NASA

Aeronautical Engineering
A Continuing Bibliography with Indexes

NASA SP-7037(153)
October 1982

National Aeronautics and Space Administration

Aeronautical Engineering Aeronautical Engineering Aeronautical Engineering

ACCESSION NUMBER RANGES

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

STAR (N-10000 Series)	N82-26199 - N82-28242
IAA (A-10000 Series)	A82-34965 - A82-38102

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NASA SP-7037(153)

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 153)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in September 1982 in

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

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INTRODUCTION

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

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 535 reports, journal articles, and other documents originally announced in September 1982 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 in two major sections, *IAA Entries* and *STAR Entries*, in that order. 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. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

Three indexes -- subject, personal author, and contract number -- are included.

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N82-10021*# Kansas Univ Center for Research, Inc Lawrence Flight Research Lab
ICING TUNNEL TEST OF A GLYCOL-EXUDING POROUS LEADING EDGE ICE PROTECTION SYSTEM ON A GENERAL AVIATION AIRFOIL Final Report
David L Kohlman, William G Schweikhard and Alan E Albright Sep 1981 37 p refs
(Grant NAG3-71)
(NASA-CR-165444, KU-FRL-464-1) Avail NTIS HC A03/MF A01 CSCL 01C

Test results show that the system is very effective in preventing ice accretion (anti-ice mode) or removing ice from an airfoil Minimum glycol flow rates required for antiicing are a function of velocity, liquid water content in the air ambient temperature, and droplet size Large ice caps were removed in only a few minutes using anti-ice flow rates with the shed time being a function of the type of ice, size of the ice cap angle of attack and glycol flow rate Wake surveys measurements show that no significant drag penalty is associated with the installation or operation of the system tested T M

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A82-11317 # **Development of aircraft production engineering discipline at IIT, Bombay** N K Naik (Indian Institute of Technology, Bombay, India) *Aeronautical Society of India, Journal,* vol 31, Feb-Nov 1979, p 119-125

The aircraft production engineering courses offered at the Indian Institute of Technology, in Bombay, are discussed To demonstrate the value of the courses, the fundamentals of aircraft production are outlined, the discussion being confined to airframe production *The loft-template method is described, and the principal* loft-template scheme used in aircraft production is shown Also described are the theory and laboratory courses offered at the institute C R

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 153)

OCTOBER 1982

IAA ENTRIES

A82-34976 * # Selected results of the F-15 propulsion interactions program. L D Webb and J Nugent (NASA, Ames Research Center, Edwards, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1041* 15 p 10 refs

A better understanding of propulsion system/airframe flow interactions could aid in the reduction of aircraft drag For this purpose, NASA and the United States Air Force have conducted a series of wind-tunnel and flight tests on the F-15 airplane This paper presents a correlation of flight test data from tests conducted at the NASA Dryden Flight Research Facility of the Ames Research Center, with data obtained from wind-tunnel tests Flights were made at stabilized Mach numbers around 0 6, 0 9, 1 2, and 1 5 with accelerations up to near Mach number 2 Wind-tunnel tests used a 7 5 percent-scale F-15 inlet/airframe model Flight and wind-tunnel pressure coefficients showed good agreement in most cases Correlation of interaction effects caused by changes in cowl angle, angle-of-attack, and Mach number are presented For the afterbody region, the pressure coefficients on the nozzle surfaces were influenced by boattail angles and Mach number Boundary-layer thickness decreased as angle of attack increased above 4 deg (Author)

A82-34977 # Selection of a starting system for a low cost single engine fighter aircraft. W F Keller (Northrop Corp , Hawthorne, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1043* 6 p

Selection of a starting system for a low cost, single engine turbofan fighter aircraft requires identification of ground start alternatives, study of the need for airstart assist and, if the need is found, of available airstart alternatives It also requires consideration of the special inflight starting requirements of turbofan engines, and evaluation of alternatives on the basis of appropriate design criteria Review of turbofan engine inflight starting requirements led to the conclusion that the need for airstart assist is real but infrequent, and that multiple airstart assist is not required Alternatives were identified using the morphological approach Evaluation, on the basis of both quantitative (weight, volume, cost, etc) and qualitative criteria (logistics, risk, flexibility, etc), led to selection of an air turbine cartridge starter The starter uses compressed air from a start cart as the ground energy source and hot gas from decomposition of hydrazine monopropellant liquid, stored in a sealed cartridge, as the inflight energy source (Author)

A82-34978 * # Evaluation of a simplified gross thrust calculation method for a J85-21 afterburning turbojet engine in an altitude facility. J L Baer-Riedhart (NASA, Ames Research Center, Edwards, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1044* 12 p 7 refs

A simplified gross thrust calculation method was evaluated on its ability to predict the gross thrust of a modified J85-21 engine The method used tailpipe pressure data and ambient pressure data to predict the gross thrust The method's algorithm is based on a one-dimensional analysis of the flow in the afterburner and nozzle The test results showed that the method was notably accurate over the engine operating envelope using the altitude facility measured thrust for comparison A summary of these results, the simplified gross thrust method and requirements, and the test techniques used are discussed in this paper (Author)

A82-34979 # Ceramic component development for limited-life propulsion engines. D W Richerson and J M Wimmer (Garrett Turbine Engine Co , Phoenix, AZ) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1050* 7 p DARPA-supported research, Contract No N00024-76-C-5352

The use of ceramic materials for high-temperature components in gas turbine engines offers significant payoffs for a broad range of commercial and military applications However, the task of integrating ceramics into advanced gas turbine engines represents a difficult challenge In February 1976, the Ceramic Gas Turbine Engine Demonstration Program was initiated with the objective to meet this challenge The engine selected for the demonstration was the Garrett Model T76 turboprop engine, a 715-horsepower engine whose various derivatives are used both for military and civil aircraft propulsion and as an industrial and marine engine The turbine section was redesigned to use ceramic gas-path components An increase of approximately 350 F in turbine inlet temperature was projected to increase engine output to 1000 horsepower and decrease specific fuel consumption by 10% G R

A82-34980 # Energy efficient engine /E3/ technology status. W B Gardner (United Technologies Corp , Commercial Products Div , East Hartford, CT) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1052* 10 p 15 refs

The Energy Efficient Engine (EEE) Technology program has the objective to establish the technology readiness of components and subsystems which could be utilized in turbofan engines in the late 1980's, early 1990's A description is presented of the results of the supporting technology programs, the status and results of the component verification testing to date, and the possibilities for employing the developed technology in connection with the design of an energy efficient, environmentally acceptable engine for the 1990's Attention is given to aspects of shroudless fan fabrication, the diffuser/combustor model, a combustor sector rig, an uncooled high-pressure turbine rig, supersonic high-pressure turbine cascades, a high-pressure turbine cooling model, aspects of high-pressure turbine leakage control, and subsonic cascades G R

A82-34981 * # Turbine blade nonlinear structural and life analysis. R L McKnight, J H Laflen (General Electric Co , Cincinnati, OH), G R Halford, and A Kaufman (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1056* 9 p 9 refs

The utility of advanced structural analysis and life prediction techniques was evaluated for the life assessment of a commercial air-cooled turbine blade with a history of tip cracking Three dimensional, nonlinear finite element structural analyses were performed for the blade tip region The computed strain-temperature history of the critical location was imposed on a uniaxial strain controlled test specimen to evaluate the validity of the structural analysis method Experimental results indicated higher peak stresses and greater stress relaxation than the analytical predictions Life predictions using the Strainrange Partitioning and Frequency Modified approaches predicted 1200 to 4420 cycles and 2700 cycles to crack initiation, respectively, compared to an observed life of 3000 cycles (Author)

A82-34982 * # Blade loss transient dynamic analysis of turbomachinery. M J Stallone, V Gallardo, A F Storace, L J Bach, G Black, and E F Gaffney (General Electric Co , Cincinnati, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1057* 8 p Contract No NAS3-22053

This paper reports on work completed to develop an analytical method for predicting the transient non-linear response of a complete aircraft engine system due to the loss of a fan blade, and to validate the analysis by comparing the results against actual blade loss test data The solution, which is based on the component element method, accounts for rotor-to-casing rubs, high damping and rapid deceleration rates associated with the blade loss event A comparison of test results and predicted response show good agreement except for an initial overshoot spike not observed in test The method is effective for analysis of large systems (Author)

A82-34992 * # Experimental study of the effects of secondary air on the emissions and stability of a lean premixed combustor. G Roffe, R S V Raman (General Applied Science Laboratories, Inc , Westbury, NY), and C J Marek (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1072* 10 p 7 refs NASA-supported research

