT (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 10 p refs
(AIAA PAPER 83-1358)

The Compact Multimission Aircraft Propulsion Simulator is a flexible cycle miniature turbine engine powered by an external source of high pressure air Its development has been to enhance the propulsion flowfield simulation capability during wind tunnel testing of subscale aircraft models Currently, a data base on the utility of the simulator is being accumulated, however, it will be sometime before the complete capability of the simulator and parametric impact of significant variables will be fully characterized In the interim, analysis results based on a cycle deck computer model are presented to parametrically define performance flexibility characteristics which will be a necessary consideration for any potential simulator user Author

A83-36421#
SURVEY OF THE ONERA ACTIVITIES ON THE ADAPTIVE WALL APPLICATIONS AND COMMUTATION OF RESIDUAL CORRECTIONS
J P CHEVALLIER (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Wind Tunnel Wall Interference-Assessment/Correction Workshop, NASA, Langley Research Center, Hampton, VA, Jan 25, 26, 1983) ONERA, TP, no 1983-11, 1983, 15 p refs
(ONERA, TP NO 1983-11)

ONERA activities in the area of computing or reducing wind tunnel wall interferences are reviewed, emphasizing improvement in the determination of corrections and the use of adapted flexible walls Corrections computed from wall measured data are presented for the two- and three-dimensional cases, and theoretical and experimental assessments of the model representation from the transverse speed component at the wall and from wall pressure measurements, respectively, are given The ONERA two-dimensional T2 wind tunnel operation is described, and the iterative process used to adapt the wall is outlined The validation of the adaptive wall operation is addressed Finally, some general observations regarding the orientation of the work for the planned three-dimensional model are formulated C D

A83-36433#
NEW TRANSFORMATIONS OF S4 MODANE HYPERSONIC WIND TUNNEL FOR RAMJET MISSILES TESTS
J CHRISTOPHE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Supersonic Tunnel Association, Semi-Annual Meeting, 59th, Colorado Springs, CO, Apr 6, 7, 1983) ONERA, TP, no 1983-24, 1983, 14 p refs
(ONERA, TP NO 1983-24)

The capabilities, equipment, and performance of the Modane S4 hypersonic wind tunnel are described The tunnel has a Mach 6 nozzle, storage facilities for dry air at 400 bars, a heater bed of aluminum pebbles capable of raising the air temperature to 1850 K, and a mounting table with two degrees of freedom Tests can be run on aerodynamics, air intakes, ablation or radome deformation, heat transfer, and the performance of complete engines at Mach 6 Full engine trials have included solid fueled ramjets, with adaptations permitting connected pipe and semi-free jet testing in conjunction with the hot gas generator The ramjet

trials have been limited to a simulation of Mach 2 7 at ground level conditions and Mach 3 35 at altitudes over 11 km M S K

N83-25720# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany) Inst for Experimental Fluid Mechanics
CONDENSATION STUDIES IN CRYOGENIC NITROGEN EXPANSIONS
M DUEKER 1982 14 p Presented at the ETW Cryogenic Technol Review Meeting, Amsterdam, 15-17 Sep 1982
Avail NTIS HC A02/MF A01

The Reynolds number range of wind tunnels is extended to higher values, when the wind tunnel operates under cryogenic conditions With a stagnation temperature, however, chosen too low, the gas may expand into its liquid or solid phase region, which will cause condensation effects Avoiding impurities in the streaming medium, heterogeneous condensation is prevented, but in an isentropic expansion, far enough into the liquid or solid phase region, homogeneous condensation will occur The determination of condensation onset points in isentropic expansions around realistic airfoils is tested in the European Tronssonic Wind Tunnel (ETW) Real gas effects in cryogenic flows are not described Author

N83-25721# Oxford Univ (England)
TEMPERATURE RESPONSE OF A MODEL TO SET-POINT CHANGES AND CONDITIONING IN ETW
W B BALD 1982 28 p refs Presented at the ETW Cryogenic Review Meeting, Amsterdam, 15-17 Sep 1982
Avail NTIS HC A03/MF A01

Preliminary finite element thermal analysis of a model balance sting arrangement mounted in a cryogenic wind tunnel concluded that heated balances were unacceptable if the model surface temperature was to satisfy the 1% adiabatic wall temperature condition specified by Green The results of a more detailed finite element thermal analysis on an assumed 0 6 meter long stainless steel delta wing model supported by an unheated balance sting arrangement and subjected to the ETW set-point changes and temperature conditioning specified are summarized Author

N83-25723# Institut de Mecanique des Fluides de Lille (France)
MATERIALS AND MODELLING TECHNOLOGY FOR CRYOGENIC ENVIRONMENT
J L PETITNIOT and F DUPRIEZ 1982 41 p refs
Avail NTIS HC A03/MF A01

Construction of a model and its support for use in a cryogenic wind tunnel induces the following problems relative to the choice of materials for the different model parts, lifting areas, fuselage, balance, sting line, construction techniques depending on the aim of the tests to be done, joints between model and its support, joints between model support and wind tunnel structure, and isolated or non-isolated board instrumentation According to type of tests, solicitations on the model in the test section will be very variable For static tests, aimed at the determination of aerodynamic coefficients, maximum stress levels were fixed, with the agreement of air frame designers, to 400 MPa for civil and 800 MPa for fighter models A dynamic stress is added to the static one whose value is of the order of 20% of the static stress The frequency range lies beyond 30 to 50 Hz As an example for a Mirage delta 2000 classic 1/8 scale model, first wing flexure mode is about 100 Hz At this level, the balance stiffness effect becomes preponderant and the first frequencies met in wind tunnel are those of the rigid modes of the model on its support Author

N83-25725# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France) Aerothermodynamics Dept
PROBLEMS INVOLVED BY THE INSTRUMENTATION AND THE CONCEPTION OF CRYOGENIC TESTS
A BLANCHARD and A MIGNOSI 1982 14 p refs Presented at the ETW Cryogenic Technol Rev Meeting, Amsterdam, 15-17 Sep 1982
Avail NTIS HC A02/MF A01

The studies carried out on stall pressure transducers tested at cool temperature, and the development of a probe which was used in T'3 (a small cryogenic transonic wind tunnel driven with a fan) are presented An important point concerns the precooling of the model, which is necessary in order to obtain a temperature ratio Tw/Taw near 1 during a run (20 to 40 seconds) This precooling is planned to be performed in a cooling box beside the test section, therefore, the model is introduced during the run starting process To distinguish the effects due to the increase of Reynolds number, from those of specious conditions, the influence of various parameters must be discerned S L

N83-25726# Royal Aircraft Establishment, Bedford (England)
EARLY EXPERIENCE IN USING THE CRYOGENIC TEST FACILITY AT RAE BEDFORD, ENGLAND
R D LAW 1982 14 p Presented at the ETW Cryogenic Technol Rev Meeting, Amsterdam, Sep 1982
Avail NTIS HC A02/MF A01

A closed circuit test duct has been constructed at RAE Bedford as part of the United Kingdom support for the ETW programme The maximum gas velocity through the 0 3 m square test section is 25 m/sec, falling with temperature, and the gas temperature can be rapidly reduced and controlled at any level between ambient and 90 K by evaporation of liquid nitrogen A simple calibration device is provided for loading small wind tunnel balances mounted in the test duct and some observations have been made of the behavior of a 3-component balance under transient temperature conditions Author

N83-25727*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
MODEL MOUNT SYSTEM FOR TESTING FLUTTER Patent Application
M G FARMER, inventor (to NASA) 31 Mar 1983 15 p
(NASA-CASE-LAR-12950-1, US-PATENT-APPL-SN-481106)
Avail NTIS HC A02/MF A01 CSCL 14B

A wind tunnel model mount system is described for effectively and accurately determining the effects of angle of attack and airstream velocity on a model airfoil or aircraft The model mount system includes a rigid model attached to a splitter plate which is supported away from the wind tunnel wall by a plurality of flexible rods Conventional instrumentation is employed to effect model rotation through turntable and to record model flutter data as a function of the angle of attack versus dynamic pressure NASA

N83-25728# Federal Aviation Administration, Washington, D C
RUNWAY SURFACE CONDITION SENSOR SPECIFICATION GUIDE
22 Apr 1983 15 p
(AC-150/5220-13A) Avail NTIS HC A02/MF A01

Ice begins to form on pavements when the pavement surface is at the freezing temperature of the water solution on it Remote runway surface condition sensors which will predict and detect the formation of ice on airport pavements will enhance runway safety while reducing airport equipment, manpower, and chemical costs The use of air temperatures exclusively to predict the occurrence of ice on a pavement is not reliable enough, primarily because the temperature differences between pavement surface and ambient air vary so greatly Factors such as runway surface color and composition, wind patterns, surface water quantity, ice control chemical residue, atmospheric moisture content, traffic, amount of sunlight as well as air temperature all influence ice formation Since ice prevention is more desirable in terms of safety, time savings and cost than ice removal, primary emphasis should be placed on predicting ice before it actually occurs Runway

sensors thus are a primary tool in developing an effective ice prevention program S L

N83-25730# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Systems and Logistics
A PLACEMENT MODEL FOR FLIGHT SIMULATORS M.S. Thesis
E P GEBHARD and J P ONEILL Sep 1982 139 p refs
(AD-A123782, AFIT-LSSR-23-82) Avail NTIS HC A07/MF A01 CSCL 14B

The use of flight simulators has been increasing due to the rising costs of operating and maintaining aircraft At the same time, a drive towards increased simulator fidelity has caused a rapid increase in simulator acquisition and support costs The rising costs of simulator acquisition and support, coupled with the fact that aircrews assigned to any one of the majority of USAF aircraft types are stationed at numerous geographic locations, provide the impetus to develop an improved methodology for comparing the costs of simulator basing strategies The methodology includes a comprehensive analysis of the relevant and significant costs of simulator ownership Using these costs as inputs, a computer program was developed which incorporates learning curve and present value theory into a facility location algorithm The program determines the number and location of the simulators to satisfy aircrew training at minimum cost A demonstration of model capabilities and a sensitivity analysis based on the acquisition of the B-52G Weapon System Trainer are included Author (GRA)

N83-25731# General Accounting Office, Washington, D C Federal Personnel and Compensation Div
GREATER BENEFITS TO BE GAINED FROM DOD FLIGHT SIMULATORS
14 Nov 1983 19 p
(AD-A123713, GAO/FPCD-83-4) Avail NTIS HC A02/MF A01 CSCL 05I

Our objectives were to determine whether the services are sufficiently analyzing their training needs and identifying those tasks that can best be taught on flight simulators, and whether simulators are training pilots to do the tasks intended We selected seven flight simulators that were among the services' highest 20 percent in terms of total dollars invested, were used to train personnel for critical jobs (tasks that contribute substantially to readiness), and had been fully operational for at least 2 years The locations we visited were in geographical areas within large concentrations of simulators At each location, we examined course syllabi to determine how the simulators were to be used We also determined how the simulators were being used, benefits derived, and problems with the simulators GRA

N83-25732# Kaman Avidyne, Burlington, Mass Structural Mechanics Sect
NOVA-2S CORRELATION WITH KC-135A FUSELAGE SHOCK TUBE TEST RESULTS Final Report
L J MENTE and W N LEE Kirtland AFB, N Mex AFWL Nov 1982 138 p refs
(Contract F29601-81-C-0031, AF PROJ 8809)
(AD-A124013, AFWL-TR-82-101, KA-TR-202) Avail NTIS HC A07/MF A01 CSCL 20D

Correlation of the experimental results from KC-135A fuselage tests in the Sandia shock tube with analytical results generated through the NOVA-2LTS structural response code were performed in this effort It was found that skin buckling between stringers was a very important factor in the overall response of the frames NOVA-2LTS had to be modified to handle skin buckling in an approximate manner without generating a prohibitive large solution model Comparisons are made between the experimental results and NOVA-2LTS analytical strain results for the unpressurized and pressurized KC-135A fuselage Overall the strain response results for the central frame correlated well considering the uncertainities involved in defining structurally an actual large stiffened aircraft section GRA

N83-25733# Canyon Research Group, Inc, Westlake Village, Calif
SIMULATOR DESIGN FEATURES FOR CARRIER LANDING. PART 2. IN-SIMULATOR TRANSFER OF TRAINING Interim Technical Report, 1 Sep. 1981 - 31 Aug. 1982
D P WESTRA Orlando, Fla Naval Training Equipment Center Dec 1982 82 p refs
(Contract N61339-81-C-0105)
(AD-A124024, NAVTRAEQUIPC-81-0105-1, CRG-TR-82-011)
Avail NTIS HC A05/MF A01 CSCL 05I

The Visual Technology Research Simulator (VTRS) at the Naval Training Equipment Center was used to study the effects of six factors on carrier-landing training An in-simulator transfer paradigm was chosen in which students were trained under various conditions and then tested under a standard condition that represented maximum realism The experimental design permitted a relatively large number of variables to be studied, using a relatively small number of student subjects Results showed some temporary transfer advantages for the wide field of view and high scene detail conditions Training on straight-in approaches resulted in transfer performance that was better than that produced by training on circling approaches There was no motion or FLOLS rate cuing effects on the transfer task Display and simulator transfer effects did not differ between the two pilot groups despite large differences in mean group performances As a result of these findings, it was suggested that a simulator-to-field transfer study be conducted with field of view, scene detail and approach type as factors Such a study, using pilots from the target population of undergraduate Naval aviators, would provide the necessary information to make final simulator design decisions for the carrier-landing task GRA

N83-25735# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
GENERATING AN OUT-THE-WINDOW COCKPIT IMAGE WITH THE IAPX 432 M.S. Thesis
R A COOPER Dec 1982 136 p refs
(AD-A124852, AFIT/GCS/EE/82D-12) Avail NTIS HC A07/MF A01 CSCL 09B

The purpose of this thesis investigation is to determine if a small computer can generate graphic images in a real time environment The specific computer to be used is the Intel iAPX 432 Micromainframe The graphic images are to be used as part of an aircraft simulator in a communication performance evaluation test This thesis investigation contains three areas of study The first investigation is to study the object-oriented architecture of the Intel iAPX 432 The second investigation is to examine the requirements of the simulator and produce design and implementation details The third investigation is aimed at studying the F111 DIG ground terrain data base and producing a new data base that the small simulator could use GRA

N83-26792# Arizona Univ, Tucson Dept of Aerospace and Mechanical Engineering
A NOTE ON ADAPTIVE WIND TUNNELS WITH IMPERFECT CONTROL Final Report
W R SEARS *In* AFWAL A Collection of Papers in the Aerospace Sci p 191-207 Jun 1982 refs
(Contract AF-AFOSR-2954E-76)
Avail NTIS HC A99/MF A01 CSCL 14B

An earlier study of the convergence of the adaptive wall wind tunnel scheme for a sinusoidal model in a two dimensional tunnel is extended to the case where ideal matching at the interface cannot be achieved It is assumed that, in place of the desired sinusoidal correction, a correction including an extraneous harmonic always occurs Two different assumptions are made regarding the fitting of this distorted sinusoid to the observed error signal The iteration converges for the same range of relaxation constants as for the ideal case, but that unconfined flow is not achieved For reasonable numerical values, the iteration nevertheless appears to make substantial improvement in a flow involving boundary interference Author

N83-26849*# Sinacori (John B) Associates, Hollister, Calif
RESEARCH AND ANALYSIS OF HEAD-DIRECTED AREA-OF-INTEREST VISUAL SYSTEM CONCEPTS
J B SINACORI Jun 1983 81 p refs
(Contract NAS2-10934)
(NASA-CR-166480, NAS 1 26 166480) Avail NTIS HC A05/MF A01 CSCL 14B

An analysis and survey with conjecture supporting a preliminary data base design is presented The data base is intended for use in a Computer Image Generator visual subsystem for a rotorcraft flight simulator that is used for rotorcraft systems development, not training The approach taken was to attempt to identify the visual perception strategies used during terrain flight, survey environmental and image generation factors, and meld these into a preliminary data base design This design is directed at Data Base developers, and hopefully will stimulate and aid their efforts to evolve such a Base that will support simulation of terrain flight operations Author

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ASTRONAUTICS

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

A83-34849
A SMALL PARAMETER METHOD IN PROBLEMS OF MANEUVERING SPACE VEHICLES WITH AERODYNAMIC EFFICIENCY
V P PLOKHIKH (Tsentral'nyi Aerogidrodinamicheskii Institut, Moscow, USSR) and V V SONIN (Akademiia Nauk SSSR, Sovet Interkosmos, Moscow, USSR) (International Astronautical Federation, International Astronautical Congress, 32nd, Rome, Italy, Sept 7-12, 1981) Acta Astronautica (ISSN 0094-5765), vol 10, Jan 1983, p 1-8 refs

An analysis is performed of optimal bank angle and incidence control in the class of piecewise-constant functions for the problem of vehicle aerodynamic maneuvering along a low altitude near-circular orbit The small parameter method is used to obtain an explicit general solution for adjoint equations system and to derive the vehicle trajectory characteristics The motion is shown to be equivalent to gravitational skipping, irrespective of the value of vehicle lift-to-drag ratio, similar to Keplerian motion but with continuous descent Suggestions for investigating an aerodynamic maneuver at several turns along a lowering orbit are outlined Author

A83-36399#
DESIGN AND DEVELOPMENT OF A NOZZLE EXTENDIBLE EXIT CONE
P GENTIL (SocieteEuropeenne de Propulsion, Saint-Medard-en-Jalles, Gironde, France) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p
(AIAA PAPER 83-1410)