A study of the effects of secondary air addition on the stability and emissions of a gas turbine combustor has been performed Tests were conducted with two types of flameholders and varying amounts of dilution air addition Results indicate that NO(x) decreases with increasing dilution air injection, whereas CO is independent of the amount of dilution air and is related to the gas temperature near the walls The axial location of the dilution air addition has no effect on the performance or stability Results also indicate that the amount of secondary air entrained by the flameholder recirculation zone is dependent on the amount of dilution air and flameholder geometry (Author)

A82-34993 # **Influence of airblast atomizer design features on mean drop size** N K Rizk and A H Lefebvre (Purdue University, West Lafayette, IN) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1073* 7 p 15 refs

Measurements of mean drop size, using the light-scattering technique, were carried out on eight different airblast atomizers The liquids employed were water and kerosine The test range included wide variations in atomizing air velocity, air pressure, and liquid and air flow rates, but the main objective was to examine the influence of scale and various design features on atomization performance The results obtained show, for all types of airblast atomizer, that atomization quality is improved by increase in ambient air pressure, decrease in atomizer size, and by minimizing the angle of impact between the fuel jet and the high velocity air stream (Author)

A82-34994 # **Numerical and experimental examination of a prevaporized/premixed combustor.** C L Proctor, II (Florida, University, Gainesville, FL) and A M Mellor *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1074* 11 p 10 refs USAF-sponsored research

An experimental prevaporizing/premixing combustor configuration was examined numerically and experimentally Non-reacting flow field calculations were made using the computer code 'CORA2' Experimental evaluation of the combustor configuration was accomplished by extracting gas samples at discrete locations from within the combustor and analyzing them for unburned hydrocarbons (UHC), CO, CO2, and O2 These data were used to calculate local combustion efficiency and temperature Contour plots were developed to interpret the gaseous flow field Results indicate two distinct regions of combustion one in the recirculation zone providing constant ignition of incoming air/fuel mixture, and another where vitiated air impinges on the burning air/fuel mixture downstream of the ignition source (Author)

A82-34995 * # **Advancements in real-time engine simulation technology.** J R Szuch (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1075* 9 p 21 refs
(Previously announced in STAR as N82-22915)

A82-34996 # **Transport engine control design.** J F Kuhlberg, J Kniat, D M Newirth, J C Jamison, and J R Switalski (United Technologies Corp, Pratt and Whitney Aircraft Group, East Hartford, CT) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1076* 11 p 7 refs

A full authority digital electronic control was selected for the Pratt and Whitney Aircraft PW2037 turbofan transport engine This control system will provide optimum engine performance and fuel economy, high operational reliability, minimum pilot workload, simplified control maintenance procedures, and maximum engine protection A general description of the system is presented and benefits are discussed (Author)

A82-34997 * # **Development of a helicopter rotor/propulsion system dynamics analysis.** W Warmbrodt (NASA, Ames Research Center, Moffett Field, CA) and R Hull (Systems Control Technology, Inc, Palo Alto, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1078* 16 p 12 refs

A time-domain analysis of coupled engine/drive train/rotor dynamics of a twin-engine, single main rotor helicopter model has been performed The analysis incorporates an existing helicopter model with nonlinear simulations of a helicopter turboshaft engine and its fuel controller System dynamic behavior is studied using the resulting simulation which included representations for the two engines and their fuel controllers, drive system, main rotor, tail rotor, and aircraft rigid body motions Time histories of engine and rotor RPM response to pilot control inputs are studied for a baseline rotor and propulsion system model Sensitivity of rotor RPM droop to fuel controller gain changes and collective input feed-forward gain changes are studied Torque-load-sharing between the two engines is investigated by making changes in the fuel controller feedback paths A linear engine model is derived from the nonlinear engine simulation and used in the coupled system analysis This four-state linear engine model is then reduced to a three-state model The effect of this simplification on coupled system behavior is shown (Author)

A82-34998 # **Analysis of two-dimensional internal flows using a primitive-variable relaxation Navier-Stokes procedure.** R K Scharnhorst (McDonnell Aircraft Co, St Louis, MO) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1083* 10 p 18 refs Research supported by the McDonnell Aircraft Co

Accurate and economic internal flow analysis procedures are needed for the efficient design of suitable diffuser and nozzles in advanced fighter aircraft engines The largely empirical conventional approach used for the design of such components is inefficient and time-consuming, and it might fail to produce optimal design solutions The present study is concerned with the latest stages in the development of a primitive-variable, relaxation Navier-Stokes solution procedure A two-dimensional version was developed primarily to become familiar with the involved technique A two-dimensional analysis procedure can provide information regarding valuable performance trends of preliminary diffuser and nozzle designs The computational time required for the implementation of the considered procedure was found to be significantly less than that of classical time dependent approaches, and no difficulties have been encountered for separated flows G R

A82-34999 * # **NASA Broad Specification Fuels Combustion Technology program - Pratt and Whitney Aircraft Phase I results and status** R P Lohmann (United Technologies Corp, Commercial Products Div, East Hartford, CT) and J S Fear (NASA, Lewis Research Center, Aerothermodynamics and Fuel Div, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1088* 12 p 11 refs

In connection with increases in the cost of fuels and the reduced availability of high quality petroleum crude, a modification of fuel specifications has been considered to allow acceptance of poorer quality fuels To obtain the information upon which a selection of appropriate fuels for aircraft can be based, the Broad Specification Fuels Combustion Technology program was formulated by NASA A description is presented of program-related investigations conducted by an American aerospace company The specific objective of Phase I of this program has been to evaluate the impact of the use of broadened properties fuels on combustor design through comprehensive combustor rig testing Attention is given to combustor concepts, experimental evaluation, results obtained with single stage combustors, the stage combustor concept, and the capability of a variable geometry combustor G R

A82-35000 * # **NASA/General Electric broad-specification fuels combustion technology program - Phase I results and status.** W J Dodds, E E Ekstedt, D W Bahr (General Electric Co, Aircraft Engine Business Group, Cincinnati, OH), and J S Fear (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1089* 12 p 14 refs

A program is being conducted to develop the technology required to utilize fuels with broadened properties in aircraft gas turbine engines The first phase of this program consisted of the experimental evaluation of three different combustor concepts to determine their potential for meeting several specific emissions and performance goals, when operated on broadened property fuels The three concepts were a single annular combustor, a double annular combustor, and a short single annular combustor with variable geometry All of these concepts were sized for the General Electric CF6-80 engine A total of 24 different configurations of these concepts were evaluated in a high pressure test facility, using four test fuels having hydrogen contents between 11 8 and 14% Fuel effects on combustor performance, durability and emissions, and combustor design features to offset these effects were demonstrated (Author)

A82-35017 * # **In-flight acoustic results from an advanced-design propeller at Mach numbers to 0.8.** K G Mackall, P L Lasagna, K Walsh (NASA, Ames Research Center, Edwards, CA), and J H Dittmar (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1120* 9 p 6 refs

Acoustic data for the advanced-design SR-3 propeller at Mach numbers to 0 8 and helical tip Mach numbers to 1 14 are presented Several advanced-design propellers, previously tested in wind tunnels at the Lewis Research Center, are being tested in flight at the Dryden Flight Research Facility The flight-test propellers are mounted on a pylon on the top of the fuselage of a JetStar airplane Instrumentation provides near-field acoustic data for the SR-3 Acoustic data for the SR-3 propeller at Mach numbers up to 0 8, for propeller helical tip Mach numbers up to 1 14, and comparison of wind tunnel to flight data are included Flowfield profiles measured in the area adjacent to the propeller are also included (Author)

A82-35018 * # **Interior noise considerations for advanced high-speed turboprop aircraft.** J S Mixson, F Farassat, J D Leatherwood (NASA, Langley Research Center, Hampton, VA), R Prydz, and J D Revell (Lockheed-California Co, Burbank, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1121* 12 p 25 refs

This paper describes recent research on noise generated by high-speed propellers, on noise transmission through acoustically treated aircraft sidewalls and on subjective response to simulated turboprop noise Propeller noise discussion focuses on theoretical prediction methods for complex blade shapes designed for low noise at Mach = 0 8 flight and on comparisons with experimental test results

Noise transmission experiments using a 168 cm diameter aircraft fuselage model and scaled heavy-double-wall treatments indicate that the treatments perform well and that the predictions are usually conservative Studies of subjective comfort response in an anechoic environment are described for noise signatures having combinations of broadband and propeller-type tone components (Author)

A82-35019 # An experimental investigation of S-duct diffusers for high-speed propfans. B H Little, Jr and W S Trimboli (Lockheed-Georgia Co , Marietta, GA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1123* 9 p

Wind tunnel test results are presented for three propfan engine installation diffuser configurations of the S-duct type, of which two were single-scoop designs having diffuser inlet throat/diffuser exit area ratios of 1 0 and 1 25, and the third, wrap-around design had a 1 25 area ratio Of the two diffusers with a 1 25 area ratio, the wrap-around design performed better than a shaft-penetrating S-duct in both pressure recovery and static pressure rise, although the thickening of the inlet boundary layer to simulate measured propfan test profiles produced a 2% loss in total pressure recovery and increased distortion parameters several-fold for this design Duct cross-sectional area distribution discontinuities inherent in simple drive shaft geometries were found to have no effect on diffuser performance O C

A82-35020 # Selecting the best reduction gear concept for prop-fan propulsion systems. J Godston (United Technologies Corp , Commercial Products Div , East Hartford, CT) and J Kish (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1124* 12 p 8 refs

A study of reduction gearboxes for application to prop-fan propulsion systems is presented in which 10 different reduction gear configurations are considered Attention is given to the definition of gearbox technical requirements and of the screening process used in the selection of the more promising concepts A detailed presentation is made of two typical prop-fan propulsion systems, of which one incorporates an in-line and the other an offset reduction gearbox The inline systems studied are the splined and integral split path, star/star, compound planetary, layshaft, and planetary/planetary Offset systems include the spur/-star, spur/planetary, compound idler, and spur/spur These are evaluated with respect to cruise efficiency, internal or external pitch control, reliability, maintainability, weight, cost, degree of risk, acoustics, and degrees of component contrarotation and ease of scaling O C

A82-35021 # Optimization of propeller blade shape by an analytical method. L K Chang and J P Sullivan (Purdue University, West Lafayette, IN) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1125* 6 p 12 refs

Based upon the vortex lattice method and nonlinear programming procedures, the problem of predicting the optimum propeller-blade shape has been formulated and solved by maximizing the propulsive efficiency under the constraint of constant power consumption The predicted optimum propeller blades with tip devices (proplets) show an ideal efficiency improvement of 1-6% Comparisons of the angle of twist distributions for the optimized and unoptimized propeller blades are presented (Author)

A82-35022 # PMUX - The interface for engine data to AIDS. J A Bluish and W Lorenz (Bendix Corp , Energy Controls Div , South Bend, IN) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1127* 10 p

The propulsion multiplexer (PMUX) unit, a new component of the Aircraft Integrated Data System (AIDS), promises to improve the accuracy and reduce the weight of condition-monitoring equipment in commercial engines PMUX will improve accuracy by packaging advanced technology pressure sensors within the electronic unit and by using digital signal conditioning - made more practical by placing the microprocessor near the engine sensors To reduce weight, the PMUX system will replace multiconductor cables with a serial digital data link This paper discusses typical design requirements and describes the approach used in a PMUX unit designed for the 747 Extended Upper Deck (EUD) aircraft (Author)

A82-35023 # Charting propulsion's future - The ATES results. A Adams and S Parkola (United Technologies Corp , Government Products Div , West Palm Beach, FL) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1139* 10 p 5 refs Contract No N00019-80-C-0225

The Advanced Technology Engine Studies (ATES) program was conducted to establish a coordinated government/industry long range propulsion plan for new aircraft systems envisioned through the year 2010 This paper presents results obtained in support of this long range planning effort These efforts identified optimum engine design requirements (e g size, cycle, duty cycle, and maintenance goals), high payoff advanced technologies and engine development-/qualification plans for 15 specific fighter, bomber, transport and V/STOL weapon systems under investigation The elements of the long range plan were selected to minimize the life cycle cost of future weapon systems while at the same time providing the engine performance necessary to meet advanced weapon system combat requirements (Author)

A82-35024 # A methodology for planning a cost effective engine development. W S Willis (General Electric Co , Evendale, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1140* 7 p

The Advanced Tactical Attack Manned System (ATAMS) was chosen as a subject for an advanced technology engine study, whose objective was the development of a life cycle cost methodology for the exploration of alternative propulsion system design and development approaches Development schedules were evaluated with respect to their impact on product reliability, durability and life cycle cost, for the case of a mixed flow augmented turbofan with 17,150-lb thrust rating, after consideration of this engine's estimated life cycle cost breakdown, failure rate models, operating and support cost breakdown, and relative development cost dependence on quality of testing A long range propulsion development plan is suggested in light of study results O C

A82-35025 # Propulsion system requirements for advanced fighter aircraft. J H Kamman and D C Perryman (McDonnell Aircraft Co , St Louis, MO) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1143* 9 p

The mission requirements stipulated for the next generation of Air Force and Navy fighter aircraft suggest the design characteristics and performance capabilities needed in a new engine Engine cycle optimizations have been performed with reference to both system life cycle cost and takeoff gross weight, in view of primary and alternate missions Parametric sensitivity results indicate the relative impact of both the primary engine cycle variables and the various mission segments envisaged on aircraft takeoff gross weight The fighter aircraft considered are an Air Force air superiority configuration in the 40,000-lb weight class, with a 300-nautical mile mission radius, and a 50,000-lb weight class Navy combat air patrol mission configuration with a 200-nautical mile combat radius Attention is given to the penalties of using derivatives of existing engines, as well as an engine development timetable spanning the period from mid-1982 to 1993 O C

A82-35041 * # Evaluation of fuel injection configurations to control carbon and soot formation in small GT combustors. T J Rosfjord (United Technologies Research Center, East Hartford, CT) and D Briehl (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1175* 12 p 6 refs

An experimental program to investigate hardware configurations which attempt to minimize carbon formation and soot production without sacrificing performance in small gas turbine combustors has been conducted at the United Technologies Research Center Four fuel injectors, embodying either airblast atomization, pressure atomization, or fuel vaporization techniques, were combined with nozzle air swirlers and injector sheaths, and evaluated at test conditions which included and extended beyond standard small gas turbine combustor operation Extensive testing was accomplished with configurations embodying either a spill return or a T-vaporizer injector Minimal carbon deposits were observed on the spill return nozzle for tests using either Jet A or ERBS test fuel A more extensive film of soft carbon was observed on the vaporizer after operation at standard engine conditions, with large carbonaceous growths forming on the device during off-design operation at low combustor inlet temperature Test results indicated that smoke emission levels depended on the combustor fluid mechanics (especially the mixing rates near the injector), the atomization quality of the injector and the fuel hydrogen content (Author)

A82-35044 # Small turbine engine augmentor design methodology. T E Kuhn, H C Mongia, T W Bruce (Garrett Turbine Engine Co , Phoenix, AZ), and E Buchanan (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1179* 8 p 14 refs

This paper describes a design technique based on the use of semianalytical methods, along with a multidimensional aerothermal analysis that has been developed for application to small thrust-class engines Partial validation of the technique is presented, utilizing existing data on spray injection and flow characteristics around typical flameholders This improved technique has been used to design an augmentor for a small gas turbine engine in a thrust class of less than 1000 pounds Typical predictions of internal profiles of fuel/air ratio, temperature, velocity, and combustion efficiency are presented for the final configuration selected for the afterburner (Author)

A82-35045 # The F404 development program - A new approach. G C Rapp (General Electric Co , Lynn, MA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1180* 14 p

The experience gained during more than 10 years of F404 engine development is summarized To achieve maximum results, engine objectives must be clearly defined to permit major design decisions and trade-offs during the initial design layouts The prototype philosophy is considered a low-cost, effective method of demonstrating new engine features and configurations, as well as 'proof of concept' It is pointed out that when the prototype is used, an adequate time period should be allowed for engine redesign prior to beginning a full-scale development program Completing aerodynamic development before or shortly after beginning full-scale development permits concentration on the controls system and on durability development without frequent changes It is also pointed out that the definition of engine failure modes requires a mix of test schedules to probe design sensitivity to various stimuli C R

A82-35046 # **Development of engine operability** T J Christie (United Technologies Corp , Government Products Div , West Palm Beach, FL) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1181* 11 p

An important criterion in connection with the selection of an engine for advanced aircraft weapon systems is related to operability Good operability is the ability of the engine to perform flawlessly in all aspects of the mission The various areas of engine operability are explored, taking into account potential design solutions for advanced engine systems Aspects of engine airstarting capability are considered, giving attention to the compressor, the utilization of digital electronic control, and the bearing support system The engine thrust response is discussed along with the solution of engine stall problems, taking into consideration fan and compressor, the augmentor, and control components Problems related to the occurrence of nonrecoverable stall are also explored It is pointed out that to ensure adequate engine operability for the next generation of air superiority fighters, it is imperative to modify the engine development program The required changes are discussed G R

A82-35047 # **Control of gas turbine power transients for improved turbine airfoil durability.** R R Sellers (United Technologies Corp , Government Products Div , West Palm Beach, FL) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1182* 11 p