Among the various Extendible Exit Cone (EEC) concepts, the folded petals EEC offers a tight packaging volume associated with good area ratio capability The design and development of such a concept is described A first step demonstrated its feasibility but the need for some improvements also A second program was conducted in which development tasks included calculations of flow pressures, aerodynamic loads and mechanical behavior, subscale mock-up hot firings with high altitude simulation, acceptance bench tests of carbon-carbon components and of the hydraulic deployment device The program was concluded with an after ignition deployment of the EEC and a 30 seconds full scale motor action test in high altitude simulation Author

A83-36408*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SPACE-STATION CREW-SAFETY REQUIREMENTS
R D WITCOFSKI (NASA, Langley Research Center, Hampton, VA) Conference and Workshops on Mission Assurance, Los Angeles, CA, June 7-9, 1983, Paper 10 p refs

Baseline rescue and survival concepts for future space station crews are described Preliminary studies are being carried out to identify potential threats to crew safety and means to counteract the dangers Significant factors being considered include the type of threat, the warning time, the number of crewmembers, strategies for protection of the crew (including life-support measures redundancy), and the dependence of space station crews on ground personnel Attention is being given to the impact of safety devices on the space station geometry and cost, as well as the equipment necessary to maintain the crew in a psychological status positive enough to cope with emergencies Typical threats would be fire, crewmember illness or injury, and abandonment of the station A Shuttle launch could take up to 12 days, while equipping the space station with an emergency return capsule would permit return on the same day as the capsule was occupied M S K

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CHEMISTRY AND MATERIALS

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

A83-33951
HIGHLY STRESSED MATERIALS, WITH AVIATION CONSIDERED AS AN EXAMPLE [WERKSTOFFE HOHER BEANSPRUCHUNG AM BEISPIEL DER LUFTFAHRT]
W BUNK, ED (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Werkstoff-Forschung, Cologne, Aachen, Rheinisch-Westfaelische Technische Hochschule, Aachen, West Germany) and J HANSEN (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Werkstoff-Forschung, Cologne, West Germany) Oberursel, West Germany, Deutsche Gesellschaft fuer Metallkunde, 1982, 220 p In German and English

Materials in the mirror of aviation criteria are considered along with structural members made of high-strength cast aluminum and their properties, a high-strength aluminum high-quality casting alloy in aeronautics and astronautics, the development and qualification of welding technology for AZ 5 G (AlZn 4 5 Mg 1) of the Ariane primary structure, and the development of technical cracks on Al-2024-T3 in the case of one-stage and non-one-stage vibratory stresses Attention is given to a comparison of microstructure and mechanical properties of Al-Li-X alloys made by conventional and by powder-metallurgy procedures, technologies for the production of titanium and titanium alloys, aspects of metallography and manufacturing technology regarding the superplastic forming of TiAl6V4, and powder metallurgy and hot isostatic pressing of the titanium alloy TiAl6V4 Other subjects investigated are related to oxide dispersion hardened mechanically alloyed materials for high temperature, and the influence of defects on the operational strength of disks and wheels in engines G R

A83-33953
MATERIAL, STRUCTURAL COMPONENT, SERVICE LIFE [WERKSTOFF - BAUTEIL - LEBENSDAUER]
D ENDEMANN (Dornier GmbH, Munich, West Germany), P ESSLINGER (Motoren- und Turbinen-Union Muenchen GmbH, Munich, West Germany), and K SCHRECK (KHD Luftfahrttechnik GmbH, Oberursel, West Germany) IN Highly stressed materials, with aviation considered as an example Oberursel, West Germany, Deutsche Gesellschaft fuer Metallkunde, 1982, p 33-52 In German

The present investigation is concerned with problems related to a guarantee with respect to a minimum service life for a structural component The solution of these problems involves basically the development of an approach by which the failure probability for structural components can be calculated on a quantitative basis The ideal conditions for conducting the required calculation can, however, currently not yet be satisfied It is, therefore, necessary to use generous safety factors Attention is given to structural components and their defects, approaches for eliminating defects, questions concerning the qualification of material and component, methods for ensuring reproducibility of the properties of the structural components of an aircraft, and future aspects related to the subject of failure probability G R

A83-33954
STRUCTURAL MEMBERS MADE OF HIGH-STRENGTH CAST ALUMINUM AND THEIR PROPERTIES [BAUTEILE AUS HOCHFESTEM ALUMINIUMGUSS UND DEREN EIGENSCHAFTEN]
J WEILKE and H FROMMEYER (Vereinigte Flugtechnische Werke GmbH, Bremen, West Germany) IN Highly stressed materials, with aviation considered as an example Oberursel, West Germany, Deutsche Gesellschaft fuer Metallkunde, 1982, p 53-59 In German

Structural members made of aluminum casting alloys have been little used in the aviation industry The reasons for this situation are related to the inferior strength of such members when compared with components made of wrought-aluminum alloys However, aspects of economics make it now urgently necessary to reduce manufacturing costs by employing structural components made of cast metal In connection with the absence of extensive machining requirements, the manufacturing costs of cast components are generally significantly lower than the costs for other parts Requirements regarding a demonstration of economical achievements and technical reliability are considered It will probably be possible to satisfy in 1995, for certain component types, up to 40 percent of the requirements with cast parts The advantages of modern casting technology compared to conventional manufacturing procedures are illustrated with the aid of a number of examples involving components of the MRCA Tornado aircraft G R

A83-33955
HIGH-STRENGTH ALUMINUM HIGH-QUALITY CASTING ALLOY IN AERONAUTICS AND ASTRONAUTICS [HOCHFESTE ALUMINIUM-FEINGUSS-LEGIERUNG IN DER LUFT- UND RAUMFAHRT]
G WEDEKING and CH LIESNER (Titan-Aluminium-Feinguss GmbH, Bestwig, West Germany) IN Highly stressed materials, with aviation considered as an example Oberursel, West Germany, Deutsche Gesellschaft fuer Metallkunde, 1982, p 61-64 In German

The method of investment ('lost wax') casting makes it possible to produce accurate castings characterized by a high surface quality Since the obtained cast components are nearly ready for installation, an employment of this method leads to savings with respect to material and to the elimination of many processing stages By combining high-quality casting techniques based on investment casting with an employment of suitable alloys of aluminum, magnesium, titanium, and zirconium, it is feasible to satisfy the rising demands of modern technology and to reduce manufacturing costs A preferred aluminum alloy with particularly excellent casting characteristics is G-AlSi7Mg Other alloys considered include G-AlSi7Mg0 6 and G-AlCu4Ag1 It is pointed out that high-strength aluminum alloys can be employed in the aerospace industry for highly stressed structural components G R

A83-34500
THE EFFECT OF PRODUCTS BASED ON HIGHER FATTY ACIDS ON THE PERFORMANCE CHARACTERISTICS OF JET FUELS [VLIIANIE PRODUKTOV NA OSNOVE VYSSHIKH ZHIRNYKH KISLOT NA EXPLUATATSIONNYE SVOISTVA REAKTIVNYKH TOPLIV]
O P LYKOV, T P VISHNIAKOVA, V V SASHEVSKII, and I E ORAKOVA (Moskovskii Institut Neftekhimicheskoi i Gazovoi Promyshlennosti, Moscow, USSR) Khimiia i Tekhnologiia Topliv i Masel (ISSN 0023-1169), no 5, 1983, p 34-36 In Russian

Higher fatty acids and their oligomers are added to jet fuels refined through various hydrogenation processes to improve their performance characteristics On the other hand, higher fatty acids may have a detrimental effect on the acidity and thermal stability of jet fuels Here, a study is made of the properties of the jet fuels T-8, T-8V, and T-7 containing 0 002-0 01 percent by mass of additives based on higher fatty acids These include the C17-C20 fraction of synthetic fatty acids, isocarbon acids extracted from the C17-C20 fraction by acetone, the bottoms of synthetic fatty acid production, and the acids extracted from the bottoms by cold methanol It is found that the additives investigated significantly improve the anti-wear characteristics of the jet fuels and do not have any deleterious effects on the service-related properties of the fuels when their concentration does not exceed 0 003 percent by mass V L

A83-35247
HIGH TEMPERATURE EROSION STUDY OF INCO 600 METAL
W TABAKOFF and B V R VITTAL (Cincinnati, University, Cincinnati, OH) Wear (ISSN 0043-1648), vol 86, April 1, 1983, p 89-99 refs
(Contract DAAG29-82-K-0029)

The erosive action of high speed particles can cause serious problems in connection with a number of applications Applications affected are related to such diverse areas as aircraft gas turbines, rocket nozzles, and coal-fired boiler systems The cost of maintaining gas turbines in dusty environments is great The employment of air filtration for an alleviation of the problem has the disadvantage that both payload and engine performance are reduced The incorporation of erosion as an engine design parameter is considered, taking into account the possible production of an erosion-tolerant engine by the considered approach In many turbomachinery applications, erosion takes place at elevated temperatures near the strength limiting temperature of the materials used An erosion test facility was design to provide erosion and rebound data in range of operating temperatures experienced in compressors and turbines The test facility was used to obtain basic erosion data for the INCO 600 material G R

A83-35811#
FURTHER STUDIES ON THE PREDICTION OF SPRAY EVAPORATION RATES
J S CHIN (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China), A H LEFEBVRE (Purdue University, West Lafayette, IN), and W G FREEMAN IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 73-78 refs

Predictions based on the Chin, Durrett and Lefebvre (1983) equation for estimating the time required to evaporate any given fraction of the mass of a liquid fuel spray in stagnant air are compared with results obtained using a more accurate, but more tedious and time-consuming, iteration procedure Attention is given to aviation gasoline, aviation kerosene, and the light diesel oil DF 2, over air pressure and air temperature ranges of 100-2000 kpa and 500-2000 K, respectively The influence of fuel spray characteristics is examined by including mean drop size values of

30-120 microns in the calculations, while the Rosin-Rammler drop size distribution parameter is varied from 2 5 to 3 5 The comparison indicates that the equation proposed yields a simple and effective means for deriving the evaporation times of fuel sprays in stagnant air O C

A83-35813#
THE EFFECTS OF FUEL PROPERTIES UPON POLLUTANTS PRESENT IN GAS TURBINE AERO-ENGINES
J ODGERS and D KRETSCHMER (UniversiteLaval, Quebec, Canada) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 93-104 Research supported by the Natural Sciences and Engineering Research Council of Canada refs

This paper discusses the probable impact of the alternative fuels upon the pollutants present in the exhaust of aircraft gas turbine The major problem is identified as carbon (soot) Hydrocarbons, carbon monoxide and oxides of nitrogen are also considered Possible solutions are suggested to minimize the various difficulties Other phenomena (atomization, ignition and heat transfer) associated with alternative fuels are lightly touched upon Author

A83-35821#
A STUDY OF LEAN EXTINCTION LIMIT FOR PILOT FLAME HOLDER
X N ZHANG and L Y JIANG (Nanjing Aeronautical Institute, Nanjing, People's Republic of China) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 154-161 refs

An experimental and theoretical study has been carried out to determine the lean extinction limit of pilot flame holder with homogeneous mixture Equations of entrainments in the recirculation of flame holder have been derived The semi-experimental equation has been set up for predicting the lean blow-out equivalent ratio of approach mixture and that of the corresponding pilot mixture at variable inlet parameters (inlet temperature, pressure, velocity and pilot flow rate) The influence of blockage of pilot stabilizer is examined Author

A83-35822#
EXPERIMENTAL RESEARCH OF THE MECHANISM OF FLAME STABILIZATION IN TWO PHASE MIXTURE
J -H WANG (Nanjing Aeronautical Institute, Nanjing, People's Republic of China) and Y -Z CHANG IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 162-171 refs

Pregutter vaporization efficiencies for a turbofan engine afterburner are simulated by the present two-phase mixture test apparatus, together with the inlet temperature and velocity, within lean flame stability limits The relationship between lean flame stability limits for the cases of homogeneous fuel-air and the two-phase mixture have been obtained, allowing semiempirical formulas for the lean stability limits of a v-gutter flameholder with three blockage ratios (in a two-phase mixture) to be obtained Fuel film temperature, length and vaporization efficiency are also experimentally investigated O C

A83-36066
FLUOROELASTOMERS
Materials and Design (ISSN 0261-3069), vol 4, Feb -Mar 1983, p 657-662 refs

Fluoroelastomers became first available in 1955 The first commercial fluoroelastomer was a copolymer of vinylidene (VF) and chlorotrifluoroethylene (CTFE) These materials are still available today and offer high resistance to chemicals (especially acids) and moisture They find applications in pumps, seals, and meters FKMs still account for the vast majority of applications of fluoroelastomers In addition to FKM elastomers, fluorosilicone elastomers have been employed for many years These elastomers have markedly enhanced resistance to fuels and petroleum products compared to silicone They may be flexible to -55 C and brittle at -66 C, but their long-term heat, stress-relaxation, and chemical resistance is not equal to that of FKM Fluorosilicone elastomers tend to be used in specialist applications where a combination of heat and fluid resistance and flexibility at subzero temperature is required Examples are seals and diaphragms in aircraft fuel and hydraulic systems G R

A83-36166* Cincinnati Univ , Ohio
THE EFFECT OF MICROSTRUCTURE ON THE FATIGUE BEHAVIOR OF NI BASE SUPERALLOYS
S D ANTOLOVICH (Cincinnati, University, Cincinnati, OH) and N JAYARAMAN IN Fatigue Environment and temperature effects New York, Plenum Press, 1983, p 119-144 refs
(Contract AF-AFOSR-80-0065, NSG-3263)

Nickel-base superalloys are used in jet engine components such as disks, turbine blades, and vanes Improvements in the fatigue behavior will allow the life to be extended or the payloads to be increased The first part of the present investigation deals primarily with the effects of microstructural variations on the fatigue crack propagation (FCP) behavior of nickel-base alloys, while the second part is concerned with low-cycle fatigue (LCF) behavior of Ni base systems Waspaloy at low temperature is considered, taking into account material heat treatment and test procedures, a composite plot of Waspaloy FCP data, Paris law fatigue crack propagation constants, monotonic tensile data, and overload FCP test results for Waspaloy It is found that the FCP and overload behavior of nickel-base alloys may be markedly improved by heat treating Attention is given to effects of cyclic deformation on microstructure and substructure, environmental damage, and an environmental/deformation model of high temperature LCF G R

A83-36240#
FEASIBILITY OF A FULL-SCALE DEGRADER FOR ANTIMISTING KEROSENE
R J MANNHEIMER (Southwest Research Institute, San Antonio, TX) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p Sponsorship U S Department of Transportation refs
(Contract DOT-FA79WA-4310)
(AIAA PAPER 83-1137)

An improved degrader for eliminating fuel filtering and atomization problems with aviation kerosene treated with FM-9 polymer to avoid droplet formation in the event of a crash are described The device was based on a prototype model that could only process 6 l of fuel (antimisting kerosene - AMK) The main features of the degrader comprised an axial piston pump, a needle valve, and a pressure gage and transducer Maximum flow rates of 1500 kg/hr were examined, the same as with a JT8D engine in cruise conditions The fuel was heated and cooled to examine different ambient temperature conditions The needle valve features a variable area orifice to maintain a constant pressure drop over a wide range of flow rates Measurements were taken of the upstream flow pressure and the ignition of the fuel and it was found that AMK could be degraded to Jet A performance standards over any flight conditions, although degradation was more difficult in low-temperature conditions M S K

A83-36241#
METHANOL COMBUSTION IN A CF6L-80A ENGINE COMBUSTOR
W J DODDS, E E EKSTEDT, and D W BAHR (General Electric Co , Aircraft Engine Business Group, Cincinnati, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p
(AIAA PAPER 83-1138)

A series of high pressure tests of a 60 deg sector of a General Electric CF6-80 engine combustor was conducted to evaluate operation on methanol fuel The use of methanol fuel was successfully demonstrated and, relative to operation with Jet A, provided significant reductions in combustor liner temperatures, flame radiation, and NOx emissions Combustion efficiency and

exit temperature profiles were similar with both methanol and Jet A Because of the low heating value of methanol, fuel flow levels had to be more than doubled at all power levels, relative to those needed with Jet A, to satisfy engine turbine inlet temperature requirements Author

A83-36243#
THERMAL STABILITY OF ALTERNATIVE AIRCRAFT FUELS
J TEVELDE, L J SPADACCINI, E J SZETELA (United Technologies Research Center, East Hartford, CT), and M R GLICKSTEIN (United Technologies Corp , Pratt and Whitney Group, West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p refs
(Contract N00140-80-C-0097)
(AIAA PAPER 83-1143)

A heated-tube apparatus was used to evaluate the thermal stability characteristics of four liquid hydrocarbon fuels and to determine the effect fuel deposits have on the heat transfer characteristics of aircraft gas turbine fuel systems The fuels tested were a low-aromatic JP-5, a blend of 80 percent JP-5 and 20 percent hydrocracked gas oil, a blend of 50 percent JP-5 and 50 percent No 2 heating oil, and a shale derived JP-5 Deposit formation rates ranging from 10 to 3000 microgram/sq cm hr were obtained at tube wall temperatures ranging from 480 to 800 K, with peak formation rates occurring at initial surface temperatures of 644 to 672 K Results indicate that deposit formation rate (1) correlates very well with initial surface temperature and (2) is relatively insensitive to fuel pressure in the range from 27 2 to 54 4 atm, and test duration in the range from 1 to 14 hr The deposit thermal resistance, as calculated from heat transfer measurements, correlates well with measured deposit quantity and thickness Author

N83-25790*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
EVALUATION OF LOW-COST ALUMINUM COMPOSITES FOR AIRCRAFT ENGINE STRUCTURAL APPLICATIONS
D L MCDANIELS and R A SIGNORELLI 1983 31 p refs Presented at the 112th Ann Meeting of the Met Soc of the Am Inst of Mining, Met and Petroleum Engineers, Atlanta, 6-10 Mar 1983
(NASA-TM-83357, E-1618, NAS 1 15 83357) Avail NTIS HC A03/MF A01 CSCL 11D