It is noted that today's advanced military fighter engines are demonstrating thrust-to-weight ratios of 8 to 1 and that fighter engine requirements exceeding 10 to 1 are forecast In practice, this increase in thrust-to-weight ratio has been achieved in large part by increasing the level of the combustor exit temperature Low cycle fatigue has thus become a lift-limiting factor in turbine airfoils because of this increased combustor exit temperature and the increased number of major throttle transients A test facility that can provide the engine data base necessary for improving turbine airfoil low-cycle-fatigue life predictions is described C R

A82-35048 # **T700 - Modern development test techniques, lessons learned and results.** R A Dangelmaier (General Electric Co , Aircraft Engine Business Group, Lynn, MA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1183* 10 p

The testing of the T700 engine is discussed The 300-hr model qualification test required the engine to withstand low cycle fatigue cycles, thermal cycles, ingestion of various objects and substances including liquid water, ice, sand, and birds, and to meet hot and cold start criteria The engine was measured for overtemperature, smoke emission and corrosion susceptibility Abusive vibration testing, inlet and exhaust system evaluation, and suction fuel system examination was also done Pre-production engine ground and flight testing was done in a number of aircraft This was followed by a two-year maturity/life verification program in order to further assure a high level of life, durability, reliability, and maturity at the time of production introduction in 1978 Accelerated endurance and accelerated mission testing was done Problems uncovered and corrected during the testing are discussed C R

A82-35049 # **Next generation trainer /NGT/ engine requirements - An application of lessons learned.** C J Bauer (USAF, Aeronautical Systems Div , Wright-Patterson AFB, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1184* 7 p

A new, four-step approach for turbine engine development is described, as well as the new Engine Structural Integrity Program (ENSIP) Instead of the former two-step qualification process including a preliminary flight rating test and a model qualification test, the new concept emphasizes definition and verification of field maintenance procedures and parts life limits It includes an initial flight release, full flight release, initial service release, and operational capacity release, each of which is briefly described ENSIP encompasses five tasks (1) design information, (2) design analysis, component and materials characterization, (3) component and core engine testing, (4) ground and flight testing, and (5) product quality control and engine life management The integration of the former procedure with the new concept and procedure is discussed C D

A82-35067 # **A concept for light-powered flight.** L N Myrabo (BDM Corp , McLean, VA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1214* 20 p 22 refs

The concept for an advanced flight transport vehicle propelled by variable cycle laser propulsion engines is described The vehicle is designed for efficient propulsion both within the atmosphere (by momentum exchange) and in space (as a rocket) Pulsed laser power is absorbed directly into gaseous reaction propellants by electrical gas breakdown and inverse Bremsstrahlung Small scale experiments on each key engine component have been performed, and their performance characteristics are known Innovation results from the synergism of the various engine parts The resultant system can demonstrate substantial performance improvements over conventional chemical thrusters and flight vehicle configurations - in a future era of plentiful beamed space power (Author)

A82-35076 # **Aircraft fire safety research with antimisting fuels - Status report.** E P Klueg, B C Fenton, and S L Imbrogno (FAA, Technical Center, Atlantic City, NJ) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1235* 26 p 18 refs

Laboratory tests have been developed which characterize the antimisting, filtration, and flammability properties and the degradation level of antimisting kerosene (AMK) Interrelations among rheological, physical, and flammability properties and production and compatibility characteristics of antimisting additives are discussed Problems caused by addition of water to AMK are studied, as are the tendency of AMK to form gel under conditions of cold temperature and shear AMK is found to provide very significant fire protection benefits under impact survivable crash conditions Problems of in-line blending of antimisting additive FM-9 and of airframe fuel system hardware incompatibilities are surmountable Turbine engines can operate on FM-9 and meet performance criteria provided the fuel is highly degraded, which does not present insurmountable problems C D

A82-35077 # **Will hydrogen-fueled aircraft be safe.** G D Brewer (Lockheed-California Co , Burbank, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1236* 6 p 9 refs

Analysis has shown that liquid hydrogen will be significantly safer than liquid methane and synjet, the other alternative fuels for aircraft With LH2 there will be less risk of a major spill occurring in event of a crash in which passengers can survive the impact If fuel is spilled, and assuming ignition does not occur, LH2 will not spread as far before it vaporizes, becomes buoyant, and dissipates in the atmosphere If the spilled fuel is ignited, as will occur more than 80 percent of the time with any of the fuels, the resulting hydrogen fire will be of such short duration and will be confined to such a small area that the passenger survival rate can be expected to be much higher (Author)

A82-35078 # **Icing conditions on sea level gas turbine engine test stands** H J Willcocks (United Technologies Corp , Government Products Div , West Palm Beach, FL) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1237* 7 p 7 refs

Engine icing conditions are discussed and various methods of icing prevention are compared Icing can be caused by a drop in the static temperature within the engine inlet duct or by increase of relative humidity with increasing Mach number till saturation Two types of icing exist, engine face icing and general stand icing, which includes engine face icing Stand inlet heaters are found to provide the best solution to engine face and general stand icing, but are not cost-effective to use for icing alone Engine running appears useful for engine face icing but is hazardous when general stand icing is present An ice detector rig is described which will discriminate between the two types of icing, and so permit running the engine when appropriate C D

A82-35079 # **Model test and full scale checkout of dry-cooled jet runup sound suppressors.** J L Grunnet (FluiDyne Engineering Corp , Minneapolis, MN) and E Ference (U S Navy, Naval Facilities Engineering Command, Alexandria, VA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1239* 12 p 7 refs

This paper describes the design, model testing and full-scale checkout of hush house type jet aircraft runup sound suppressors This hush house concept features complete enclosure of the aircraft, dry cooling of the exhaust sound suppressor even during afterburning, and adaptability of one enclosure to a variety of aircraft types The comparison of model test data and full-scale checkout data (exhaust system temperatures, air flow rates and exhaust sound suppression) is emphasized in the paper Also the extension of the concept to unusual aircraft designs and to dry-cooled engine test cells are covered (Author)

A82-35080 * # **Increased capabilities of the Langley Mach 7 Scramjet Test Facility.** S R Thomas and R W Guy (NASA, Langley Research Center, Hampton, VA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1240* 13 p 15 refs

An experimental research program which explored the potential for expanding the operating range of NASA Langley's Mach 7 Scramjet Test Facility is described The facility uses electric arc-heated air as the test gas and is configured for testing airframe-integrated scramjet engine models at conditions duplicating flight velocities and temperatures Previous scramjet testing in this facility was limited to a single simulated flight condition of Mach 6 9 at 115,300 ft altitude

The present arc heater research demonstrated that the facility can be used for scramjet testing at simulated flight conditions from Mach 4 (at altitudes from 77,000 to 114,000 ft) to Mach 7 (at altitudes from 108,000 to 149,000 ft) Flow quality was established from the uniformity of measured total temperature profiles In addition, nitrogen oxide levels in the test stream were determined for relating engine test data to expected flight performance The test frequency and reliability of the facility were also improved by a novel redesign of the heater downstream electrode and by defining limits for stable arc operation (Author)

A82-35089 # **Characteristics of a side dump gas generator ramjet.** P R Choudhury (Southern California, University, Los Angeles, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1258* 5 p 7 refs Grant No AF-AFOSR-77-3354

This paper deals with an experimental study of a small side dump gas generator ramjet whose geometric characteristics and flow field were changed parametrically to investigate the interaction of vortices and stable burning in the combustor Vortices were perturbed and the size of the recirculation zone reduced by external means The results show that the vortices at the head are crucial to stable and oscillation free operation Axial fuel injection at the head and the introduction of swirl by canting the inlets tend to weaken the system of vortices at the head and thereby degrade the burner performance Secondary vortices downstream of the dump plane are weak and cannot function properly without the recirculation zone at the head acting as a 'pilot flame' A well designed side dump burner can operate satisfactorily at low IR and visible signatures in the exhaust Although the burner was not choked at the exit plane, it is felt that the mutual interaction of vortices would not change significantly for the choked case and the conclusions from this study would aid in designing a real side dump propulsion system (Author)

A82-35091 * # **A comprehensive method for preliminary design optimization of axial gas turbine stages.** R M Jenkins (Tuskegee Institute, Tuskegee, AL) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1264* 11 p 15 refs Grant No NsG-3295

A method is presented that performs a rapid, reasonably accurate preliminary pitchline optimization of axial gas turbine annular flowpath geometry, as well as an initial estimate of blade profile shapes, given only a minimum of thermodynamic cycle requirements No geometric parameters need be specified The following preliminary design data are determined (1) the optimum flowpath geometry, within mechanical stress limits, (2) initial estimates of cascade blade shapes, (3) predictions of expected turbine performance The method uses an inverse calculation technique whereby blade profiles are generated by designing channels to yield a specified velocity distribution on the two walls Velocity distributions are then used to calculate the cascade loss parameters Calculated blade shapes are used primarily to determine whether the assumed velocity loadings are physically realistic Model verification is accomplished by comparison of predicted turbine geometry and performance with four existing single stage turbines C D