Panels of discontinuous SiC composites, with several aluminum matrices, were fabricated and evaluated Modulus, yield strength and tensile strength results indicated that the properties of composites containing SiC whisker, nodule or particulate reinforcements were similar The modulus of the composites was controlled by the volume percentage of the SiC reinforcement content, while the strength and ductility were controlled by both the reinforcement content and the matrix alloy The feasibility of fabricating structural shapes by both wire performs and direct casting was demonstrated for Al2O3/Al composites The feasibility of fabricating high performance composites into structural shapes by low pressure hot molding was demonstrated for B4C-coated B/Al composites Author

N83-25793# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
A PARAMETRIC STUDY OF SURFACE IMPERFECTIONS AND SMALL CUTOUTS IN A COMPOSITE PANEL M.S Thesis
T C JANISSE Dec 1982 168 p refs
(AD-A124739, AFIT/GAE/AA/82D-15) Avail NTIS HC A08/MF A01 CSCL 12A

A finite element computer code, STAGS C-1, was used to study the effects surface imperfections and cutouts have on the load bearing capability and the displacement patterns of a graphite-epoxy panel A nonlinear collapse analysis was conducted on two different ply layups each with five different surface imperfection patterns In addition three different ply orientations were studied each having two different size cutouts (a two inch by two inch square and a four inch by four inch square) The nonlinear branch of STAGS C-1 uses a energy technique using the nonlinear stiffness matrix that was generated by using the Sanders' strain displacement equations STAGS did a very good job in calculating the collapse load and displacement of a panel with surface imperfections when compared with experimentally tested panel The collapse characteristics of composite panels are dependent on the ply layup and size of the cutout Small cutouts had a displacement pattern that was not expected and is different than the larger cutouts Changing the vertical boundary conditions on the panel with the small cutout had a negligible effect GRA

N83-25795# Atlantic Research Corp , Alexandria, Va
COMPOSITE MATERIAL AIRCRAFT ELECTROMAGNETIC PROPERTIES AND DESIGN GUIDELINES
J A BIRKEN, W G DUFF, D R PFLUG, and R A WALLENBERG Oct 1981 369 p refs
(Contract N00019-79-C-0634)
(AD-A124016) Avail NTIS HC A16/MF A01 CSCL 01C

This document collects and primarily summarizes aircraft advanced composite material electromagnetic properties, and secondarily, summarizes composite material mechanical, thermal, environmental, fabrication properties noting their ramifications on electromagnetic performance It, then, overviews the electromagnetic sub-disciplines of threats, external to internal aircraft coupling, component and subsystems susceptibility protective methods as well as test and evaluation of small sample to total aircraft composite material electromagnetic performance The sub-disciplines constitute a partioned set of independent variables which allow the reader to locate his area of interest in one section of the book The sub-discipline are then combined to perform total aircraft electromagnetic system performance noting the protective methods, advantages and penalties
Author (GRA)

N83-25829# Naval Postgraduate School, Monterey, Calif Dept of Aeronautics
AUTOMATIC CONTROL AND DATA ACQUISITION SYSTEM FOR COMBUSTION LABORATORY APPLICATIONS M.S Thesis
B J HANSEN Oct 1982 120 p refs
(AD-A125195) Avail NTIS HC A06/MF A01 CSCL 21B

A modern computer based automatic data acquisition/control system was installed at the Department of Aeronautics' Combustion Laboratory This system utilizes an HP-85 desktop computer as system controller for the HP-3054A data acquisition system Large quantities of high quality data can be acquired at high data rates and stored for future use or processed real time in closed loop feedback control circuits for precise process control and display Other electromechanical equipment such as Visicorders provide analog real time data and run in parallel with digital equipment but can be remotely controlled for precise timing of experiments Interactive programs on the HP-85 computer allow the experimenter to do preliminary calculations, initial experiment set-up, and to perform accurate process control of system functions On line data reduction and display of results is performed by the system CRT display, the 7225B Plotter, or the system printer Four basic experiments/experimental apparatuses are currently automated using the automatic data acquisition system, a light scattering experiment, a vitiated air heater, a solid fuel ramjet, and a turbojet combustor test rig The first three applications are discussed in subsequent sections along with the measurement techniques used to implement the process Author (GRA)

N83-25854*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala
PRELIMINARY SCIENCE REPORT ON THE DIRECTIONAL SOLIDIFICATION OF HYPEREUTECTIC CAST IRON DURING KC-135 LOW-G MANEUVERS
P A CURRERI, D M STEFANESCU, and J C HENDRIX Apr 1983 23 p refs
(NASA-TM-82528, NAS 1 15 82528) Avail NTIS HC A02/MF A01 CSCL 11F

An ADSS-P directional solidification furnace was reconfigured for operation on the KC-135 low-g aircraft The system offers

many advantages over quench ingot methods for study of the effects of sedimentation and convection on alloy formation The directional sodification furnace system was first flown during the September 1982 series of flights The microstructure of the hypereutectic cast iron sample solidified on one of these flights suggests a low-g effect on graphite morphology Further experiments are needed to ascertain that this effect is due to low-gravity and to deduce which of the possible mechanisms is responsible for it Author

N83-25904# Southwest Research Inst , San Antonio, Tex Fuels and Lubricants Research Lab
EMERGENCY FUELS TECHNOLOGY Interim Report, May 1981 - Jun. 1982
J N BOWDEN and L I STAVINOHA Jun 1982 84 p refs
(Contract DAAK70-80-C-0001, DAAK70-82-C-0001, DA PROJ 1L7-72733-AH-20)
(AD-A125275, AFLRL-155, SWRI-6800-129) Avail NTIS HC A05/MF A01 CSCL 21D

Different types of engines in the military system require specific fuels for normal operation Spark-ignition engines require gasoline, compression-ignition engines and ground gas turbine engines require diesel fuel The requirements of each engine type are listed in Army Regulation 703-1 as primary, alternate and emergency fuels The work reported here identifies other combustible liquids that, in extreme emergency scenarios, could be used as field emergency fuels (FEF), either as extenders of the primary fuel supply, or as acquired Correlations are presented that permit estimating the fuel blend properties considered to be crucial for operation of engines at a minimal performance level Author (GRA)

N83-26929# Ohio State Univ , Columbus
TRANSIENT HEAT FLOW ALONG UNI-DIRECTIONAL FIBERS IN COMPOSITES Final Report, 1 Jul. 1978 - 31 Dec. 1981
L S HAN Wright-Patterson AFB, Ohio AFWAL Dec 1982 147 p
(Contract AF-AFOSR-3640-78, AF PROJ 2307)
(AD-A122926, AFWAL-TR-82-3061, REPT-761108/711129)
Avail NTIS HC A07/MF A01 CSCL 11D

For uni-directional fibrous composites and laminated composites, a heat balance integral method has been developed for the analysis of transient heat flow along the fibers or in the plane of laminates The method is based on the construction of, for the two constituent media, temperature profiles which not only satisfy the necessary boundary conditions but also fulfill the asymptotic error function properties when inter-region conduction is vanishingly small or at very early times of the heat transient By comparing with the results of exact solutions, accuracy of the method has been established to be dependent on a number of factors especially the inter-face conduction coefficient and thermal capacity ratio For the case of a constant surface heat flux, a relevant engineering problem, surface temperature rises of the two regions may be quite different from each other Temperature differences, however, diminish quite rapidly toward the interior and are only confined to a depth equal to a few fiber radii or laminate thicknesses Author

N83-26934# ECON, Inc , Princeton, N J
STATUS, TRENDS AND IMPLICATIONS OF CARBON FIBER MATERIAL USE Final Report, 20 Sep. 1979 - 19 Sep. 1981
Dec 1982 160 p refs
(Contract EPA-68-03-2857)
(PB83-147751, EPA-600/2-82-103) Avail NTIS HC A08/MF A01 CSCL 11D

The future usage of carbon fiber composite materials in both consumer and industrial products, and the resultant economic impact of the disposal of these products and industrial scrap in both the municipal and industrial waste streams are estimated The technical and economic substitutability of carbon fiber composite materials for materials now in use is analyzed, and the major uses of this material forecasted Potential problems relating to the disposal of products containing carbon fiber materials are analyzed, and estimates made of the economic impacts of the disposal of these products for alternative scenarios that cover a wide range of disposal technologies The economic impact of the disposal of products and industrial scrap containing carbon fiber composite materials is found to be insignificant for all of the scenarios investigated GRA

N83-27033# Virginia Polytechnic Inst and State Univ , Blacksburg Dept of Aerospace and Ocean Engineering
INJECTION, ATOMIZATION, IGNITION AND COMBUSTION OF LIQUID FUELS IN HIGH-SPEED AIR STREAMS Final Report, 1 Dec. 1978 - 30 Nov. 1981
J A SCHETZ Nov 1982 25 p
(Contract AF-AFOSR-3485-78, AF PROJ 2308)
(AD-A125237, VPI-AERO-130, AFOSR-83-0025TR) Avail NTIS HC A02/MF A01 CSCL 21B

Experimental studies of the penetration, break-up and atomization of transverse liquid and slurry jets were performed All tests were with an air cross flow at Mach 3 0 with Po = 4 atm and To = 300 deg K The processes studied were (1) the effects of injectant viscosity and surface tension, (2) the performance of an impinging jet injector and (3) the effects of particle loading for a slurry jet with 3-50 micrometer particles The diffractively scattered light method was employed at these high-density, supersonic conditions to study droplet sizes The major results are, (1) mean droplet size is approximately 10 microns for injectors of 0 05 in , (2) it has an inverse relation with jet/free stream dynamic pressure ratio, (3) it has a direct relation with orifice diameter, (4) it decreases downstream, (5) transverse variation has no simple pattern and (6) droplet size increases with viscosity GRA

N83-27034# Naval Postgraduate School, Monterey, Calif
AN INVESTIGATION OF THE EFFECTIVENESS OF SMOKE SUPPRESSANT FUEL ADDITIVES FOR TURBOJET APPLICATIONS M.S. Thesis
J R BRAMER Oct 1982 72 p refs
(AD-A125025) Avail NTIS HC A04/MF A01 CSCL 21E

Seven fuel additives were tested to investigate their effectiveness at reducing exhaust stack gas opacity in a turbojet test cell Exhaust particle sizes and mass concentrations were determined at the engine and stack exhausts using measurements of light transmittance at three frequencies Particle samples were also collected at the engine exhaust and measured with a scanning electron microscope to verify the optical technique Nitrous oxide emissions were measured at the test cell stack exhaust Four of the additives tested were found effective at reducing stack exhaust opacity and particulate mass concentration None of the additives had any measurable effect on particle diameters No meaningful changes in particle size or mass occurred between the engine and stack exhausts The optical technique for determining particle size was verified effective using the scanning electron microscope No additive had any significant effect on nitrous oxide production Author (GRA)

N83-27035# California Univ , Riverside Pollution Research Center
HIGH ALTITUDE JET FUEL PHOTOCHEMISTRY Final Report, Nov. 1980 - Sep. 1982
A M WINER, R ATKINSON, W P L CARTER, W D LONG, S M ASCHMANN, and J N PITTS, JR Tyndall AFB, Fla Air Force Engineering and Services Center Oct 1982 164 p refs
(Contract F08635-80-C-0359, AF PROJ 1900)
(AD-A125035, AFESC/ESL-TR-82-38) Avail NTIS HC A08/MF A01 CSCL 21D

Military jet aircraft flight procedures make it necessary to jettison excess fuel in the event of certain in-flight operational situations These fuel expulsions can be sizable, and in the presence of sunlight and NOx emissions from engine exhaust there exists the potential for formation of ozone and other manifestations of photochemical smog Since these fuel dumping procedures are carried out at elevated altitudes the atmospheric properties involved

are significantly different from those at ground level
Author (GRA)

12

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

A83-33507
EVALUATION OF THE EFFECT OF VOIDS IN COMPOSITE MAIN ROTOR BLADES
D G ORLINO (U S Army Applied Technology Laboratory, Fort Eustis, VA), R J SHUFORD, and W W HOUGHTON (U S Army, Army Materials and Mechanics Research Center, Watertown, MA) American Helicopter Society, Journal (ISSN 0002-8711), vol 27, Oct 1982, p 49-56

Design and fabrication of the Improved Main Rotor Blade, designated K-747, as a replacement for the Bell Model AH-1S Cobra, evolved through mission requirements necessitating higher armament payloads, and thus a need to improve rotor lifting capacity Required increases in performance appeared to be obtainable by directly replacing the main rotor blades with new blades having increased aerodynamic efficiency Attention was given to a test program directed at assessing void growth characteristics and rates for composite structures A description is presented of void growth measurements conducted in connection with fatigue testing one K-747 main rotor blade for 29 million cycles, taking into account the nondestructive techniques used during the test program G R

A83-33650
MICROECONOMIC MODELS FOR PROCESS DEVELOPMENT
V A TIPNIS, U WATWE (Tipnis Associates, Inc , Cincinnati, OH), S J MANTEL, JR (Cincinnati, University, Cincinnati, OH), and G L RAVIGNANI IN Advanced processing methods for titanium, Proceedings of the Symposium, Louisville, KY, October 13-15, 1981 Warrendale, PA, Metallurgical Society of AIME, 1982, p 289-308 refs
(Contract F33615-79-C-5119)

The evaluation of return on added investments, and economic sensitivities during process development, have been introduced into the 'macro', or processing sequence level, and 'micro', or cut/stroke level, in order to identify opportunity windows, and ranges of operating variables, within which a novel process can be made competitive with existing ones The process model consists of process inputs, constraints, and outputs for the unit under investigation, and is ultimately related to phenomenological models derived from constitutive relationships, interface phenomena such as friction and wear, and fracture limit instability The microeconomic model is based on the process model at the level of the processing unit The overall relationship between the process and miroeconomic models is presently investigated for the case of Ti airframe milling O C

A83-33964
THE INFLUENCE OF DEFECTS ON THE OPERATIONAL STRENGTH OF DISKS AND WHEELS IN ENGINES [FEHLEREINFLUSS AUF DIE BETRIEBSFESTIGKEIT VON TRIEBWERKSSCHEIBEN UND -RAEDERN]
G KOENIG and J WORTMANN (Motoren- und Turbinen Union Muenchen GmbH, Munich, West Germany) IN Highly stressed materials, with aviation considered as an example Oberursel, West Germany, Deutsche Gesellschaft fuer Metallkunde, 1982, p 155-167 In German

It is pointed out that rotating parts belong to those components of an aircraft engine which have to satisfy the most exacting safety requirements Safety hazards are related to the risk of engine failure, and, in addition, also to the possibly very serious effects which can be produced in connection with the rupture of a rotating component with its enormous kinetic energy The relative frequency of an occurrence of various types of failure mechanisms is considered, taking into account also the relative importance of the responsible causes Low-frequency cyclic stresses related to changes in the rotational speed in connection with changes from one flight phase to another are found to be particularly critical Attention is given to the sections of a component for which the possibility of crack formation is especially great, aspects of crack propagation, the maximum size of defects which cannot be discovered with the employed inspection methods, the effect of defects on operational conditions, and the results of tests conducted with disks made of various materials G R

A83-33974
RESIDUAL LIFE PREDICTION FOR JET ENGINE ROTOR DISKS AT ELEVATED TEMPERATURE
H OHNABE, M ZAKO, T KAWASHIMA (Ishikawajima-Harima Heavy Industries Co , Ltd , Tokyo, Japan), and T MIYOSHI (Tokyo, University, Tokyo, Japan) Metallurgical Society of AIME, Annual Meeting, 111th, Dallas, TX, Feb 14-18, 1982, Paper 11 p refs

The life prediction method of rotor disks at elevated temperatures is presented, assuming crack initiation to occur at the rim slot of an aircraft jet engine rotor disk and converting the two-dimensional stress into a quasi-three-dimensional one Thermal and centrifugal stress at the cracked part of the rim slot is calculated by the finite element method, and Paris's rule is used for calculation of the crack propagation Assuming Klc and the difference between Klc and calculated KI, that is, Klc - KI, to be a Gaussian distribution, safety is estimated by the relationship between fracture probability and standard deviation In the numerical examples, an elliptic surface crack being assumed at three different parts of the rim slot of a rotor disk at elevated temperature, the crack propagation after the 2000th cycle is calculated and then compared with the case of constant (room) temperature The safety of rotor disks is judged by the value of Klc - KI Author

A83-34170
LASERS IN AIRCRAFT CONSTRUCTION [LAZERY V SAMOLETOSTROENII]
E T VAGNER Moscow, Izdatel'stvo Mashinostroenie, 1982, 184 p In Russian refs

Theoretical considerations and practical results concerning the application of lasers in aircraft construction and production are generalized and systematized Particular attention is given to the theoretical principles underlying relativistic laser metrology, laser interferometers, laser aligning systems, the use of laser measuring systems in assembly processes, and the effect of environmental conditions on the operation of laser aligning systems, and measurement errors B J

A83-34311
OPTIMIZATION FOR STRUCTURES OF DISCRETE-SIZE ELEMENTS
H M HUA (Aero Industry Development Center, Republic of China) Computers and Structures (ISSN 0045-7949), vol 17, no 3, 1983, p 327-333 refs

An optimization algorithm for finding the minimum weight design of a structure assembled with material of discrete sizes is

presented Examples of the use of this method for aerospace structure design problems are presented, including the four-bar space truss, the ten-bar truss, and the eighteen-member wing box The results of these examples show that the structures under displacement and stress constraints can be optimized by using this search algorithm Although the algorithm is formulated to find the feasible solution through direct evaluation, it can be extended easily to solving the optimization problem with dynamic constraints The method is very flexible and it can be applied to selecting an optimal design among the material available and to determining the optimal fiber layer distribution of various orientations in the structures of composite materials N B

A83-34315
NONLINEAR SUPERSONIC FLUTTER OF PANELS CONSIDERING SHEAR DEFORMATION AND ROTARY INERTIA
K S RAO and G V RAO (Indian Space Research Organization, Vikram Sarabhai Space Centre, Div , Trivandrum, India) Computers and Structures (ISSN 0045-7949), vol 17, no 3, 1983, p 361-364 refs

The finite element method is employed to study the nonlinear supersonic flutter of panels for end conditions of simply supported, clamped, and partial restraint against rotation The effect of shear deformation and rotary inertia on the nonlinear flutter boundary is investigated for varying thicknesses of the panel Results show that shear and rotary inertia reduce the critical dynamic pressure parameter, while the large deflection increases the critical dynamic pressure parameter It is concluded that for panels with L/h less than or equal to 10, where L is the length of the panel and h is the thickness of the panel, the shear and rotary inertia effects are considerable and should be included N B

A83-34472
THE DISTRIBUTION OF THE DISPERSE FRACTION OF A POLYDISPERSE JET INJECTED INTO A GAS FLOW [O RASPREDELENII V GAZOVOM POTOKE DISPERGIROVANNOI FRAKTSII IZ VVODIMOI V NEGO POLIDISPERSNOI STRUI]
I L MOSTINSKII, D I LAMDEN, and O G STONIK (Akademiia Nauk SSR, Institut Vysokikh Temperatur, Moscow, USSR) Inzhenerno-Fizicheskii Zhurnal (ISSN 0021-0285), vol 44, May 1983, p 739-748 In Russian refs

Analytical expressions describing the distribution of a polydisperse jet in a gas flow are obtained, and the cases of longitudinal and transverse aerosol injection are examined The spray geometry and the droplet size distribution functions are used in sufficiently arbitrary form and are suitable for both direct-jet and centrifugal nozzles The solutions employ relationships for the trajectories of individual droplets that have been obtained by using an empirical drag coefficient in a two-dimensional equation of motion The resulting expressions for the disperse phase distribution over the flow cross section are reduced to a form convenient for engineering applications Illustrative examples are given V L

A83-34744
ON IMPROVING THE FATIGUE PERFORMANCE OF A DOUBLE-SHEAR LAP JOINT
L SCHWARMANN (Vereinigte Flugtechnische Werke GmbH, Bremen, West Germany) International Journal of Fatigue (ISSN 0142-1123), vol 5, April 1983, p 105-111 Research sponsored by the Bundesministerium der Verteidigung refs

Different methods of improving the fatigue performance of a double-shear lap joint which is representative for airframe structures are discussed, Considering all aspects concerning fatigue performance, fabrication problems and costs, one method is recommended for practical application in aviation This method involves the installation of cylindrical fasteners with a low degree of interference-fit into cold-worked holes Author

A83-35040
VIBRATIONAL DIAGNOSTICS OF GAS-TURBINE BLADES [VIBRODIAGNOSTIKA RABOCHIKH LOPATOK GAZOTURBINNYKH USTANOVOK]
E A IGUMENTSEV (Nauchno-Proizvodstvennoe Ob'edinenie Soiuzturbogaz, Kharkov, Ukrainian SSR) Problemy Prochnosti (ISSN 0556-171X), May 1983, p 40-44 In Russian refs

A stochastic method is proposed for the diagnostics of resonance stresses in the blading of gas turbines on the basis of the torsional vibrations of the rotor The principal probability characteristics of the blade dynamics essential for the diagnosis are determined The suitability of the proposed relationships for practical calculations is demonstrated by an example V L

A83-35809#
EFFECT OF AIR, LIQUID AND INJECTOR GEOMETRY VARIABLES UPON THE PERFORMANCE OF A PLAIN-JET AIRBLAST ATOMIZER
G A HUSSEIN, A K JASUJA, and R S FLETCHER (Cranfield Institute of Technology, Cranfield, Beds , England) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 56-63 refs

Plain air jet air blast atomizer design is undertaken, on the basis of an examination of the breakup characteristics of a discrete liquid jet that is injected into a high velocity cross-flowing airstream, where the variables considered are airstream velocity, liquid jet velocity, injection orifice diameter, liquid viscosity, and liquid surface tension Tests were conducted in normal atmospheric pressure and temperature conditions, using a laser light scattering technique for mean drop size determination O C

A83-35810#
FURTHER STUDY ON THE PREDICTION OF LIQUID FUEL SPRAY CAPTURE BY V-GUTTER DOWNSTREAM OF A PLAIN ORIFICE INJECTOR UNDER UNIFORM CROSS AIR FLOW
M -H CAO and J -S CHIN (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 64-72 refs

On the basis of the Chin and Cao (1983) flat fan spray and fuel capture models, flame holder liquid fuel spray capture is predicted in route to a consideration of the effect of different factors on fuel spray capture for a wide range of parameters A comparison is then undertaken between fuel spray capture by vertically and horizontally positioned flame holders, and a correlation for maximum fuel spray capture is determined The results obtained indicate that the vertically positioned flame holder provides more effective fuel capture, as well as the ability to change fuel capture over a wide range through simple alteration of juxtaposition distance O C

A83-35862#
EXPERIMENTAL INVESTIGATION ON THE ROLE OF FLEXBARS AND METALLIC END SEALS IN SQUEEZE FILM DAMPERS
V A KUMAR (National Aeronautical Laboratory, Bangalore, India), S C KAUSHAL, and K LAKSHMIKANTAN (GTRE, Research Div , Bangalore, India) IN International Symposium on Air Breathing Engines, 6th, Paris, France, June 6-10, 1983, Symposium Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 530-534 refs

A performance evaluation is undertaken for squeeze film dampers by means of a novel test program which highlights the effect of several related parameters on damper performance Attention is given to the effects of flexbars and metallic end seals on the performance of squeeze film dampers Damping coefficient quantitative values were calculated by direct measurement of the force transmitted to the foundation, damper sleeve displacement, phase angle between force transmitted and damper sleeve displacement, and excitation frequency, for various oil supply pressures and rotor speeds Flexbars and metallic end seals

generally improve system damping characteristics, and it is noted that the location of the end seal gap, in relation to the position of the squeeze film oil supply inlet ports, plays a significant role in making the introduction of the end seal more effective in system damping O C

A83-35933
INTEGRO-DIFFERENTIAL EQUATIONS OF THE DYNAMICS OF ELASTIC SYSTEMS IN NONSTATIONARY FLOWS [INTEGRO-DIFFERENTSIAL'NYE URAVNENIIA DINAMIKI UPRUGIKH SISTEM V NESTATSIONARNOM POTOKE]
V I MOROZOV and A T PONOMAREV (Voenno-Vozdushnaia Inzhenernaia Akademiia, Moscow, USSR) Prikladnaia mekhanika (ISSN 0032-8243), vol 19, May 1983, p 128-131 In Russian refs

A mathematical model of nonstationary aeroelasticity has been developed by combining the numerical methods of aerodynamics with elasticity theory The aerodynamics is described using a linearized approach, in the elastic part of the problem, both linear and nonlinear relationships are employed The two parts are combined by using the convolution for determining the variable pressure fields The possibilities of the model are illustrated by examples involving the behavior of a flight vehicle as a whole and its components in turbulent nonseparated flow Results are presented in graphical form V L

A83-36039*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EVALUATION OF A SURFACE PANEL METHOD COUPLED WITH SEVERAL BOUNDARY LAYER ANALYSES
S O KJELGAARD (NASA, Langley Research Center, Low-Speed Aerodynamics Div, Analytical Methods Branch, Hampton, VA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 21st, Reno, NV, Jan 10-13, 1983 9 p refs
(AIAA PAPER 83-0011)

Three boundary layer models are interacted with an inviscid panel method to evaluate their capabilities to predict aerodynamic performance characteristics These boundary layer models include two two-dimensional boundary layer models and one three-dimensional boundary layer model Previously reported discrepancies between the transpiration and surface displacement inviscid boundary layer simulations are discussed and resolved Results from each of the models are compared with experimental data Author

A83-36085*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
SEVEN-HOLE CONE PROBES FOR HIGH ANGLE FLOW MEASUREMENT THEORY AND CALIBRATION
K N EVERETT, A A GERNER, and D A DURSTON (NASA, Ames Research Center, Moffett Field, CA) AIAA Journal (ISSN 0001-1452), vol 21, July 1983, p 992-998 refs

Previously cited in issue 08, p 1219, Accession no A82-22070

A83-36174
LIFE PREDICTION FOR TURBINE ENGINE COMPONENTS
T NICHOLAS and J M LARSEN (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) IN Fatigue Environment and temperature effects New York, Plenum Press, 1983, p 353-375 USAF-supported research refs

An alternate approach to life management of turbine engines is being considered considered by the U S Air Force Whereas most major structural components are currently limited by low cycle fatigue and are retired fro service after their design life has been reached, a 'Retirement for Cause' approach would keep components in service until a fatigue crack has been detected The approach is based on non-destructive inspection and prediction of fatigue crack growth behavior under engine operating conditions This paper discusses the concept of retirement for cause and reviews the problems associated with the prediction of crack growth Several aspects of crack growth under engine spectrum loading including creep crack growth and crack retardation are discussed Recommendations for future research efforts are presented Author

A83-36221#
DESIGN OF A REAL-TIME CGSI SYSTEM
D M BALDWIN (U S Navy, Naval Training Equipment Center, Orlando, FL), B F GOLDIEZ (U S Army, Orlando, FL), and C P GRAF (Honeywell Systems and Research Center, Minneapolis, MN) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 154-162
(AIAA PAPER 83-1101)

A hybrid system, CGSI, is being developed which will merge the attributes of video disc technology and Computer Generated Imagery (CGI) Initial non-real time feasibility has been demonstrated and reported on Detailed design of a limited real-time system is being conducted The basic design is modular with a parallel pipeline architecture This real-time design is the topic of this paper Author

A83-36237#
ECCENTRIC END WEAR IN CYLINDRICAL ROLLER BEARINGS CAN BE PREDICTED AND PREVENTED
W E POOLE and G E CHETTA (United Technologies Corp, Pratt and Whitney Group, West Palm Beach, FL) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 7 p
(AIAA PAPER 83-1132)

Cylindrical roller bearings are widely used for rotor support in gas turbine engines because of their high load capacity, suitability for high speed and their capability to allow relative axial movement between the engine rotor and case However, problems may arise, as the gas turbine environment becomes more demanding Although not new, eccentric end wear occurs more frequently and may progress to secondary engine damage more rapidly in modern high speed turbine engines Several theories were developed as potential causes of eccentric end wear based on earlier work A test program was structured to evaluate each theory with the goal of duplicating the cage fracture sequence in a bearing rig and, if successful, in an engine It is found that wear can be initiated by roller dynamic unbalance Other observed causes of eccentric end wear are local end defects and end runout High internal radial clearance contributes to wear progression Wear progression leading to large end runout depends only on geometry G R

A83-36239*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
DESIGN ANALYSIS OF A SELF-ACTING SPIRAL-GROOVE RING SEAL FOR COUNTER-ROTATING SHAFTS
EL DI RUSSO (NASA, Lewis Research Center, Cleveland, OH) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 8 p
(AIAA PAPER 83-1134)

A self-acting spiral groove inter-shaft ring seal of nominal 16 33 cm (6 43 in) diameter for sealing fan bleed air between counter rotating shafts in advanced turbofan engines was analyzed The analysis focused on the lift force characteristics of the spiral grooves A NASA Lewis developed computer program for predicting the performance of gas lubricated face seals was used to optimize the spiral groove geometry to produce maximum lift force Load capacity curves (lift force as function of film thickness) were generated for four advanced turbofan engine operating conditions at relative seal speeds ranging from 17,850 to 29,800 rpm, sealed air pressures from 6 to 42 N/sq cm (9 to 60 Psi) absolute and temperatures from 95 to 327 C (203 to 620 F) The relative seal sliding speed range was 152 to 255 m/sec (500 to 836 ft/sec) The analysis showed that the spiral grooves are capable of producing sufficient lift force such that the ring seal will operate in a noncontacting mode over the operating range of typical advanced turbofan engines Previously announced in STAR as N83-23306 Author

A83-36277*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
EXPERIMENTS IN DILUTION JET MIXING
J D HOLDEMAN (NASA, Lewis Research Center, Cleveland, OH), R SRINIVASAN, and A BERENFELD (Garrett Turbine Engine Co., Phoenix, AZ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 14 p refs
(AIAA PAPER 83-1201)

Experimental results are presented on the mixing of a single row of jets with an isothermal mainstream in a straight duct, with flow and geometric variations typical of combustion chambers in gas turbine engines included It is found that at a constant momentum ratio, variations in the density ratio have only a second-order effect on the profiles A first-order approximation to the mixing of jets with a variable temperature mainstream can, it is found, be obtained by superimposing the jets-in-an-isothermal-crossflow and mainstream profiles Another finding is that the flow area convergence, especially injection-wall convergence, significantly improves the mixing For opposed rows of jets with the orifice cone centerlines in-line, the optimum ratio of orifice spacing to duct height is determined to be 1/2 of the optimum value for single injection at the same momentum ratio For opposed rows of jets with the orifice centerlines staggered, the optimum ratio of orifice spacing to duct height is found to be twice the optimum value for single side injection at the same momentum ratio C R

A83-36354#
EFFECTS OF COMPRESSOR HUB TREATMENT ON STATOR STALL MARGIN AND PERFORMANCE
P CHENG, M E PRELL, E M GREITZER, and C S TAN (MIT, Cambridge, MA) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 9 p refs
(Contract F49620-82-K-0002)
(AIAA PAPER 83-1352)

The application of grooves or slots over the rotor tips in the casing of an axial flow compressor can have a large effect on compressor stall margin and performance Relative motion between endwall and blade is found to be an important element for the success of the grooves in reducing the endwall boundary layer blockage in the rotor tip region In this connection, the question has been asked whether a rotating 'hub treatment' below a row of cantilevered stator blades would also be effective in improving the stall margin The present investigation is concerned with the effect of hub treatment on the stall margin and performance of a 'hub critical' stator Two sets of blading configurations were tested, each with a solid wall and with hub treatment It was found that for the first set of blading (low stagger) the application of hub treatment did not have a major effect on the stator performance However, for the second set of blading (high stagger), the hub treatment improved the compressor performance G R

A83-36405#
FEASIBILITY OF DRY LUBRICATION FOR LIMITED-DUTY GAS TURBINE ENGINES
J DILL (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH), D BRANDES, P KAMSTRA, and R SOLOMON (Garrett Turbine Engine Co., Phoenix, AZ) AIAA, SAE, and ASME, Joint Propulsion Conference, 19th, Seattle, WA, June 27-29, 1983 14 p DARPA-USAF-supported research refs
(AIAA PAPER 83-1130)

The advantages and disadvantages of dry-lubrication systems for limited duty engines, those that are of only intermittent or emergency use, are discussed, together with technology areas needing development to produce a dry lubricated turbine engine Two approaches have been identified, one in which the lubricant is already in the bearing, the second involving an external feed to the bearing Dry lubricated bearings have two critical material properties, thermal conductance and the thermal expansion coefficient The materials must be resistant to oxidation and corrosion Hot-pressed silicon nitride ceramics have demonstrated the desired features, but at a high cost, with surface cleanliness problems, and some doubt is present as to their uniformity Promising lubricants include MoS2, graphite, WSe2-GaIn, and AgHg-PTFE-MoS2 Attempts at simulating dry lubricated bearing behavior and performance by computer program are outlined M S K

A83-36794#
SOME APPLICATIONS OF ULTRASONIC METHODS FOR THE QUALITY CONTROL OF NONMETALLIC OBJECTS [WYBRANE ZASTOSOWANIA METOD ULTRADZWIEKOWYCH DO OCENY JAKOSCI WYROBOW WYKONANYCH Z TWORZYW NIEMETALOWYCH]
I AUERBACH, E NAPORA, W SZACHNOWSKI, and K SZCZEPANSKI Instytut Lotnictwa, Prace (ISSN 0509-6669), no 91, 1982, p 73-87 In Polish

Two methods of nondestructive ultrasonic testing are described which have been developed for the quality control of the rotor blades of the drive system of an agricultural aircraft and for the quality control of the adhesive joints of an aircraft undercarriage skid A procedure for optimizing the ultrasonic method is proposed, and the design of auxiliary equipment for production control is discussed B J

A83-36910
DETERMINATION OF THE SENSITIVITY OF U S. AIR FORCE AIRCRAFT HYDRAULIC SYSTEM COMPONENTS TO PARTICULATE CONTAMINATION
C E SNYDER, JR., L J GSCHWENDER, and C J PELLERIN (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Lubrication Engineering (ISSN 0024-7154), vol 39, July 1983, p 450-455, Discussion, p 455, 456, Authors' Closure, p 456, 457

The effect of particulate contamination on aircraft hydraulic system components was determined using a 3000 psi hydraulic multipass test stand equipped with a horizontal stabilator actuator and hydraulic pump used in the F-4 hydraulic system The test fluid was MIL-H-5606 hydraulic fluid Particulate contamination was introduced into the system in the form of AC test dust and was added in incremental amounts while changing the actuator piston dither position for a total of nine piston positions with increasing contamination Filtration was added to the stand late in the experiment Fluid samples were drawn throughout the experiment and properties were monitored Both the actuator and the pump were monitored for leakage rates and the pump was monitored for outlet pressure during the experiment Post-test inspection of the hardware and fluid analyses lead to wear/contamination conclusions which were relevant to Air Force aircraft operations Author