A82-35100 # **Individual bypass throttling in fighter engines.** H Kuenkler (Industrieanlagen-Betriebsgesellschaft mbH, Ottobrunn, West Germany) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1285* 9 p

It is demonstrated that individual bypass throttling (IBT) by an independent bypass nozzle/throttle device is an attractive means of influencing partload specific fuel consumption characteristics in low bypass ratio turbofan engines, such as those of fighter aircraft, without introducing turbocomponent variable-geometry features An IBT application is considered in which total engine pressure ratio as well as bypass ratio have been selected with a view to high thrust characteristics and optimum reheat conditions, while the low-partload specific fuel consumption was decreased by means of the IBT feature The calculated total propulsive weight for both long-loiter and interception fighter missions shows that the more complex construction of a separate bypass nozzle will be compensated by the new engine design's efficiency An 8% takeoff weight saving was attained by the IBT engine over a conventional design for the two missions considered O C

A82-35101 # **Combat survivability in the Advanced Technology Engine Study /ATES/.** L Throndson (U S Naval Weapons Center, China Lake, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1287* 9 p

The Advanced Technology Engine Study (ATES) has shown that the advanced tactical aircraft used as study baselines will have high survivability in year-2000 combat scenarios which include advanced missile threats in high densities Reductions in radar cross section and infrared signature greater than 50%, however, are required for significant reductions in combat attrition losses Cost studies indicate that configurations requiring extensive modification for low observables should be avoided, in favor of 15-year peacetime life cycle cost vehicles possessing low radar and infrared detectability features from the outset of design formulation Attention is given to engine cycle, bypass configuration and nozzle design elements of infrared signature reduction, as well as requirements for radar cross section reduction in engine inlet and nozzle design O C

A82-35102 # **Turbine stage heat flux measurements.** M G Dunn (Calspan Advanced Technology Center, Buffalo, NY) and J L Holt (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1289* 8 p 30 refs Contract No F33615-81-C-2017

This paper describes an ongoing effort at Calspan designed to obtain detailed heat transfer data for a full-stage rotating turbine A description of the accompanying analysis effort intended to define the range of validity of the various predictive methods is also presented The experiments are performed using a shock tunnel as a short-duration source of heated air which is used to drive a test-section device containing the high-pressure stage of the Garrett TFE 731-2 turbine The turbine is extensively instrumented with thin-film heat-transfer gauges Heat-flux distributions have been obtained at the turbine design flow function and 100% corrected speed for values of the ratio of the wall temperature to the total temperature in the range of 0 2 to 0 3 (Author)

A82-35233 **Ultralight airplanes** M A Markowski *Scientific American,* vol 247, July 1982, p 62-68

The typical design features and performance capabilities of ultralight aircraft, which incorporate a small reciprocating engine on a hang glider airframe and may be flown without a pilot's license, are described Designs of this class, of which more than 10,000 were sold in 1981, generally have an empty weight of 200 lbs, a wingspan of more than 30 ft, and cruising and stalling speeds of 50 and 25 mph, respectively Glide ratios better than 9 1 and 500 ft/min rates of climb have been achieved After a brief historical account of ultralight-like aircraft development, attention is given to the aerodynamic and propulsion-system features of a variety of popular configurations It is noted that great care must be taken by ultralight pilots of wind conditions, because of their crafts' high sensitivity to gusts Extant ultralight configurations are illustrated with attention to performance-maximizing features O C

A82-35256 **A laboratory mock-up ultrasonic inspection system for composites.** F H Chang (General Dynamics Materials Research Laboratory, Fort Worth, TX), J R Bell, A H Gardner, C P Fisher, and R W Haile *Materials Evaluation,* vol 40, June 1982, p 756-761 Contract No F33615-77-C-5206

The use of advanced composite materials in aircraft structures offers distinct advantages in terms of reduced weight, increased performance, lower cost, and higher structural reliability The complexity of the advanced composite structures increases the degree of difficulty for nondestructive testing (NDT) and inspection The major NDT techniques for composite structure inspection are ultrasonics and radiography In connection with requirements for the low-cost inspection of large areas for small flaws, a need exists for an in-service inspection system for composites which will record the flaw location in a pseudo real-time C-scan while minimizing the operator effort to attain a high level of inspection reliability In 1978 a program was initiated with the aim to develop such an in-service inspection system (ISIS) for advanced composite aircraft structure A description is given of a laboratory mock-up model of the ISIS G R

A82-35257 **Acoustic emission in jet engine fan blades.** E v K Hill (Clemson University, Clemson, SC) and D M Egle (Oklahoma, University, Norman, OK) *(American Society for Nondestructive Testing, Fall Conference, Atlanta, GA, Oct 1981) Materials Evaluation,* vol 40, June 1982, p 770-773 10 refs Contract No F34601-78-C-2828

Titanium alloys, in connection with their low density and, in general, good mechanical properties at high temperatures, are particularly popular for applications in high performance military aircraft However, unfortunately these materials exhibit also low fracture toughness which can often lead to sudden failure of components without warning An enhancement of nondestructive test procedures to reduce damage related to the failure of compressors in turbofan engines proved to be only partly successful A test program was, therefore, developed for the study of flaw growth in fan blades using acoustic emission (AE) It was found through testing that AE can detect the presence of flaws even when conventional techniques cannot Moreover, it can sense them long before they become critical Therefore, it is believed that with a proper development program, acoustic emission could be the best nondestructive test technique for sensing flaws in jet engine fan blades G R

A82-35278 # **F-14 inlet development experience** R H Tindell, C A Hoelzer (Grumman Aerospace Corp , Bethpage, NY), and D Alexander (U S Naval Air Systems Command, Washington, DC) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-5* 11 p Members, $2 00, nonmembers, $4 00

The inlet control system of the F-14 fighter, which has demonstrated in-flight compatibility with the advanced F401-PW-400 and GE-F-101X engines, as well as the TF30 engine, is based on a simple concept that minimizes maintenance and maximizes reliability The potential benefits of inlet and engine control integration are presently under study The primary function of the air inlet control system is to position the three variable ramps in each inlet to some preset schedule of angles, so that ramp position is exclusively a function of Mach number To achieve low total pressure distortion for static operation, total pressure recovery was intentionally lowered to minimize differences between average and minimum pressures Analytical estimates of aircraft forebody effects on the inlet flow field, using a three-dimensional inviscid supersonic flow field code, are found to be close to wind tunnel test results Suggestions are made in light of study determinations for more advanced inlet designs O C

A82-35279 # **The performance of centrifugal compressor channel diffusers.** C Rodgers (Solar Turbines, Inc , Turbomach Div , San Diego, CA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-10* 13 p 14 refs Members, $2 00, nonmembers, $4 00

The most important performance criteria influencing maximum diffusion capability are formulated through the analysis of test results, for single-stage centrifugal compressors having backswept impellers and channel-type diffusers The diffuser types considered are pipe, splitter, tandem, profiled L/E, channel, and slotted It is determined that for any given stage, state surge occurred near a constant mean stream velocity diffusion ratio between the impeller tip and diffuser throat While this diffusion ratio reached a maximum number of 1 8 for impeller tip Mach numbers lower than unity, it was not unique for all stages and was more strongly associated with throat blockage accumulation as a function of diffusion rate Results of experiments in the vaneless space illustrate the sensitivity of the influence of flow in that region on centrifugal compressor performance O C

A82-35285 # **Semi-empirical analysis of liquid fuel distribution downstream of a plain orifice injector under cross-stream air flow.** M -H Cao (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China), H -K Jiang, and J -S Chin *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-16* 9 p Members, $2 00, nonmembers, $4 00

An improved flat-fan spray model is used for the semi-empirical analysis of liquid fuel distribution downstream of a plain orifice injector under cross-stream air flow The model assumes that, due to the aerodynamic force of the high-velocity cross air flow, the injected fuel immediately forms a flat-fan liquid sheet perpendicular to the cross flow Once the droplets have been formed, the trajectories of individual droplets determine fuel distribution downstream Comparison with test data shows that the proposed model accurately predicts liquid fuel distribution at any point downstream of a plain orifice injector under high-velocity, low-temperature uniform cross-stream air flow over a wide range of conditions V L

A82-35287 # **Casing wall boundary-layer development through an isolated compressor rotor.** I H Hunter (Shell Research, Ltd , Chester, England) and N A Cumpsty (Cambridge University, Cambridge, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-18* 13 p 20 refs Members, $2 00, nonmembers, $4 00