N83-25919# Transportation Research and Marketing, Salt Lake City, Utah
TRANSPORTATION ENERGY CONSERVATION THROUGH LAND USE PLANNING Final Report
Jun 1982 58 p refs Conf held in Washington, D C., 5-6 Nov 1981 Sponsored in part by the FHA
(PB83-148387, DOT-1-82-50) Avail NTIS HC A04/MF A01 CSCL 13B

The interrelationships of transportation, land use and energy are covered Two major areas were highlighted, the fundamental social, economic, energy, and cultural factors that influence planning, and opportunities for the coordination of transportation and land use Although no specific recommendations are contained, highlight examples of effective plans and programs and questions that can form the basis for further research are described GRA

N83-25929# National Severe Storms Lab , Norman, Okla
SCANNING STRATEGIES FOR NEXT GENERATION WEATHER RADARS A STUDY BASED ON LIFETIMES OF CONVECTIVE ATMOSPHERIC PHENOMENA HAZARDOUS TO AVIATION Final Report
P R MAHAPATRA and D S ZRNIC Jul 1982 94 p refs
(Contract DTFA01-80-Y-10524)
(FAA-RD-82-69) Avail NTIS HC A05/MF A01

The lifetimes of significant features in typical storm phenomena were investigated and the results are expected to help in deciding the scan strategy of NEXRAD radars In particular, the question of the adequacy of a 5 minute information update rate for NEXRAD in its aviation weather surveillance role was addressed Two methods are used for the lifetime study photo-interpretive and computer based correlation The basis and program steps of the correlation method are discussed Several storms are studied using both methods It is found that the storms studied contain no feature that might have been missed by a 5 minute scan cycle provided that data from all the three moment fields (reflectivity, radial velocity, and Doppler spectrum width) at several elevations are utilized in the detection of hazardous phenomena Author

N83-25934# Houston Univ , Tex Dept of Electrical Engineering
THE REMOTE LINK UNIT A DEMONSTRATION OF OPERATIONAL PERFORMANCE PART 3: DESIGN MANUAL, VOLUME 1 Final Report, 1 Apr. - 31 Dec. 1980
C J TAVORA, J R GLOVER, JR , M A SMITHER, H M COLLINS, and W C LAW Wright-Patterson AFB, Ohio AFWAL Aug 1981 230 p refs 2 Vol
(Contract F33615-80-C-1095, AF PROJ 2003)
(AD-A124621, AFWAL-TR-81-1131-PT-3-VOL-1) Avail NTIS HC A11/MF A01 CSCL 17B

This document is a design manual for the Remote Link Unit Demonstration System (RLUDS) The Remote Link Unit (RLU) is a new design concept for remote terminals This document contains detailed design information on the RLUDS The RLUDS described in this design manual is an operational hardware breadboard prototype that performs most of the important RLU functions This effort has demonstrated the feasibility of implementation of the Link Module (LM), the Interface Configuration Adapter (ICA), the Electronic Nameplate (NP) and the Interface between the Link Module and the Link Manager The Link Manager (LMG) was simulated with a PDP-11 computer The extent of RLU implementation encompassed by the demonstration unit is illustrated The configuration of the RLUDS is presented GRA

N83-25935# Houston Univ , Tex Dept of Electrical Engineering
THE REMOTE LINK UNIT: A DEMONSTRATION OF OPERATIONAL PERFORMANCE. PART 3: DESIGN MANUAL. VOLUME 2: APPENDICES A - C Final Report, 1 Apr. - 31 Dec. 1980
C J TAVORA, J R GLOVER, JR , M A SMITHER, H M COLLINS, and W C LAW Wright-Patterson AFB, Ohio AFWAL Aug 1981 661 p refs 2 Vol
(Contract F33615-80-C-1095, AF PROJ 2003)
(AD-A124622, AFWAL-TR-81-1131-PT-3-VOL-2) Avail NTIS HC A99/MF A01 CSCL 17B

The source code tape directory, hardware schematics, and software flow charts are presented for the remote link unit GRA

N83-25938# Houston Univ , Tex Dept of Electrical Engineering
THE REMOTE LINK UNIT: A DEMONSTRATION OF OPERATIONAL PERFORMANCE. PART 2: USER'S MANUAL Final Report, 1 Apr. - 31 Dec 1980
C J TAVORA, J R GLOVER, JR , M A SMITHER, H M COLLINS, and W C LAW Wright-Patterson AFB, Ohio AFWAL Aug 1981 113 p refs 2 Vol
(Contract F33615-80-C-1095, AF PROJ 2003)
(AD-A124620, AFWAL-TR-81-1131-PT-2) Avail NTIS HC A06/MF A01 CSCL 17B

The purpose of this manual is to provide a guide for the use and operation of the Remote Link Unit Demonstration System (RLUDS) without the details of the design of the system The sections of this manual provide information on inspection of the equipment to verify a correct physical configuration, external cable connections, procedures for operation This manual provides all the details necessary for operations of the RLUDS, assuming the user is generally knowledgeable of the concept, purpose, and configuration of the RLU and its major components Both background information and design details may be found in the Design Manual (Part III) GRA

N83-25939# Houston Univ , Tex Dept of Electrical Engineering
THE REMOTE LINK UNIT A DEMONSTRATION OF OPERATIONAL PERFORMANCE, PART 1 Final Summary Report, 1 Apr - 31 Dec. 1980
C J TAVORA, J R GLOVER, JR , M A SMITHER, H M COLLINS, and W C LAW Wright-Patterson AFB, Ohio AFWAL Aug 1981 36 p refs 2 Vol
(Contract F33615-80-C-1095, AF PROJ 2003)
(AD-A124619, AFWAL-TR-81-1131-PT-1) Avail NTIS HC A03/MF A01 CSCL 17B

This report summarizes the results of the program of implementation of an RLU Demonstration System This system allows the evaluation of the most unique parts of the RLU and has facilitated the resolution of problem areas in the RLU design Enhancements to the RLU functional design are presented and an implementation plan for an RLU prototype is proposed The User's Manual and the Design Manual for the system are included as Parts II and III, respectively Author (GRA)

N83-25948# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
ANALYSIS OF F-16 RADAR DISCREPANCIES M.S Thesis
K A RICHE Dec 1982 44 p refs
(AD-A124749, AFIT/GE/EE/82D-56) Avail NTIS HC A03/MF A01 CSCL 15E

One hundred and eight aircraft were randomly selected from three USAF F-16 bases and examined These aircraft included 63 single-seat F-16As and 45 two-seat F-16Bs and encompassed 8,525 sorties and 748 radar system write-ups Programs supported by the Statistical Package for the Social Sciences (SPSS) were run on the data Of the 748 discrepancies, over one-third of them occurred within three sorties of each other and half within six sorties Sixteen percent of all aircraft which had a discrepancy within three sorties had another write-up within the next three sorties Designated repeat/recurring write-ups represented one-third of all the instances in which the write-up separation interval was three sorties or less This is an indication that maintenance is unable to correct equipment failures as they occur, most likely because the false alarm rate is too high and maintenance is unable to duplicate the error conditions on the ground for correct error diagnosis GRA

N83-25990# Edgerton, Germeshausen and Grier, Inc , Salem, Mass
PHASE 2A BENCH MODEL DEVELOPMENT TACTICAL RUBIDIUM FREQUENCY STANDARD Final Technical Report, 16 Feb. - 16 Jun. 1982
W J RILEY Hanscom AFB, Mass RADC Dec 1982 34 p
(Contract F1628-81-C-0055, AF PROJ 2277)
(AD-A124462, RADC-TR-82-253) Avail NTIS HC A03/MF A01 CSCL 14B

A working bench model of a rubidium frequency standard has been designed and built that offers small size, fast warm-up and ruggedness for avionic applications Author (GRA)

N83-26023# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
DESIGN OF CHOKING CASCADE TURNS M.S. Thesis
J BAIRD Dec 1982 79 p refs
(AD-A124792, AFIT/GAE/AA/82D-3) Avail NTIS HC A05/MF A01 CSCL 16D

Five different shock-positioning cascades, for short-radius turns in ramjet inlet diffusers, were designed and tested on the AFIT water table These flow controllers were to perform the same function as the conventional arrangement of an aerodynamic grid and a long-radius turn The tests were to determine the suitability of the water table for such experimentation, in addition to determining the flow-control capabilities and pressure recovery of the cascades All five designs accomplished the flow-control function as designed, and two designs exhibited the same or better pressure recovery than the aerodynamic grid The water table proved to be an excellent means of testing these cascades, primarily due to the ease of flow visualization in the tests done The shock-positioning cascade, short-radius turn concept shows promise and should be tested further in gas-dynamic apparatus Author (GRA)

N83-26080*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala
DAMPING SEAL FOR TURBOMACHINERY Patent Application
G L VONPRAGENAU, inventor (to NASA) 28 Apr 1983 11 p
(NASA-CASE-MFS-25842-1, US-PATENT-APPL-SN-489902)
Avail NTIS HC A02/MF A01 CSCL 11A

A damping seal between a high speed rotor member and stator member that separates pressurized fluid compartments is described The rotor member has a smooth outer surface and the stator member has a bore surface roughened by a plurality of pockets or depressions NASA

N83-26081# Hughes Helicopters, Culver City, Calif
ULTRASONIC WELD BONDING OF HELICOPTER PRIMARY STRUCTURES Final Report, Sep. 1979 - Jul. 1981
K K NIJI Dec 1982 38 p refs
(Contract DAAK51-79-C-0045)
(AD-A124645, USAAVRADCOM-TR-82-D-28, HHI-82-261) Avail NTIS HC A03/MF A01 CSCL 13H

This program was a study to develop and optimize an ultrasonic weld bonding procedure for the fabrication of primary structural components for helicopters This procedure, a combination of ultrasonic welding and adhesive bonding, was studied through a series of coupon tests Various adhesives and surface treatments were evaluated with regard to their adaptability of ultrasonic weld bonding Adhesive bond quality and weld quality were evaluated through various T-shear, fatigue, and environmental salt-spray tests Environmental degradation of the adhesively bonded areas occurred consistently and could not be resolved It was determined that the surface condition required for good adhesive bonding was not compatible with that required for good ultrasonic welding and the program was terminated Author (GRA)

N83-26099# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
STATIC AEROELASTIC ANALYSIS OF FLEXIBLE WINGS VIA NASTRAN, PART 1 M. S. Thesis
K JONES Dec 1982 97 p refs
(AD-A124662, AFIT/GAE/AA/82D-16-PT-1) Avail NTIS HC A05/MF A01 CSCL 01C

The purpose of this study was to expand the capabilities of the Static Flexible Wing Aeroelastic Sequence that Captain Lance P Chrisinger developed for NASTRAN as his Master's Thesis at AFIT Captain Chrisinger developed a basic procedure to enable NASTRAN to analyze flexible wing airloads and stresses That capability is expanded to enable analysis of standard wing models A subroutine was incorporated into NASTRAN to eliminate extensive hand-calculation of transformation matrices The capability to tolerate control surfaces was discovered Also, a survey of wing models in the Air Force inventory was taken to determine the characteristics of the average wing model This was used to determine where the aeroelastic procedure was lacking in its ability to analyze wing models Author (GRA)

N83-26103# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
STRUCTURAL MODEL TUNING VIA VECTOR OPTIMIZATION M.S. Thesis
C R DEVORE Dec 1982 82 p refs
(AD-A124791, AFIT/GAE/AA/82D-8) Avail NTIS HC A05/MF A01 CSCL 13M

This report examines tuning a finite element model using vector optimization techniques Structural models using finite element theory often need to be adjusted so they can accurately simulate the real structure The goal is to tune the model such that it will reproduce data derived from the structure The tuning procedure is complicated by many factors First of all, the model may be required to reproduce several sets of different performance data which may have conflicting effects on the model The number and kinds of parameters to modify may be large or uncertain Also, there may be many constraints on the model With all these considerations and several performances indices to extremize, there may be many compromise solutions to examine in order to select the best one Therefore, the problem has been broken into two parts First, the performance indices are extremized using multiple objective optimization theory, producing a set of possible solutions Next, the solutions are ranked ordered according to a decision maker's preferences The solution ranked number one is, then, the best answer The tuning process was applied to a T-38 horizontal stabilator Four static deformation and two natural frequency experimentally determined data sets were used as the objective functions for the three parameter model GRA

N83-26805# Air Force Flight Dynamics Lab , Wright-Patterson AFB, Ohio
ADVANCES IN EJECTOR TECHNOLOGY: A TRIBUTE TO HANS VON OHAIN'S VISION Final Report
K S NAGARAJA *In* AFWAL A Collection of Papers in the Aerospace Sci p 489-517 Jun 1982 refs
Avail NTIS HC A99/MF A01 CSCL 20D

A brief review of the significant accomplishments made at ARL in the basic understanding of the aerothermo fluid dynamic characteristics of ejectors is given The studies of AFFDL which further enhanced the state-of-the-art of the ejectors for V/STOL applications are also indicated The spectrum of activities in the Air Force not only gave a great deal of insight into the characteristics of the ejector flows, but also resulted in the development of compact ejectors that are relevant foor aircraft application The saga of ejector investigations is continuing and it is within the realm of possibility that ejector systems will be successfully applied for a variety of aircraft operations in the coming years B W

N83-27114# Ecole Nationale Superieure des Telecommunications, Paris (France) Dept Systemes et Communications
NUMERICAL TREATMENT OF DOPPLER RADAR SIGNALS Ph.D. Thesis [TRAITEMENT VIDEO DOPPLER EN RADAR]
B GONULLU 17 Dec 1982 200 p refs In FRENCH
(ENST-E-82014) Avail NTIS HC A09/MF A01

Doppler radar signal processing algorithms are discussed The analysis of a moving target identification filter system leads to a fast Fourier transform implementation with a matrix of order eight The analytic computation of the plot center, the estimation of radial velocity, the logarithmic laws and the multiplication using a PROM table are discussed Applications of filters with distributed zeroes and of residium arthmetic are examined Author (ESA)

N83-27148*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
CALCULATION OF BOUNDARY LAYERS NEAR THE STAGNATION POINT OF AN OSCILLATING AIRFOIL
T CEBECI (California State Univ, Long Beach) and L W CARR May 1983 17 p refs Prepared in cooperation with Army Research and Technology Labs, Moffett Field, Calif
(NASA-TM-84305, A-9143, NAS 1 15 84305, USAAVRADCOM-TR-83-A-1) Avail NTIS HC A02/MF A01 CSCL 20D

The results of an investigation of boundary layers close to the stagnation point of an oscillating airfoil are reported Two procedures for generating initial conditions, the characteristics box scheme and a quasi-static approach, were investigated, and the quasi-static approach was shown to be appropriate provided the initial region was far from any flow separation With initial conditions generated in this way, the unsteady boundary layer equations were solved for the flow in the leading edge region of a NACA 0012 airfoil oscillating from 0 to 5 deg Results were obtained for both laminar and turbulent flow, and, in the latter case, the effect of transition was assessed by specifying its occurrence at different locations The results demonstrate the validity of the numerical scheme and suggest that the procedures should be applied to calculation of the entire flow around oscillating airfoils Author

N83-27149*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
IMPLICIT UPWIND METHODS FOR THE COMPRESSIBLE NAVIER-STOKES EQUATIONS
T J COAKLEY May 1983 13 p refs Proposed for presentation at the AIAA Computational Fluid Dyn Conf, Danvers, Mass, 13-15 Jul 1983
(NASA-TM-84364, A-9332, NAS 1 15 84364) Avail NTIS HC A02/MF A01 CSCL 20D

A class of implicit upwind differencing methods for the compressible Navier-Stokes equations is described and applied The methods are based on the use of local eigenvalues or wave speeds to control spatial differencing of inviscid terms and are aimed at increasing the level of accuracy and stability achievable in computation Techniques for accelerating the rate of convergence to a steady state solution are also used Applications to inviscid and viscous transonic flows are discussed and compared with other methods and experimental measurements It is shown that accurate and efficient transonic airfoil calculations can be made on the Cray-I computer in less than 2 min Author

N83-27210# Research Inst of National Defence, Linkoeping (Sweden) Dept 3
LASER SAFETY OF AIR BATHYMETRY
B KLEMAN Jan 1983 26 p refs In SWEDISH, ENGLISH summary
(FOA-C-30292-E1) Avail NTIS HC A03/MF A01

Data for permissible irradiation at pulse-repetition green N d YAG radiation are reported Flight altitude and speed permissible for irradiation at the sea surface are discussed Safety aspects of laser bathymetry from helicopters or aircraft are treated The need for the laser operator to have observational control over the part of the sea surface that can be hit by radiation of higher irradiance than the threshold value is stressed The risks of flights over islands and shores are outlined, as well as the risks for animal life Author (ESA)

N83-27213*# Rocketdyne, Canoga Park, Calif
HYBRID HYDROSTATIC/BALL BEARINGS IN HIGH-SPEED TURBOMACHINERY Final Report, 29 Aug. 1980 - 15 Dec. 1982
C E NIELSON Jan 1983 381 p refs
(Contract NAS3-22480)
(NASA-CR-168124, NAS 126 168124, RI/RD83-104) Avail NTIS HC A17/MF A01 CSCL 13I

A high speed, high pressure liquid hydrogen turbopump was designed, fabricated, and tested under a previous contract This design was then modified to incorporate hybrid hydrostatic/ball bearings on both the pump end and turbine end to replace the original conventional ball bearing packages The design, analysis, turbopump modification, assembly, and testing of the turbopump with hybrid bearings is presented here Initial design considerations and rotordynamic performance analysis was made to define expected turbopump operating characteristics and are reported The results of testing the turbopump to speeds of 9215 rad/s (88,000 rpm) using a wide range of hydrostatic bearing supply pressures are presented The hydrostatic bearing test data and the rotordynamic behavior of the turbopump was closely analyzed and are included in the report The testing of hybrid hydrostatic/ball bearings on a turbopump to the high speed requirements has indicated the configuration concept is feasible The program has presented a great deal of information on the technology requirements of integrating the hybrid bearing into high speed turbopump designs for improved bearing life Author