A comprehensive series of measurements were made of the development of the casing wall boundary layer across an isolated compressor rotor having variable tip clearance with a view to revealing details of the flow phenomena Time-averaged measurements of the outer-wall boundary layer downstream of the rotor were obtained using a conventional pressure probe, while a hot-wire anemometry technique yielded the three-dimensional blade-to-blade structure of the flow The downstream boundary layer was found to thicken as the rotor blading and blade-end clearance were increased, with fluid tending to accumulate towards the pressure side of the passage Results of the study should find application in multistage machines where the importance of casing boundary layers is particularly great V L

A82-35288 # **Secondary flows and losses in axial flow turbines.** D G Gregory-Smith (Durham, University, Durham, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-19* 4 p 11 refs Members, $2 00, nonmembers, $4 00

A simple method is proposed for estimating secondary flow angles and losses in turbines which is suitable to form a subroutine of a larger design method The secondary flow angles are calculated using classical secondary flow theory, while losses are estimated by identifying three sources of loss, calculating them independently, and adding them together Initial results show that the method has the potential of yielding reliable estimates, while being much faster and easier to apply than viscous three-dimensional flow calculation methods V L

A82-35289 # **CFD technology for propulsion installation design - Forecast for the 80's.** G C Paynter (Boeing Military Airplane Co , Seattle, WA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-21* 8 p 13 refs Members, $2 00, nonmembers, $4 00

One of the objectives of the present investigation is to provide an outline of the primary role of Computational Fluid Dynamics (CFD) in the aerospace industry and to clarify why CFD will be of increasing interest to industry in the 1980's A second objective is to present current trends in CFD along with an explanation of these trends Finally, key problem areas are defined which will pace the application of CFD technology by industry In aircraft design procedures, the potential role of CFD is to minimize parametric model scale testing and use parametric analysis as the basis for configuration selection Use of parametric analysis rather than parametric testing for design offers the advantages of reduced development cost, time, and risk It also removes as a design contraint the existing test data base Aspects of flow analysis technology development are discussed, taking into account numerics and mesh generation, turbulence modeling, and modeling and validation experiments G R

A82-35290 # **Smoke reduction in FJR-710 turbofan engines by an airblast combustor** K Eguchi, A Ishii (National Aerospace Laboratory, Chofu, Tokyo, Japan), K Suzuki (Ministry of International Trade and Industry, Mechanical Engineering Laboratory, Ibaraki, Japan), K Kitahara (Kawasaki Heavy Industries Co , Ltd , Hyogo, Japan), and T Tagashira (Ishikawajima-Harima Heavy Industries Co , Ltd , Jet Engine Div , Tokyo, Japan) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-24* 11 p 18 refs Members, $2 00, nonmembers, $4 00 Research supported by the Ministry of International Trade and Industry of Japan

An airblast fuel atomizer has been developed to reduce smoke emission levels in turbofan engines of the FJR-710 series An annular combustor with the newly designed fuel atomizer was rig-tested in the presence of inlet airflow distortions over a wide range of inlet pressures and temperatures with a view to improving the combustor performance and reducing exhaust emissions through cowl and liner modifications Smoke emission levels were below the visible limits for both main- and main/primary-fuel operations in the engine tests, levels at full-power conditions were found to meet the 1984 EPA standard for T2-class engines There was no problem with flame instability or combustor durability V L

A82-35292 # **Thermal decomposition of aviation fuel.** A E Peat (Rolls-Royce, Ltd , Derby, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-27* 4 p 5 refs Members, $2 00, nonmembers, $4 00

Thermal stressing of aviation fuels can promote the formation of fuel insoluble compounds Their presence within the fuel system is troublesome to aviation gas turbine manufacturers as they can adversely affect engine performance To study this phenomenon, an experimental program based on a fuel rig capable of reproducing relevant engine conditions and featuring an instrumented replica fuel injector feed arm was devised The initial objectives are to rate quantitatively the effects of bulk fuel and metal temperatures, fuel flow rates, and fuel types on the production of fuel insoluble matter, both deposited and suspended This report presents the initial results which indicate a relationship between the weight of 'tube' carbon deposits and a function of 'tube' metal temperature and fuel velocity Further, this approach could provide an interface between the engine and laboratory test results (Author)

A82-35293 # **Plain-jet airblast atomization of alternative liquid petroleum fuels under high ambient air pressure conditions.** A K Jasuja (Cranfield Institute of Technology, Cranfield, Beds , England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-32* 7 p 5 refs Members, $2 00, nonmembers, $4 00 Research supported by the Ministry of Defence (Procurement Executive)

The effects that air and fuel properties have upon the spray mean drop size characteristics of a plain-jet airblast atomizer of the type employed in the gas turbine engine are investigated The tests used kerosene, gas oil and a high-viscosity blend of gas oil in residual fuel oil, and covered a wide range of ambient air pressures Laser light-scattering technique was employed for drop size measurements It is concluded that the atomizer's measured mean drop size characteristics are only slightly different from those of the pre-filming type, especially when operating on low-viscosity kerosene under higher ambient air pressure The beneficial effect of increased levels of ambient air pressure on mean drop size is shown to be much reduced in the case of high-viscosity fuels, thus making the attainment of good atomization performance on such fuels difficult An expression is derived for correlating the obtained mean drop size data C D

A82-35294 # **Fuel microemulsions for jet engine smoke reduction.** D W Naegeli and C A Moses (Southwest Research Institute, San Antonio, TX) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-33* 10 p 11 refs Members, $2 00, nonmembers, $4 00 Contract No F08635-79-C-0213

Soot formation in gas turbine engines continues to be a threat to the operation and performance of aircraft A recent problem is related to the control of smoke emissions from jet engine test cell facilities A concept of water-in-fuel emulsions for the purpose of reducing smoke emissions from jet engine test cells was developed However, some basic problems were encountered with water-in-fuel macroemulsions Recently, methods were developed for creating 'microemulsions' of water-in-fuel and of alcohol-in-fuel The present investigation has the objective to determine if the microemulsion concept could be used as a viable method to reduce exhaust smoke from gas turbine engines It was found that if it is possible to formulate microemulsions involving fuel blends of both JP-4 and JP-8 with ethanol (aqueous), methanol, and water Ethanol (anhydrous) is soluble in JP-4 and JP-8 Effects of these blends on combustion performance are related to the reduction of soot formation, exhaust smoke, and nitrogen oxide concentration G R

A82-35295 # Investigation of blade vibration of radial impellers by means of telemetry and holographic interferometry. U Haupt and M Rautenberg (Hannover, Universitat, Hanover, West Germany) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-34* 6 p Members, $2 00, nonmembers, $4 00 Research supported by the Deutsche Forschungsgemeinschaft and Forschungsvereinigung Verbrennungskraftmaschinen

Blade vibration measurements are carried out on a high-pressure, high-mass-flow, centrifugal compressor to determine the excitation mechanism in various operating ranges Semiconductor strain gauges are used in the experiments, and an eight-channel telemetry system serves to transmit the signals Blade vibration measurements are made for different operating ranges of the compressor, such as rotating stall and surge and flutter, and for the case of nonuniform flow conditions The results of vibration tests with the impeller at rest show the stress distribution and the strain directions during blade vibration This information is used for the choice of the strain gauge position on the blade The experimental results are confirmed by a finite-element calculation considering a segment of the impeller with one blade, which determines the different vibration modes In addition, the steady strain distribution of the impeller due to centrifugal force and temperature is calculated The investigations are completed by optical measurements to find out the vibration modes of the different blades in rotating operation The results reveal the various vibration modes of the blade up to a rotational speed of the compressor of 13,000 rpm C R

A82-35296 # Acoustic control of dilution-air mixing in a gas turbine combustor. P J Vermeulen, J Odgers (Universite Laval, Quebec, Canada), and V Ramesh (Calgary, University, Calgary, Alberta, Canada) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-35* 12 p Members, $2 00, nonmembers, $4 00 Natural Sciences and Engineering Research Council of Canada *Grant No A-7801*

A successful test carried out on a small combustor of normal design employing acoustic control of the dilution-air flows is described, noting that the combustor, even though tested at 'off-load' conditions, is much more representative of an engine combustor than the one described by Vermeulen and Odgers (1979) It is demonstrated that acoustic modulation of the dilution-air flows can be used to selectively and progressively control the exit plane temperature distribution In particular, for an already good traverse quality, it is shown to be possible to trim the temperature profile, the results here are seen as sufficiently encouraging to warrant further development of the technique It is thought that the study will contribute to the design of combustors in which a desired exit plane temperature distribution may be achieved The acoustic drive is found to have no effect on the combustion efficiency C R