N83-27260# Air Force Inst of Tech, Wright-Patterson AFB, Ohio
ANALYSIS OF PROGRESSIVE COLLAPSE OF COMPLEX STRUCTURES Ph.D. Thesis
G E RIGGS Dec 1982 205 p refs
(AD-A125266, AFIT-CI-NR-82-63D) Avail NTIS HC A10/MF A01 CSCL 12A

The principal goal of the study was to evaluate an analytical procedure for predicting progressive collapse in damaged complex structures A structure was modeled for analysis by the finite element method using relatively large, simple elements There was little or no refinement of mesh size in areas of initial damage or damage propagation A method was developed for determining and applying allowable stresses to help compensate for the absence of model detail Stress results of a finite element analysis were examined by a computer post-processor program written for this study to make selective changes to the finite element model The modified model was analyzed using the finite element method and the procedure was repeated in an iterative fashion to predict progressive collapse Analytical results were compared to experimental test data to determine the validity of the analytical procedure The analytical procedure provided a relatively economical method for predicting progressive collapse in a complex structure Evaluation of a complex structure subjected to three initial damage conditions showed acceptable correlation between experimental and analytical results The method of determining appropriate allowable stresses was general enough to apply to a wide range of materials and structures The procedure proved to be an economical estimating tool for predicting residual structural strength Author (GRA)

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GEOSCIENCES

Includes geosciences (general), earth resources, energy production and conversion, environment pollution, geophysics, meteorology and climatology, and oceanography

N83-26320# Mitre Corp , McLean, Va
FAA INTEGRATED NOISE MODEL VALIDATION: ANALYSIS OF AIR CARRIER FLYOVERS AT SEATTLE-TACOMA AIRPORT
G W FLATHERS, II Washington FAA Nov 1982 73 p refs
(Contract DTFA01-82-C-10003)
(AD-A124097, FAA-EE-82-19, MTR-82W162) Avail NTIS HC A04/MF A01 CSCL 09B

The Federal Aviation Administration's Integrated Noise Model (INM) is a series of computer programs designed to estimate environmental noise levels in the vicinity of an airport As part of the effort's to validate INM outputs for the FAA, comparisons were made between the Sound Exposure Levels (SEL) of actual aircraft flyovers at Seattle-Tacoma International Airport and SELs which were computed by the INM for identical conditions Data for this analysis were obtained from the FAA ARTS-III radar to determine the actual slant range and velocity of observed aircraft, and from noise monitors located beyond each runway end to determine actual SEL values associated with observed aircraft The report presents the results of the comparison of INM and observed SEL values for seven transport-category aircraft GRA

N83-26322# Federal Aviation Administration, Washington, D C Office of Environment and Energy
A SURVEY OF HELICOPTER AND AMBIENT URBAN NOISE LEVELS IN PHOENIX, ARIZONA Final Report
J S NEWMAN Sep 1982 44 p
(AD-A123856, FAA-EE-82-20) Avail NTIS HC A03/MF A01 CSCL 20A

The FAA has been conducting controlled helicopter noise measurement programs since 1976 The data have been used for a variety of purposes including evaluation of proposed U S and international noise standards, validation of helicopter noise prediction methodologies, and development of practical heliport design guidance In order to supplement the results of the controlled tests, field survey data are also being gathered to represent in-service operating conditions Measurements are intended to represent helicopter noise within the context of urban ambient background noise The results reported in this document are termed 'survey measurements', as opposed to controlled test data, in order to reflect the limited control imposed over factors which contribute to the variability of measured noise levels Noise data are presented for the Bell 206-L, Aerospatiale Alouette III, and the Aerospatiale A-Stare, SA-350 Operational modes include approach, takeoff, hover, and flat-pitch-idle Noise data include A-weighted Sound Level time histories, maximum A-Weighted Sound Level (LASm), Sound Exposure Level (LAE), and Equivalent Sound Level (Leq) Author (GRA)

N83-26345# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
A REVIEW AND COMPARISON OF LIGHTNING RETURN STROKE MODELS USING EXPERIMENTAL DATA M S. Thesis
S M HANIF Dec 1982 182 p refs
(AD-A124680, AFIT/GE/EE/82D-61) Avail NTIS HC A09/MF A01 CSCL 12A

Over the last three decades many lightning return stroke models have been proposed to predict the current pulse of the return stroke as it propagates in the channel These models were mainly proposed by trying to solve the inverse problem of suggesting the current in the channel which will give the experimental measurement of the electromagnetic (EM) fields on the ground Due to the lack of airborne data, the validity of these models as a function of height have not been verified In this thesis we provide a discussion of all the significant return stroke models and their credibility as a function of height by comparing their EM fields with recent acquired airborne lightning data The equations to compute the electric and magnetic fields in space due to a vertical channel are also derived The last part of the thesis is related to the comparison of these models The predicted fields due to Master et al were plotted and compared with the empirical results Also, the Master et al model was modified for the channel current pulse propagation velocity and the channel current wave form The plots due to these modifications are included and compared with the experimental data GRA

N83-26367# Air Force Geophysics Lab , Hanscom AFB, Mass Meteorology Div
ANALYSIS AND SPECIFICATION OF SLANT WIND SHEAR Interim Report
H A BROWN 8 Nov 1982 44 p refs
(AD-A125883, AFGL-TR-82-0366, ERP-810) Avail NTIS HC A03/MF A01

Wind data collected at the Air Force Geophysics Laboratory (AFGL) Otis Weather Test Facility (WTF) for the period 28 March 1981 to 4 May 1981 have been analyzed to produce frequencies of occurrence of slant wind shear with respect to surface wind speed, time of day, vertical temperature gradient and wind shear direction differences Slant wind shear (SWS) is a measurement that more closely approximates the shear encountered by an aircraft on takeoff or landing It is computed as the wind shear between a higher level wind (in this study, 60 m) and the surface separated by a horizontal distance equivalent to that which an aircraft would traverse in descending or ascending that height B W

N83-27476# Technische Hogeschool, Delft (Netherlands) Dept of Aerospace Engineering
AERODYNAMIC RESEARCH ON TIPVANE WINDTURBINES
G J W VANBUSSEL, T VANHOLTEN, and G A M VANKUIK Apr 1982 19 p refs
(PB83-147413, LR-355) Avail NTIS HC A02/MF A01 CSCL 10B

The research on tipvane turbines aims at a process improvement of the wind energy conversion system, which is more than component improvement such as efficient aerofoils and optimized transmission systems These latter developments make it possible for a modern wind turbine to approach the Betz maximum power coefficient However, process improvements are possible based on flow phenomena which are not consistent with the assumptions made in Betz theory Power coefficients far above the Betz maximum value are possible when for example forces are applied perpendicular to the winddirection and when viscous effects play an important role The effect of tipvanes, which are small auxiliary wings at the end of the turbine blades inducing a mass flow augmentation by the creation of a venturi flow is investigated GRA

N83-27537*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
RF RADIATION FROM LIGHTNING CORRELATED WITH AIRCRAFT MEASUREMENTS DURING STORM HAZARDS-82
D M LEVINE Mar 1983 27 p refs
(NASA-TM-85007, NAS 1 15 85007) Avail NTIS HC A03/MF A01 CSCL 04B

During the Storm Hazards Experiment 1982, the Goddard Space Flight Center monitored radiation from lightning from a site at the Wallops Flight Facility, Wallops Island, VA Measurements were made while the NASA F106 penetrated thunderstorms to obtain data on lightning strikes to the aircraft The objective of the ground-based measurements was to help determine if the events recorded by the F106 were part of lightning discharges During the experiment, 53 cases were obtained in which events were recorded aboard the aircraft while reliable quality RF radiation was recorded on the ground These cases came from 12 different

storms occurring from June through August 1982 The data confirms that the aircraft was measuring events which were part of lightning and indicates that the events recorded on the aircraft tend to occur early in the flash Author

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MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general), computer *operations and hardware, computer programming and software,* computer systems, cybernetics, numerical analysis, statistics and probability, systems analysis, and theoretical mathematics

A83-33613
SURFACES IN COMPUTER AIDED GEOMETRIC DESIGN; PROCEEDINGS OF THE CONFERENCE, OBERWOLFACH, WEST GERMANY, APRIL 25-30, 1982
R E BARNHILL, ED (Utah, University, Salt Lake City, UT) and W BOEHM (Braunschweig, Technische Universitaet, Brunswick, West Germany) Amsterdam, North-Holland Publishing Co , 1983, 231 p

Aspects of computer aided surface representation and design are considered along with a method of constructing nonstandard surface patches, methods and applications of the mathematical curve and surface description in the case of passenger car development, questions concerning a smooth interpolation to scattered three-dimensional data, and the continuity of curvature between adjacent Bezier patches Other topics considered are related to the generation of the Bezier points of triangular splines, some aspects of car body design in a German automobile factory, convex combination surfaces, the de Boor algorithm for triangular splines, the design and fairing of ship surfaces, and surface approximation with imposed conditions Attention is also given to dual Bezier curves and surfaces, surfaces and their applications as used by a German car manufacturer, surface construction based upon triangulation, the construction of functions for the representation of surfaces, and multivariate splines G R

A83-36210#
SINUSOIDAL INTEGRATION FOR SIMULATION OF SECOND-ORDER SYSTEMS
D R ROLSTON (McDonnell Aircraft Co , St Louis, MO) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 52-63 refs
(AIAA PAPER 83-1086)

Many classical numerical methods for differential equations are based on the exact integration of polynomial functions However, methods based on sinusoidal functions may be better suited to analysis of oscillatory systems Discrete time difference equations have been developed for sinusoidal extrapolation, predictor integration, and corrector integration and tested in the equations of motion of real-time flight simulation The computational stability and accuracy were significantly improved when a sinusoidal function frequency was chosen to match the natural frequency of the aircraft Author

A83-36212#
ANALYSIS OF A REAL-TIME APPLICATION
R SHASTRI (Gould, Inc , S E L Computer Systems Div , Fort Lauderdale, FL) IN Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, 1983, p 71-74
(AIAA PAPER 83-1088)

In most real-time applications such as simulation and process control, the scope of the project at its onset is usually much smaller than what it turns out to be downstream into the project As the project progresses, additional requirements are specified and a situation is reached wherein the programs expand to consume all available compute power and/or resources This paer describes the characteristics of a real-time application in the field of simulation and process control, explores the nature of the problem and suggests some implementation considerations that should be adapted in the initial design phase In doing so, down-the-line enhancements are readily accommodated and, if necessary, resources may be added incrementally, such that the system as a whole never reaches a performance or resource threshold Author

A83-36223#
OLD PROBLEM/NEW SOLUTIONS - MOTION CUING ALGORITHMS REVISITED
F M CARDULLO (New York, State University, Binghamton, NY) and R L KOSUT (Integrated Systems, Inc , Palo Alto, CA) American Institute of Aeronautics and Astronautics, Flight Simulation Technologies Conference, Niagara Falls, NY, June 13-15, 1983 8 p refs
(AIAA 83-1082)

The design concept of a nonlinear cue-shaping filter to exploit the motion-system-hardware capability of flight simulators is presented Cue-error and sensory-error expressions are derived from the models of platform, aircraft, and sensory dynamics and inserted as parameters in a cost functional for the optimal-tracking-control problem The resulting nonlinear filters are shown to be indirectly sensitive to cue magnitude, increasing onset duration and washout-to-onset cue magnitude as input cue magnitude decreases The approach used is seen as applicable to simulators incorporating other cues such as visual displays, g-seats, or vibration systems T K

A83-36430#
INTERACTIVE FINE-TUNING OF LINEAR-QUADRATIC GOVERNERS BY SELECTIVE AND DIRECT ACTION ON THE POLES OF THE CONTROL SYSTEM [MISE AU POINT INTERACTIVE DES REGULATEURS LINEAIRES-QUADRATIQUES PAR ACTION DIRECTE ET SELECTIVE SUR LES POLES DU SYSTEME CONTROLE]
O L MERCIER (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France), Y JOANNIC, and O MOREIGNE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, Institut Industriel du Nord de la France, Villeneuve d'Ascq, France) (International Association of Science and Technology for Development, Symposium d'Informatique Applique, Lille, France, Mar 15-17, 1983) ONERA, TP, no 1983-21, 1983, 7 p In French refs
(ONERA, TP NO 1983-21)

Interactive software for fine-tuning linear-quadratic governers for use in engineering the control of optimal multivariable gains is presented Analytical relationships are defined for characterizing the response of the control system to variations in a specified value corresponding to the variation of a system parameter The resulting response gradients account for cause-effect relations existing between the fitted values and the coefficients of the weighting matrices for the cost function The algorithm permits qualitatively setting the end-points of a system's performance, i e , use of the nondiagonal coefficients of the Q matrix that defines the degrees of freedom of the system Furthermore, interaction between the machine and the operator is provided An example is provided of the case of multivariable piloting of an aircraft, and *other aerospace applications are indicated* M S K

A83-36455
A MODIFIED ALGORITHM FOR DETERMINING STRUCTURAL CONTROLLABILITY
C R BURROWS and M N SAHINKAYA (Strathclyde, University, Glasgow, Scotland) International Journal of Control (ISSN 0020-7179), vol 37, June 1983, p 1417-1431 Research supported by the Science and Engineering Research Council refs

The algorithm of Burrows and Sahinkaya (1981) for determining the structural controllability of multi-input time invariant processes with ill-defined parameter values is modified to take account of insights arising from an examination of three counter-examples

The modified algorithm has the same underlying philosophy as the original method It can be applied without computational aids to determine the controllability of many practical problems and this is demonstrated by examining a twelth order model of a rotor-bearing system The method also provides an aid to system design A graphical procedure is presented for determining the rank of the pair (A, b) The extension to multiple inputs is discussed Author

N83-26501# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
DEVELOPMENT OF AN OCULOMETER DATA COLLECTION SUBSYSTEM M.S. Thesis
N L WOOD Dec 1982 259 p refs
(AD-A124700, AFIT/GE/EE/82D-72) Avail NTIS HC A12/MF A01 CSCL 09B

A SYM-1 microprocessor with dual 5-1/4 inch disk drives was used to develop software to gather and reduce data from a Cubic-Foot Remote Oculometer built by Honeywell, Inc The primary function of the oculometer is to measure the look direction of a pilot's eye in a ground cockpit simulator The output of the oculometer used for this effort is eye lookpoint in azimuth and elevation and whether the oculometer is tracking the eye or not The line-of-sight measurement covers a viewing field of plus and minus 30 degrees in azimuth and zero to plus 30 degrees in elevation This viewing field is broken into instruments whose boundaries are defined by the data collection subsystem Performance measures are printed out at the end of the data mission The software for the SYM-1 was developed modularly with each module tested separately and then the whole subsystem tested Simulated oculometer data was used to test the software The data collection subsystem was designed to run with minimal knowledge and interaction required by the user GRA

N83-26637# Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
AN INTERACTIVE BOMBING MISSION SIMULATION WITH COMPUTER GRAPHICS INTERFACE M.S. Thesis
M J GOCI Dec 1982 151 p refs
(AD-A124661, AFIT/GCS/MA/82D-4) Avail NTIS HC A08/MF A01 CSCL 09B

An interactive flight simulation with computer graphics interface was designed using top-down structured analysis techniques The project converts a passive bombing mission simulation used in the Avionics Laboratory, Air Force Wright Aeronautical Laboratories at Wright-Patterson AFB, into an interactive, real-time, man-in-loop simulation The design was documented using SofTech's Structured Analysis and Design Technique (SADT) then coded in FORTRAN The graphics were implemented using TEKTRONIX PLOT-10 software and the system operates on a VAX-11/780 computer coupled through a TEKTRONIX 4016 terminal Author (GRA)

N83-27624# Naval Postgraduate School, Monterey, Calif
HAND-HELD COMPUTER PROGRAMS FOR PRELIMINARY HELICOPTER DESIGN M.S. Thesis
P J FARDINK Oct 1982 180 p refs
(AD-A125036) Avail NTIS HC A09/MF A01 CSCL 09B

This project gives the user of the HP-41 handheld programmable calculator a series of programs that give acceptable results during the preliminary phases of the helicopter design process The project consists of three parts The first part consists of several short programs and their subroutine form These programs and subroutines compute density altitude, density, disc area, solidity, tip velocity, induced velocity, coefficient of thrust, tip loss factor, equivalent chord, and ground effect The second part consists of major subroutines These subroutines compute profile power, induced power, climb power, parasite power, and total power, equivalent area and induced power for tandem rotor, and data input and change The third part consists of the main programs These programs compute the various power requirements for hovering flight, forward (straight and level), flight, vertical flight, and foward climbing flight, also tail rotor power, autorotative flight, and tandem rotor flight GRA

16

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

A83-33486*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
ACOUSTIC MODAL ANALYSIS OF A FULL-SCALE ANNULAR COMBUSTOR
A M KARCHMER (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr 11-13, 1983 17 p refs
(AIAA PAPER 83-0760)

An acoustic modal decomposition of the measured pressure field in a full scale annular combustor installed in a ducted test rig is described The modal analysis, utilizing a least squares optimization routine, is facilitated by the assumption of randomly occurring pressure disturbances which generate equal amplitude clockwise and counter-clockwise pressure waves, and the assumption of statistical independence between modes These assumptions are fully justified by the measured cross spectral phases between the various measurement points The resultant modal decomposition indicates that higher order modes compose the dominant portion of the combustor pressure spectrum in the range of frequencies of interest in core noise studies A second major finding is that, over the frequency range of interest, each individual mode which is present exists in virtual isolation over significant portions of the spectrum Finally, a comparison between the present results and a limited amount of data obtained in an operating turbofan engine with the same combustor is made The comparison is sufficiently favorable to warrant the conclusion that the structure of the combustor pressure field is preserved between the component facility and the engine Previously announced in STAR as N83-21896 Author