A82-35298 # Experimental investigations on the flow in the impeller of a centrifugal fan. G Caignaert, B Desmet, and D Stevenaert (Ecole Nationale Superieure d'Arts et Métiers, Lille, France) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-37* 6 p 9 refs Members, $2 00, nonmembers, $4 00

A centrifugal research fan facility designed for pressure measurements on the impeller blades is described Results of mean and fluctuating pressures are presented, showing the flow to be three-dimensional and rather unsteady Also included is an analysis of rotating stall at low flow rates The variations in the pressure distributions on the blade when the flow is varied reveal the influence of the angle of attack all along the blade leading edge and the importance of a good design of the inlet part of the blade in order to obtain better characteristics The analysis of pressure fluctuations shows the important interaction with the volute, despite a large gap between the volute tongue and impeller C R

A82-35299 # Small engine inlet air particle separator technology. H L Morrow and D B Cale (U S Army, Applied Technology Laboratory, Fort Eustis, VA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-40* 7 p 18 refs Members, $2 00, nonmembers, $4 00

In connection with Army operations involving an employment of the newly developed airmobile concept, it was found that engine erosion problems, related to an ingestion of sand and dust, limited the average operational life of helicopter gas turbine engines to about 300 hours A number of programs were initiated with the aim to study approaches for solving the corrosion problem The Army finally elected to solve the problem by having the engine manufacturer develop the inlet protection system as part of the engine This approach insures adequate development testing of the protection system concurrent with normal engine development and precludes quick-fix, after-the-fact development It also results in the inclusion of the inlet protection system and its losses in the basic engine weight, volume, and performance G R

A82-35300 # Conversion of centrifugal compressor performance curves considering non-similar flow conditions. W Fister (Bochum, Ruhr-Universität, Bochum, West Germany) and J Kotzur (Maschinenfabrik Augsburg-Nurnberg AG, Oberhausen, West Germany) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-42* 14 p 22 refs Members, $2 00, nonmembers, $4 00

A detailed flow model of a radial compressor stage has been used to develop a new conversion method which makes it possible to consider, with few measurements, the effect of the most important parameters, such as Mach and Reynolds numbers, on energy transfer in the stage and flow losses The new method is shown to provide a convenient, time-saving and sufficiently accurate way of converting performance characteristics within relatively wide ranges of peripheral Mach numbers and Reynolds numbers Performance curves converted using the proposed method are presented and compared to measured values V L

A82-35301 # On the influence of the number of stages on the efficiency of axial-flow turbines G Lozza, E Macchi, and A Perdichizzi (Milano, Politecnico, Milan, Italy) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-43* 10 p 12 refs Members, $2 00, nonmembers, $4 00

A computer code able to optimize significant design variables of a multi-stage axial-flow turbine is described, and the selection of optimizing design variables, constraint assumptions within which the solution is searched, and the optimization procedure used, are discussed Losses are predicted by the Craig and Cox (1971) correlation The design and performance prediction of a number of representative turbines is accomplished by a computer program, and similarity parameters are introduced to generalize the results obtained after a discussion of their physical significance for a multistage turbine's compressible flow Turbine stage number influence on overall turbine efficiency is derived as a function of expansion ratio, specific speed and turbine dimensions O C

A82-35302 # Secondary flow mixing losses in a centrifugal impeller. M W Johnson (Liverpool, University, Liverpool, England) and J Moore (Virginia Polytechnic Institute and State University, Blacksburg, VA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-44* 9 p 13 refs Members, $2 00, nonmembers, $4 00 Research supported by Rolls-Royce, Ltd

A 'jet-wake' pattern has been observed in studies of outlet flows from centrifugal impellers However, although impeller geometry, flow rate, and operating speed are known to influence the size and position of the wake, wake flows cannot be predicted reliably by current design methods An improvement regarding the understanding of the wake flow would, therefore, be helpful in connection with efforts to optimize the performance of centrifugal compressors In order to predict the development of the wake, it is necessary to investigate in detail the secondary flows which contribute to the thickening of the boundary layers on the suction surface and shroud walls The present investigation is concerned with the determination of the flow phenomena which influence the development of the wake and its size and location in the impeller discharge flow It is found that the secondary flows strongly influence the position of the wake in the outlet plane of a centrifugal impeller G R

A82-35303 # The influence of flow rate on the wake in a centrifugal impeller. M W Johnson (Liverpool, University, Liverpool, England) and J Moore (Virginia Polytechnic Institute and State University, Blacksburg, VA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-45* 8 p 11 refs Members, $2 00, nonmembers, $4 00 Research supported by Rolls-Royce, Ltd

A description is presented of the results of measurements made in a de Havilland Ghost centrifugal impeller running at low speed (500 rpm) All three mutually perpendicular components of relative velocity and the rotary stagnation pressure were measured on five cross-sectional planes between the inlet and the outlet of the impeller for three different flow rates It was found that significant total pressure losses occur in two regions of the impeller, including the suction-side/-shroud corner region in the inducer at both the 'below design' and 'design' flow rates, and the final radial section of the impeller at all three flow rates The losses in the inducer are the result of an adverse pressure gradient in the streamwise direction in the suction-side/shroud corner region, which causes the separation of the boundary layer The separation point moves downstream as the flow rate is increased, until, at the 'above design' flow rate, separation losses are entirely avoided in the inducer G R

A82-35304 # **Secondary flow effects and mixing of the wake behind a turbine stator.** A Binder and R Romey (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Antriebstechnik, Cologne, West Germany) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-46* 9 p 16 refs Members, $2 00, nonmembers, $4 00

The increase in secondary flow effects of highly loaded turbines with large hub/tip ratios is investigated for the case of a single-stage turbine with cold air flow, whose stator was designed for transonic flow and has a hub/tip ratio of 0 756 After taking measurements without the rotor in several sections behind the turbine stator, with attention to wake mixing and secondary vortices, the magnitude of the mixing losses is derived from the distributions of total pressure loss coefficient and flow direction The position, intensity structure and development of secondary vortices are also obtained Complementary five-hole probe measurements confirm the earlier, two-dimensional measurement results O C

A82-35306 # **The low temperature properties of aviation fuels.** G Brunton, R R Willock, and M A Voisey (Shell Research, Ltd , Thornton Research Centre, Chester, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-48* 10 p 15 refs Members, $2 00, nonmembers, $4 00

In connection with easing major constraints regarding the aviation fuel market in connection with increasing fuel demands and decreasing supplies, it is desirable to identify ways of moderating specification requirements which will enhance flexibility, but at the same time maintain product quality One of the important specification requirements that can constrain fuel availability is the freezing point A description is presented of research into the low-temperature properties of aviation fuels conducted by a major oil company Attention is given to the need to define the low-temperature specification requirement, tank studies, the effect of fuel composition on low-temperature properties, current efforts, and the consequences of utilizing a flow-related low-temperature specification requirement G R

A82-35307 * # **Deposit formation in hydrocarbon fuels** R Roback, E J Szetela, and L J Spadaccini (United Technologies Research Center, East Hartford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-49* 9 p 9 refs Members, $2 00, nonmembers, $4 00 Contract No NAS3-22277

The hydrocarbon fuels RP-1, commercial-grade propane, JP-7 and chemically pure propane were subjected to tests in a high pressure fuel coking apparatus in order to evaluate their thermal decomposition limits and carbon deposition rates in heated copper tubes A fuel thermal stability parametric evaluation was conducted at 136-340 atmospheres, bulk fuel velocities of 6-30 m/sec, and tube wall temperatures of 422-811 K, and the effect of inside wall material on deposit formation was evaluated in tests using nickel-plated tubes Results show RP-1 deposit formation at wall temperatures between 600 and 800 K, with peak deposit formation near 700 K Substitution of deoxygenated JP-7 for RP-1 showed no improvement, and the carbon deposition rates for propane fuels were found to be higher than those of either of the kerosene fuels Nickel plating of the tube walls significantly reduced RP-1 carbon deposition rates O C

A82-35310 # **Development and application of Dabber gas tungsten arc welding for repair of aircraft engine, seal teeth.** J F Rudy (General Electric Co , Aircraft Engine Business Group, Cincinnati, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-55* 4 p Members, $2 00, nonmembers, $4 00

It has been recognized that the task of rebuilding worn seal teeth on rotating parts of gas turbine engine hardware is an important part of any program for the reduction of the operating costs of these engines A procedure for performing the required repair operations for such a task is discussed Attention is given to the development of a welding technique which places a minimum puddle volume and a small width build-up on top of a continuous narrow edge, to achieve a minimal heat affected zone and minimum shrinkage, in the absence of cold overlaps or other weld defects A process which worked significantly better than other procedures investigated was to 'dab' the filler wire into the puddle or arc plasma zone Aircraft gas turbine engine components with seal teeth repaired by the 'Dabber' welding method are now performing satisfactorily in commercial service G R