A83-33487*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
CROSS SPECTRA BETWEEN TEMPERATURE AND PRESSURE IN A CONSTANT AREA DUCT DOWNSTREAM OF A COMBUSTOR
J H MILES, C A WASSERBAUER, and E A KREJSA (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 8th, Atlanta, GA, Apr 11-13, 1983 27 p refs
(AIAA PAPER 83-0762)

The feasibility of measuring pressure temperature cross spectra and coherence and temperature-temperature cross spectra and coherence at spatially separated points along with pressure and temperature auto-spectra in a combustion rig was investigated The measurements were made near the inlet and exit of a 6 44 m long duct attached to a J-47 combustor The fuel used was Jet A The cross spectra and coherence measurements show the pressure and temperature fluctuations correlate best at low frequencies At the inlet the phenomena controlling the phase relationship between pressure and temperature could not be identified However, at the duct exit the phase angle of the pressure is related to the phase angle of the temperature by the convected flow time delay Previously announced in STAR as N83-23116 M G

A83-33505
FULL-SCALE MEASUREMENTS OF BLADE-VORTEX INTERACTION NOISE
D A BOXWELL and F H SCHMITZ (U S Army, Aeromechanics Laboratory, Moffet Field, CA) American Helicopter Society, Journal (ISSN 0002-8711), vol 27, Oct 1982, p 11-27 refs

Full-scale far-field acoustic data on four different two-bladed rotors encountering blade-vortex interaction are compared The UH-1H helicopter was tested with its standard NACA 0012 airfoil rotor Data are also presented for the AH-1S helicopter configured with its standard 540 rotor, the Kaman K747 rotor, and the OGEE tip rotor The data were reduced using 'time-windowing' of the impulsive noise event, thus enhancing the signal-to-noise ratio of the in-flight data Strong pressure gradients, isolated in the UH-1H and AH-1S 540 rotor signatures, strongly influenced the subjective annoyance of the rotor The peak amplitudes and power spectrum of the K747 and OGEE rotors were about equal and generated less annoyance than the standard AH-1S or UH-1H rotors

Author

A83-35712
THE RELATIONSHIP BETWEEN THE AERODYNAMIC AND ACOUSTIC CHARACTERISTICS OF COAXIAL JETS [O SVIAZI AERODINAMICHESKIKH I AKUSTICHESKIKH KHARAKTERISTIK SOOSNYKH STRUI]
V M KUZNETSOV, M P LAVRUKHINA, and G MUNIN Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza (ISSN 0568-5281), Mar -Apr 1983, p 124-128 In Russian refs

The results of an experimental study of the mean and peak velocity distributions in the mixing zone of isothermal coaxial jets are presented for jets with both regular and inverted velocity profiles (in the latter case the velocity of the outer flow exceeds that of the inner flow) Based on experimental results, estimates are obtained for the noise of coaxial jets with different initial profile velocities These estimates are then compared with experimental acoustic data

V L

A83-36077#
EDGE TONES IN HIGH-SPEED FLOWS AND THEIR APPLICATION TO MULTIPLE-JET MIXING
A KROTHAPALLI, K KARAMCHETI, Y HSIA, and D BAGANOFF (Stanford University, Stanford, CA) AIAA Journal (ISSN 0001-1452), vol 21, July 1983, p 937, 938
(Contract F49620-79-0189)

Previously cited in issue 06, p 941, Accession no A82-17794

A83-36096*# Santa Clara Univ , Calif
DERIVATION OF THE FUNDAMENTAL EQUATION OF SOUND GENERATED BY MOVING AERODYNAMIC SURFACES
H R AGGARWAL (Santa Clara, University, Santa Clara, CA) AIAA Journal (ISSN 0001-1452), vol 21, July 1983, p 1048-1050 refs
(Contract NCC2-191)

Ffowcs Williams and Hawkings (1969) based their derivation of the fundamental equation of the sound generated by arbitrarily moving aerodynamic surfaces on the study of mass and momentum balance of a control volume imbedding a mathematical surface(s) exactly corresponding to real surface(s) These investigators also sketched an alternative method, employing generalized functions, for its derivation This latter method, which was later developed by Farassat (1975), is purely mathematical and formal Goldstein (1976) used the free-space Green function to produce an implicit derivation of the Ffowcs Williams and Hawkings equation In the study presented here, Lowson's (1965) concept of moving point singularities is generalized to moving surface singularities, and a new derivation is given of the fundamental equation The derivation is based on topological considerations of the underlying space, the fluid medium, and the integral properties of the Dirac delta function

C R

N83-26643*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
A COMPACT INFLOW CONTROL DEVICE FOR SIMULATING FLIGHT FAN NOISE
L HOMYAK, J G MCARDLE, and L J HEIDELBERG 1983 11 p refs Presented at the 8th Aeroacoustics Conf , Atlanta, 11-13 Apr 1983, sponsored by AIAA Previously announced in IAA as A83-28005
(NASA-TM-83349, E-1606, NAS 1 15 83349, AIAA-83-0680)
Avail NTIS HC A02/MF A01 CSCL 20A

Inflow control device (ICD's) of various shapes and sizes have been used to simulate inflight fan tone noise during ground static tests A small, simple inexpensive ICD design was optimized from previous design and fabrication techniques This compact two-fan-diameter ICD exhibits satisfactory acoustic performance characteristics without causing noise attenuation or redirection In addition, it generates no important new noise sources Design and construction details of the compact ICD are discussed and acoustic performance test results are presented Author (IAA)

N83-27793*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
JT150 1/2-SCALE NOZZLE JET NOISE EXPERIMENT AND COMPARISON WITH PREDICTION
D E GROESBECK and C A WASSERBAUER May 1983 26 p refs
(NASA-TM-83370, E-1636, NAS 1 15 83370) Avail NTIS HC A03/MF A01 CSCL 20A

As part of a program to study flight effects on the exhaust noise of a full scale JT15D engine, static half scale model jet noise experiments were conducted Acoustic data were recorded for microphone angles of 45 deg to 155 deg with jet conditions for the model scale nozzle corresponding closely to those at 55, 73 and 97 percent of corrected rated speed for the full scale engine These data are useful for determining the relative importance of jet and core noise in the static full scale engine test data and will in turn allow for a proper evaluation of flight effects on the exhaust noise results The model scale data are also compared with he coaxial jet noise prediction Above 1000 Hz, the prediction is nominally 0 to 3 dB higher than the data The arithmetic mean of the differences between the experimental OASPL and the predicted OASPL for all angles for each run ranged from 0 to -3 2 dB The standard deviation of all the OASPL differences is 2 2 dB The discrepancies are greatest at low primary jet velocities and appear to be due to inadequacy in the variable jet density exponent incorporated in the prediction procedure

S L

N83-27794*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
LOW FLIGHT SPEED ACOUSTIC RESULTS FOR A SUPERSONIC INLET WITH AUXILIARY INLET DOORS
R P WOODWARD, F W GLASER, and J G LUCAS 1982 47 p refs Presented at the 19th Joint Propulsion Conf , Seattle, Wash , 27-29 Jun 1983, sponsored by AIAA, SAE, and ASME
(NASA-TM-83411, E-1694, NAS 1 15 83411) Avail NTIS HC A03/MF A01 CSCL 20A

A model supersonic inlet with auxiliary inlet doors and bounday layer bleeds was acoustically tested in simulated low speed flight up to Mach 0 2 in the NASA Lewis 9x15 Anechoic Wind Tunnel and statically in the NASA Lewis Anechoic Chamber A JT8D refan model was used as the noise source Data were also taken for a CTOL inlet and for an annular inlet with simulated centerbody support struts Inlet operation with open auxiliary doors increased the blade passage tone by about 10 dB relative to the closed door configuration although noise radiation was primarily through the main inlet rather than the doors Numerous strong spikes in the noise spectra were associated with the bleed system, and were strongly affected by the centerbody location The supersonic inlet appeared to suppress multiple pure tone (MPT) generation at the fan source Inlet length and the presence of support struts were shown not to cause this MPT suppression Author

N83-27796# Pennsylvania State Univ , University Park Applied Research Lab
INVESTIGATION OF THE COUPLING OF UNSTEADY LIFT TO LOW ORDER ACOUSTIC DUCT MODES IN AN AXIAL FLOW FAN M.S. Thesis
J P COWAN 17 Jun 1982 145 p refs
(Contract N00024-79-C-6043)
(AD-A124819, ARL/PSU-TM-82-137) Avail NTIS HC A07/MF A01 CSCL 20A

By using flow distortion screens, the plane wave (0,0) and first higher order (-1,0) and (1,0) spinning modes were generated in a low-speed axial flow fan The perpendicular unsteady lift force on a segment of a nine-bladed rotor and the acoustic pressure along the duct were measured simultaneously by a strain gage sensor and a flush-mounted microphone, respectively The total pressure field downstream of the screens was measured by circumferentially traversing a Kiel probe The typical signal-to-noise ratio was sufficiently high for the desired signal isolation with a spectrum analyzer A phase-locked ensemble averaging technique was used to obtain amplitude and phase measurements of the periodic unsteady signals Standing waves set up in the duct between the rotor and duct inlet seemed to cause a back-reaction effect which resulted in an increase and reduction of the unsteady lift force above and below expected levels If these effects are taken into account, theoretical predictions coupling unsteady lift to acoustic far field pressure levels conform to measured data Therefore, it is concluded that there is a definite coupling between unsteady lift and acoustic pressure in the duct, yet determination of an unambiguous coupling factor would require more extensive data acquisition GRA

N83-27801# Flying Training Wing (323d), Mather AFB, Calif Environmental Planning Sect
AICUZ (AIR INSTALLATION COMPATIBLE USE ZONE) REPORT Progress Report, 5 Jan. 1978 - Aug. 1982
Sep 1982 103 p
(AD-A124974) Avail NTIS HC A06/MF A01 CSCL 20A

The development and use of lands near U S Air Force base is of continuing concern to Air Force officials It is recognized that the public must be protected from noise and other hazards of air base operations At the same time it is recognized that lands near air bases often are highly attractive areas for development Aircraft operations are likely to continue from Mather AFB for the indefinite future Operations will include the T-37, T-43, B-52, KC-135 or replacement aircraft The types of aircraft, flight tracks, frequency, and other characteristics will be continuously evaluated by Mather AFB to determine the effects on the AICUZ and the community The AICUZ study was prepared to promote orderly and compatible land use around Mather AFB Land use guidelines and noise measurement techniques are based on recent technology Data from this study should be considered for incorporation into existing land use plans and ordinances of surrounding communities, and used as a basis for decisions on future land development requests GRA

N83-27803# Sandia Labs , Albuquerque, N Mex Facility Systems Engineering Div
SANDIA HELICOPTER ACOUSTIC DETECTOR (SHAD)
H D ARLOWE May 1982 12 p refs
(Contract DE-AC04-76DP-00789)
(DE82-018925, SAND-81-0538) Avail NTIS HC A02/MF A01

The Sandia Helicopter Acoustic Detector was developed to provide a low cost alternative to radar for countering the helicopter threat at new DOE facilities The main buildings of these new designs are generally hardened to provide significant delay to a helicopter borne adversary team Under these circumstances the sensor is only required to detect helicopters that are in their final landing phase and at close range (less than 75 m) This short detection range allows the use of a fairly simple acoustic detection algorithm without making the system overly sensitive to wind noise, motor vehicles, and ventilation/heat exchange blowers This work was sponsored by the Department of Energy/Office of Safeguards and Security as part of the overall Sandia Fixed Facility Physical Protection Program DOE

N83-27845*# Spectron Development Labs , Inc , Costa Mesa, Calif
FEASIBILITY STUDY OF THREE-DIMENSIONAL HOLOGRAPHIC INTERFEROMETRY FOR AERODYNAMICS Final Report
J E CRAIG May 1983 64 p refs
(Contract NAS2-19573)
(NASA-CR-166483, NAS 1 26 166483) Avail NTIS HC A04/MF A01 CSCL 20F

Laser holographic interferometry was tried as a nonintrusive diagnostic tool for studying unsteady two dimensional flows A NACA 0012 airfoil was tested, while undergoing dynamic stall, over a range of Mach numbers of 0 3 to 0 5, Reynolds number of 0 5 x 10 to the 6th power to 2 x 10 to the 6th power, and at reduced frequencies of 0 015 to 0 15 It was found that both quantitative and qualitative data could be obtained by the technique Surface pressures on the airfoil can be measured to within 1% of those measured with orifices and pressure transducers when the flow is attached Velocity profiles were measured near the wake region, and they compared very well with laser velocimeter data for attached flows For separated flows with large scale vortices, densities can be measured, but pressures and velocities cannot be deduced with the assumption of constant pressure gradient in the normal direction The sensitivity of the interferograms was good at a Mach number of 0 4 and a Reynolds number of 4 x 10 to the 6th power/ft, the sensitivity worsened at smaller Mach numbers and Reynolds numbers, and improved at larger ones Author

N83-27895# Department of Energy, Bartlesville, Okla Energy Technology Center
THERMODYNAMICS OF ORGANIC COMPOUNDS Final Report, 1 Oct. 1981 - 30 Sep. 1982
B E GAMMON and N K SMITH Nov 1982 21 p refs
(Contract AF-AFOSR-ISSA-82-00012, AF PROJ 2308)
(AD-A125022, AFOSR-83-0047TR) Avail NTIS HC A02/MF A01 CSCL 21E

This research program consisted of an integrated and interrelated effort of basic and applied research in chemical thermodynamics and thermochemistry Knowledge of variation of physical and thermodynamic properties with molecular structure was used to select compounds for study that because of high ring strain or unusual steric effects may have good energy characteristics per unit volume or per unit mass and thus be useful in the synthesis of high energy fuels These materials were synthesized, and their thermodynamic properties were evaluated In cooperation with researcher at Wright-Patterson Air Force Base, ramjet fuels currently in use were subjected to careful thermodynamic evaluation by measurements of heat capacity, enthalpy of combustion and vapor pressure During the last year of this effort, seven kerosene-type fuels produced by British Petroleum and seven jet fuels produced from shale oil were studied Author (GRA)

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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

A83-34475
AIRLINE SAFETY AND LABOR RELATIONS LAW - BALANCING RIGHTS AND RESPONSIBILITY
G D SKONING (Seyfarth, Shaw, Fairweather and Geraldson, Chicago, IL) (Flight Safety Foundation, Annual International Air Safety Seminar, 35th, Johannesburg, Republic of South Africa, Sept 6-9, 1982) Air Law (ISSN 0165-2079), vol 8, no 2, 1983, p 104-116 refs

The legal status of conflicts between an airline's obligation to provide the highest degree of safety and federal antidiscrimination statutes is reviewed, with a focus on the age-60-mandatory-retirement and maximum-age-at-hiring policies for pilots, and on mandatory pregnancy leaves and physical-handicap restrictions for flight attendants It is shown that the FAA highest-safety requirement has been broadly interpreted by the courts as a justification for policies which are prima facie violations of the Age Discrimination in Employment Act or of Title VII of the Civil Rights Act Safety-based criteria have generally been accepted as bona fide occupation qualifications under those acts Employees were found to be unjustifiably discriminated against, however, when the airline could not show that a policy was safety-related, or when there was evidence suggesting that safety was being used as a pretext for economically determined actions T K

A83-34851
CANADIAN SYMPOSIUM ON AIR CUSHION TECHNOLOGY, 16TH, CHARLOTTETOWN, PRINCE EDWARD ISLAND, CANADA, OCTOBER 19-21, 1982, PREPRINTS
Symposium sponsored by the Canadian Aeronautics and Space Institute and Hovercraft Society Ottawa, Canadian Aeronautics and Space Institute, 1982, 110 p

Among the topics discussed are the application of system identification flight analysis techniques to the pitch-heave dynamics of an air cushion vehicle (ACV), the dynamic stability of ACVs, surface impulse propulsion principles, the improvement of ACV performance with wave-forming keels, an innovative icebreaker vessel design for arctic environments, diesel versus gas turbine engine concepts in hovercraft design, combat damage considerations for ACVs, the potential application of military hovercraft in NATO's northern flank, and the U S Coast Guard's operational evaluation of a 110-foot surface-effect ship Also considered are the design, development and testing of such ACVs as the AEROBAC AB-7, LARUS, VP-1, the HM5 prototype, and the AP 1-88 O C

A83-34852
APPLICATION OF SYSTEM IDENTIFICATION FLIGHT ANALYSIS TECHNIQUES TO THE PITCH-HEAVE DYNAMICS OF AN AIR CUSHION VEHICLE
P A SULLIVAN, P V HARTMANN, and T A GRAHAM (Toronto, University, Toronto, Canada) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 2-16 Research supported by the National Research Council of Canada and Transport Canada, Natural Sciences and Engineering Research Council of Canada refs
(Contract NSERC-A-3378, NSERC-A-1613)

Flight test data obtained for the Vampire 1 Air Cushion Vehicle are analyzed The skirt used in these tests was of the uncompartmented segmented skirt type, and the test data, consisting of the outputs from accelerometers, angular rate gyros, etc , was obtained by flying the vehicle over a ramp installed in a 43-m diameter circular track The analysis employed a maximum likelihood, Gauss-Newton system identification technique developed for the interpretation of aircraft flight test data Reasonable agreement was obtained beween the estimates of stiffness and damping in pitch, and the corresponding values measured in the static pitch tests It was also confirmed that the hysteresis observed in the static pitch tests can have a major effect of vehicle dynamics O C

A83-34853
AN OVER-VIEW OF UTIAS RESEARCH ON THE DYNAMIC STABILITY OF AIR CUSHION VEHICLES
M J HINCHEY (Toronto, University, Toronto, Canada) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 17-29 Research supported by the National Research Council of Canada and Transport Canada refs

Dynamic instabilities have been encountered by a number of Canadian operators of air cushion vehicles This paper presents an overview of research at the University of Toronto, Institute for Aerospace Studies (UTIAS), dedicated to understanding the phenomenon It includes a brief review of theoretical and experimental work on the destabilizing effect of cushion air supply ducts The duct-plenum system is shown to behave as a Helmholtz resonator with the slug of air in the duct oscillating on the plenum air spring For this work, a unique facility was developed which used a large hollow sphere as a pneumatic filter to isolate the duct-plenum system from the fan The paper also outlines recently completed work on limit cycle oscillations, skirt material damping, large air cushion platforms, and air cushions hovering over water Author

A83-34855
HOW TO IMPROVE AIR CUSHION VEHICLE PERFORMANCE WITH VUMP EQUIPPED WAVE-FORMING KEELS
A JONES, JR (FASTCO, Virginia Beach, VA) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 39-41

Vent-pump, or 'VUMP'-equipped Wave Forming (W-F) keels are suggested as a means of imparting hydrodynamic lift to air cushion lift The planning surfaces of the W-F keels are lubricated by air pumped by the venturi-effect action of the VUMP The concept is similar to that of the Muller-Thomamuhl (1915) air cushion hydroplane, although instead of requiring a blower, it is powered by the action of the forward motion of the air cushion vehicle on the VUMP O C

A83-34858
TECHNICAL ASPECTS OF THE AEROBAC AB-7
J BOUDREAULT (Bombardier, Ltd , Valcourt, Quebec, Canada), G HERROUIN (Dubigeon-Normandie, S A , Paris, France), and D GAWISH IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 55-60

The AEROBAC AB-7, an off-road vehicle concept combining air cushion and conventional tracks, is the subject of a feasibility study which has as its goal the formulation of an economical means of transportation in the northern regions of Canada (where low population density and harsh terrain make the building of a conventional transportation system prohibitive) Attention is given to the design features and projected performance capabilities of the AEROBAC AB-7, which with a 7 metric ton payload has a weight of 21 metric tons, and is able to travel at a maximum speed of 30 km/hr over terrain that would be impassable for conventional off-road vehicles O C

A83-34859
'LARUS' AND 'VP-1' TESTED IN WINTER 1982
S KORPPOO (Oy Wartsila AB, Helsinki, Finland) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 61-63

Two air-cushion vehicles, 'Larus' and 'VP-1', were tested in the south-western archipelago of Finland The tests were carried out in March 1982, when the sea was frozen and covered with 50 mm of snow During the tests 'Larus' operated independently and also towed 'VP-1' Measurements were made of the speed, resistance and manoeuvrability of the two craft Author

A83-34860
NEW CONCEPT IN HOVERCRAFT DESIGN DIESEL VERSUS GAS TURBINES
D E EMMAS IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 64-68

The fuel cost increases experienced during the 1970s compelled certain hovercraft designers to investigate the relative advantages of the use of lightweight diesel engines rather than the previously favored gas turbines, which had higher fuel consumption The AP1-88 hovercraft presently considered has been tested with both air-cooled and water-cooled diesel engines Although fuel consumption reduction was the paramount consideration in the test program undertaken, engine weight reduction was also sought, and resulted in the choice of turbocharged versions of both the air- and water-cooled engines O C

A83-34861
ACV LIFT AIR SYSTEMS - MORE PUFF FOR LESS POWER
H S FOWLER (National Research Council, Ottawa, Canada) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 70-74 refs

While Air Cushion Vehicle lift air supplies are often considered as merely isolated fans by designers, an attempt is presently made to take into account all aerodynamic factors involved in fan intake and exhaust duct design It is noted that the frequently employed fan scroll exhaust duct is not necessarily the most efficient alternative, and other are proposed within the constraints presented by vehicle design Emphasis is put on overall air system stability and efficiency O C

A83-34862
AP.1-88 CRAFT 001 PROTOTYPE CLEARANCE TRIALS
R L WHEELER (British Hovercraft Corp , Ltd , East Cowes, Isle of Wight, England) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 75-80

The AP 1-88 001 is the first prototype of an 80-passenger hovercraft design which, relative to the SR N6-type craft which have served in the cross-Solent (U K) route for which the AP 1-88 is intended since 1965, represents an entirely new design incorporating such novel features as a welded aluminum hull and four air-cooled diesel engines with twin ducted propulsors A major feature retained in the new design from the latest of the development versions of the SR N6 craft is the highly responsive, low pressure ratio skirt which permits reduced propulsion and lift power levels relative to weight, thereby improving ride comfort O C

A83-34864
OPERATIONAL DEPLOYMENT OF THE AIR CUSHION VEHICLE
R W HELM (Bell Aerospace Canada Textron, Grand Bend, Ontario, Canada) IN Canadian Symposium on Air Cushion Technology, 16th, Charlottetown, Prince Edward Island, Canada, October 19-21, 1982, Preprints Ottawa, Canadian Aeronautics and Space Institute, 1982, p 87-92

An analysis of air cushion vehicle program objectives is the basis for the formulation of fielding and support plans, with the type or types of vehicles to be used determining the requirements for the base of operations, the type and quality of ground support equipment, and the supply of spare parts and special tools Payload types, either passenger or cargo, also influence requirements, especially with respect to the provisioning of mechanical handling equipment Mission profiles and route stage lengths determine fuel requirements Each operational deployment task is accomplished through some function that is in turn influenced by the preceding task The failure to identify any given task, or to make allowances for those which have been identified, will have a detrimental impact on the achievement of program objectives O C

A83-35052
FROM VOYAGEUR ON - THE EXPLOITATION OF AN OPPORTUNITY TO DEVELOP A CANADIAN AIR CUSHION VEHICLE INDUSTRY
R W HELM (Bell Aerospace Canada Textron, Grand Bend, Ontario, Canada) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 62-71

Experiences of Canadian developers of air cushion vehicles (ACV) are surveyed Markets for ACVs were projected to include applications as active river-crossing ferries, off-road freight hauling, air-cushion on-road transports, and icebreaking, as well as landing craft in military use The first Canadian hovercraft was completed in 1972 and subjected to trials on Lake Ontario Several models of this Voyageur ACV were built, with learning and redesign experience in operations, including offshore discharge of container ships in a military role The Viking, a small ACV with one power module and two propellers, was designed as an SAR vessel, but encountered sea-keeping problems The U S Army ordered two Voyageurs, each able to carry 30 tons, in 1975 Design improvements have recently been incorporated in the LACV-30s, of which eight have been ordered as amphibious landing craft for the U S Army Older Voyageurs are currently employed as training craft in the Gulf of Mexico M S K

A83-35053
A NEW CLASS ACV - TANKER-FREIGHTER
R G LONGAKER IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 74-87

A qualitative examination of the concept-to-delivery to the Coast Guard of a 70 S T air cushion hoverbarge is presented The entire process consumed only 51 weeks, beginning with a decision to proceed with hardware that was rugged and reliable and required a common welding rig and diesel engine tools The project was the Demonstration Program Alaskan Air Cushion vehicle with an eight wheel, hydraulically powered, dual direction driving system The axles were built to steer, level, extend, retract, and displace horizontally about a central mounting shaft, and the vehicle was outfitted with all-terrain tires Contract specifications allowed 36 short tons of fuel as part of the 70 ton cargo capacity The vehicle was intended to transport freight and people between ports and remote Alaskan villages in all weather conditions Operating personnel were brought in at the early manufacture phase Test runs in 20-27 in of new snow were performed at 7-10 mph, and a winter test program in Alaska covered 2600 mi Details of the experience gained in the hoverbarge development are provided, including a checklist to summarize monthly activities M S K

A83-35054
DYNAMIC MODELING OF AN AIR CUSHION VEHICLE
A J AMATO (ORI, Inc , Ship Technology Div , Silver Spring, MD) and D D MORAN (David W Taylor Naval Ship Research and Development Center, Bethesda, MD) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 89-98 refs

A time domain nonlinear analytic model in four-degrees-of-freedom of the dynamic motion response of an air cushion supported vehicle is presented Predicted craft response to both declining oscillation tests and gully overpassage are presented and compared with published experimental data

Author

A83-35055
COMPUTER STUDIES OF ACV HEAVE DYNAMICS STABILIZATION
J R AMYOT (National Research Council, Ottawa, Canada) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 100-112

A hybrid computer model of an air cushion vehicle (ACV) capable of heave instability was postulated based on experimental data from a heave test rig The model was developed to study automatic vent valve control in ACV heave dynamics stabilization Results have shown that it is a potentially effective means of stabilizing ACV's and improving their ride quality Furthermore, it provides the designer with more flexibility in determining plenum volume and bearing area

Author

A83-35056
DEVELOPMENTS IN AIR CUSHION VEHICLE SPRAY SUPPRESSION
R W DYKE (Aerojet Liquid Rocket Co , Panama City, FL) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 113-142

The development of improved spray aprons for air cushion vehicles has been driven by the need to improve crew and passenger vision, as well as to reduce ice accretion, salt corrosion, erosion, and water ingestion in the engine and machinery rooms The spray is produced by the cushion pressure (up to 70 lb/sq ft) and the skirt design Initial studies involving a weighted apron permitted development of an empirical expression that numerically modeled the performance of the suppressor The most important design considerations included the need to vent the spray, avoid overloading the skirt, and to ensure the security of the suppressor attachments Specific successful designs implemented on the Voyageur 004 and, in another configuration, on the Jeff A (a Navy seacraft) are described, noting that the suppressors were introduced with no increase in drag M S K

A83-35057
A DESIGN SYNTHESIS MODEL FOR ACV/SES LIFT SYSTEMS
J A TREMILLS (Defence Research Establishment Atlantic, Dartmouth, Nova Scotia, Canada), E G U BAND (Band, Lavis and Associates, Inc , Severna Park, MD), and R ST LAURENT (Davis Engineering, Ltd , Canada) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 144-180 refs

This paper describes a design synthesis model for Air Cushion Vehicle (ACV) and Surface Effect Ship (SES) lift systems for craft of 100 to 10,000 tons The details of the basic technology, and the cushion and the fan system design procedures and algorithms are described The resulting interactive computer program is extensively modular and flexible in operation The program, which is designed for easy modification to include different algorithms or to increase the size of the data base, outputs details on the cushion, air ducting, fans, power transmission and engines

Author

A83-35058
SKIRTS - TIME FOR A NEW LOOK?
H S FOWLER (National Research Council, Ottawa, Canada) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 181-186

The development of skirts for air cushion vehicles (ACV) is traced, with a focus on skirts for overland hovercraft Initial applications for ACVs were all for sea-going missions, and mainly involved production of a flexible skirt to reduce weight and increase clearance in hover However, the marine skirt is not directly applicable to the terrain changes, conditions, and roughness encountered in overland operations Lighter fabrics permit the flexibility and low inertia necessary to rapid responses to obstacles Abrasion of the material takes on the significance that flutter fatigue has on water Low speed motion defrays the abrasive damage to the skirt, allowing a stiffer and heavier material to be used The segment needed for spray suppression on water can be dispensed with on land, although synthetic 'dragon scales' are under development in order to protect the skirt's flat underside from the abrasion caused by movements over ground obstacles M S K

A83-35059
THE TRANSPORTATION DEVELOPMENT CENTRE CONTRIBUTION TO AIR CUSHION TECHNOLOGY
J E LAFRAMBOISE (Transport Canada, Transportation Development Centre, Montreal, Canada) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 187-207 refs

Projects in which the Transport Development Center of Canada has been testing, redesigning, and defining applications for air cushion vehicles (ACV) are summarized Specific studies have concentrated on using hovercraft for overland transportation, evaluating the potential for using ACVs in the Northwest Territories, testing the effectiveness of ACVs as ice breakers, and analyzing air cushion system dynamics Trials have been performed with various skirt systems and overland hovercraft trailers Attention has been given to using the overland hovercraft as transport vehicles in sparsely populated regions, where traffic virtually stops during the spring thaw and where no road systems exist Two modes of ice breaking, one suitable for rivers and one for lakes, have been defined and are under development Finally, the stability of the air cushion on large ACVs is being examined M S K

A83-35062
LACV-30 SUPPORTABILITY
J SARGENT (U S Army, Mobility Equipment Research and Development Command, Fort Belvoir, VA) IN Canadian Symposium on Air Cushion Technology, 15th, Toronto, Canada, September 29, 30, 1981, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1981, p 244-266

The steps necessary for bringing the U S Army LACV-30 amphibious support vehicles to operational status are reviewed, together with the projected missions Containerized cargo handling raised the expected loads to 22 5 tons, delivered to a secured beach through the surf and blowing sand from ships moored 1 5 miles offshore The first air cushion vehicle tested was the Canadian Voyageur, which was the prototype for the LACV-30 craft Each craft in the LACV-30 program required 15 crewmembers, including the maintenance and repair teams Assigning specific teams to one craft enhanced efficiency and enthusiasm Procedures were defined for recycling defective parts to the manufacturer and providing for technical assistance on an organizational maintenance level Details of the manual definition, spare parts packaging, handling, and storage, transportation provisions, and designing the berthing facilities for the LACV-30 craft are summarized M S K

N83-27921# Committee on Commerce, Science, and Transportation (U S Senate)
NASA AUTHORIZATION FOR FISCAL YEAR 1984
Washington GPO 1983 227 p Hearing before the Subcomm on Sci , Technol and Space of the Comm on Com , Sci and Transportation, 98th Congr , 1st Sess , 8, 9, 15 Mar 1983
(GPO-19-200) Avail Subcommittee on Science, Technology and Space

Fiscal year 1984 authorization for NASA are developed in recognition of the close relationship between civilian and defense aeronautical and space activities Author

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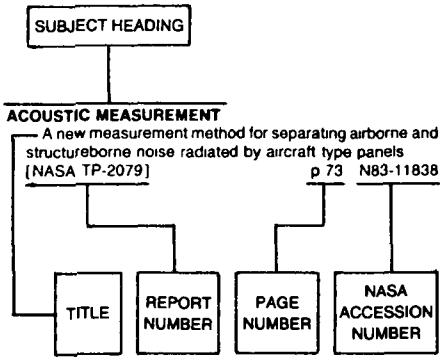
GENERAL

N83-26783# Air Force Wright Aeronautical Labs , Wright-Patterson AFB, Ohio
AIR FORCE TECHNICAL OBJECTIVE DOCUMENT FY 1984
R L VERGA Dec 1982 31 p Supersedes AFWAL-TR-81-4134
(AD-A123961, AFWAL-TR-82-4201, AFWAL-TR-81-4134) Avail NTIS HC A03/MF A01 CSCL 05A

This technical objective Document was prepared by the Materials Laboratory and describes the Materials Technology Planning Objectives (TPOs) for meeting future Air Force operational needs The six TPOs encompass the full spectrum of materials capabilities required for future aircraft, missile, space, and electronic systems - Thermal Protection Materials, Aerospace Structural Materials, Aerospace Propulsion Materials, Fluid, Lubricant, and Elastomeric Materials, Protective Coatings and Materials, and Electromagnetic Windows and Electronics Presented for each TPO is the general objective, specific goals, technical approaches, and a Laboratory focal point who can facilitate face-to-face discussions with Laboratory engineers and scientists GRA

Typical Subject Index Listing



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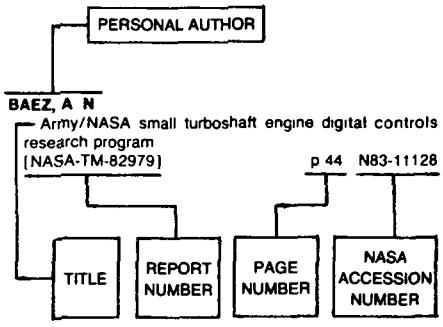

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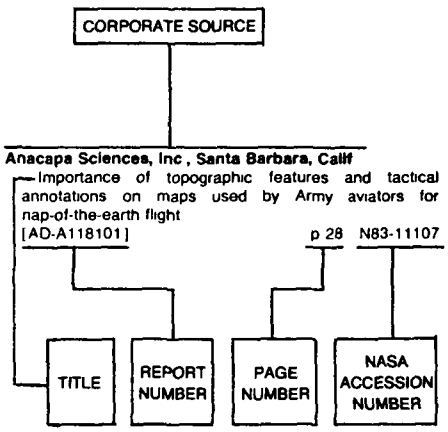

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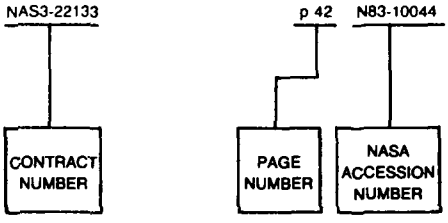

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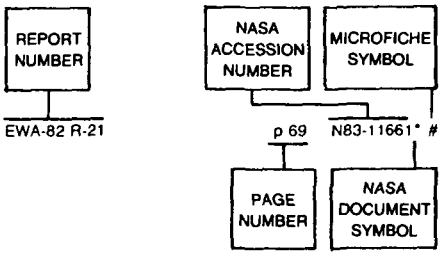

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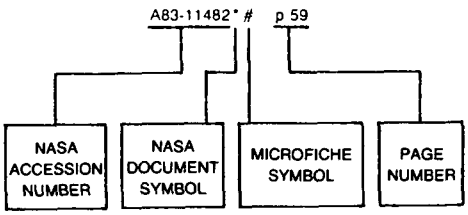

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