A82-35311 # **EAGLE - An interactive engine/airframe life cycle cost model.** E J Reed, R R Horton, and J B Fyfe (United Technologies Corp , Government Products Div , West Palm Beach, FL) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-56* 7 p Members, $2 00, nonmembers, $4 00 Contracts No N00019-80-C-0225, No F33657-77-C-0403, No F33657-78-C-0256

The DOD is placing increased emphasis on procedures for predicting and tracking the cost of developing, procuring, and supporting weapon systems over their life cycles The DOD has also begun to state weapon system requirements in terms of mission to be accomplished rather than specific hardware The net effect of these and other similar DOD actions has been to require weapon system contractors to expand their system analysis capability to meet DOD requirements A description has been presented of the Engine/Airframe Generalized Life Cycle Cost Evaluator (EAGLE) model, which has been developed by an American aerospace company primarily to evaluate the influence of engine design decisions on the total weapon system To accomplish this, an adequate accounting and understanding of engine/airframe interaction, mission impact, engine performance, maintenance, and cost effects was a prerequisite G R

A82-35312 * # **Experimental study of external fuel vaporization.** E J Szetela and J A TeVelde (United Technologies Research Center, East Hartford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-59* 8 p 9 refs Members, $2 00, nonmembers, $4 00 Contract No NAS3-21971

The fuel properties used in the design of a flash vaporization system for aircraft gas turbine engines were evaluated in experiments using a flowing system to determine critical temperature and pressure, boiling points, dew points, heat transfer coefficients, deposit formation rates, and deposit removal Three fuels were included in the experiments Jet-A, an experimental referee broad specification fuel, and a premium No 2 diesel fuel Engine conditions representing a NASA Energy Efficient Engine at sea-level take-off, cruise, and idle were simulated in the vaporization system and it was found that single phase flow was maintained in the heat exchanger and downstream of the throttle Deposits encountered in the heat exchanger represented a thermal resistance as high as 1300 sq M K/watt and a deposit formation rate over 1000 gC/sq cm hr C D

A82-35314 # **Atomization quality of twin fluid atomizers for gas turbines.** M M Elkotb, M A E Mahdy (Cairo University, Cairo, Egypt), and M E Montaser (Egyptian Army, Egypt) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-61* 10 p 17 refs Members, $2 00, nonmembers, $4 00

The flow and atomization performance characteristics of external mixing twin fluid atomizers, which were tested over a wide range of geometries and operating conditions, are discussed Attention is given to such factors as nozzle/needle diameter ratio, normal fuel area, cone angle, and droplet size distribution It is found that the flow rate increases with nozzle/needle diameter ratio and fuel nozzle area, as well as with an increase of fuel pressure and decrease of air pressure A dimensional relation is derived which accurately predicts flow number Functions are also derived for droplet size distribution and Sauter mean diameter, which can together with that for flow number be used in the prediction of fuel concentration and heat release O C

A82-35315 # **The effect of coolant flow on the efficiency of a transonic HP turbine profile suitable for a small engine** G W Michel (Rolls-Royce, Ltd , Aero Div , Bristol, England) and F H Kost (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur experimentelle Stromungsmechanik, Gottingen, West Germany) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-63*10 p 10 refs Members, $2 00, nonmembers, $4 00 Research supported by the Ministry of Defence (Procurement Executive)

In connection with plans for improving gas turbine efficiency by raising the operational temperature, an investigation has been conducted concerning the design of a suitable engine cooling procedure The investigation involved a study of the aerodynamic penalties of coolant flow for various configurations of coolant flow Tests were carried out to investigate the effect of coolant ejection through slots in the trailing edge of a turbine profile suitable for a small engine In the considered case, the trailing edge thickness has to be large to accommodate the slot and a wall thickness which is mechanically strong enough on either side of the slot It was found that the vortex shedding from the airfoil trailing edge has a very great effect on the airfoil efficiency at subsonic speeds, at least for airfoils with a thick trailing edge The efficiency can be improved by the using of a trailing edge slot of certain characteristics G R

A82-35316 # **The use of performance-monitoring to prevent compressor and turbine blade failures.** R E Dundas (Factory Mutual Research Corp , Norwood, MA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-66* 14 p Members, $2 00, nonmembers, $4 00

It is noted that in nearly all cases the cause of complete failure in turbine blades is high-frequency fatigue The three types of vibration that give rise to alternating loading, namely free vibration, forced vibration, and self-excited vibration (flutter), are discussed It is recommended that manufacturers design blades in such a way that no critical resonances exist within the operating speed range It is pointed out that no practical method exists for detecting vibration in a blade The only way to avoid resonant vibration failures is to avoid conditions that produce abnormal circumferential flow distortion A regular program of frequent performance analysis of compressors and gas turbines can serve to detect developing flow distortion Uneven combustion can be detected from temperature differences between exhaust-area thermocouples It is stressed that the occurrence of fatigue signifies a change in the system that should be corrected C R

A82-35318 # Improved vane-island diffusers at high swirl T Jiang and T -T Yang (Clemson University, Clemson, SC) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-68* 9 p 7 refs Members, $2 00, nonmembers, $4 00

An experimental study is presented on the performance of vane-island diffusers at high swirl (lambda = 9) Results obtained for four sets of 14 straight vanes are compared with those obtained by Ryan and Yang (1980) for five sets of eight vanes The 14-vane configuration results in a 40% reduction in pressure loss coefficient below that obtained with the eight-vane configurations, the lowest loss coefficients being obtained where the vane leading edge is at a radius equal to about 1 2 times the diffuser inlet radius Results are presented in terms of (1) pressure rise versus radial location along the diffuser, (2) diffuser effectiveness versus flow coefficient, and (3) minimum pressure loss coefficient versus flow coefficient O C

A82-35322 # Test facility and data handling system for the development of axial compressors A C Reusch and S Timberley (Ruston Gas Turbines, Ltd , New Products Div , Lincoln, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-73* 9 p Members, $2 00, nonmembers, $4 00

The test installation and the data acquisition system used in the aerothermodynamic development of the axial compressor for a new Ruston 6-MW industrial gas turbine are described Developments in instrumentation techniques are discussed Processing of the data is outlined and data are presented for a typical graphical output The merits of the flexibility achieved, both for the aerothermodynamic test facility and the data acquisition system, are discussed The potential of the installation for the development of other axial compressors is outlined (Author)

A82-35323 # Comprehensive analysis of an axial compressor test with adjustable guide vanes. C -L Chang, C -H Kuo, and S -L Sha (Marine Boiler and Turbine Research Institute, Harbin, People's Republic of China) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-74* 7 p 14 refs Members, $2 00, nonmembers, $4 00

Adjustment tests have been successfully conducted on a 12-stage single rotor axial compressor formed by adding two stages to the front of the original 10-stage subsonic compressor Tests were carried out for five rows of adjustable guide vanes, based on the relationship of setting angle variation to speed The test results were compared with the case when fixed geometry was used Under the latter conditions, there existed in the medium speed zone 'dual value characteristics' for which detailed measurements were taken and possible implications discussed It has been shown that the use of adjustable guide vanes for improving medium and low speed performance is fully justified C D

A82-35327 # Optimization of compressor vane and bleed settings. J E Garberoglio, J O Song, and W L Boudreaux (United Technologies Corp , Government Products Div , West Palm Beach, FL) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-81* 9 p 16 refs Members, $2 00, nonmembers, $4 00 Contract No F33615-79-C-2013

A comparative evaluation of optimization techniques applied to the optimization of vane and bleed settings in multistage axial compressors is carried out The main considerations in the evaluation are the number of test points required to achieve an optimum performance goal, the ability to handle performance and aeromechanical constraints, the sensitivity to measurement errors, and the effect of finite vane travel and bleed flow variations Descriptions are given of Conmin (a FORTRAN program for constrained minimization) and Copes (a FORTRAN program for engineering synthesis) It is concluded that the Copes/Conmin approximate optimization technique is able to guide the optimization of compressor vane and bleed settings The approximate optimization approach is shown to work well on problems involving experimental measurements and finite step sizes of the independent variables C R

A82-35329 # Gas turbine airflow control for optimum heat recovery W I Rowen and R L Van Housen (General Electric Co , Schenectady, NY) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-83* 9 p Members, $2 00, nonmembers, $4 00

Attention is given to the economic gains that can be realized by using the control modes now available to optimize the cycle efficiency at part load operation Included here are variable inlet guide vane (VIGV) control for single-shaft units, and combined VIGV and variable high pressure set (compressor) speed control for two-shaft units In addition to the normal control optimization mode for maintaining the maximum exhaust temperature, a new control mode is discussed which permits airflow to be modulated in response to a process signal while at constant part load This control feature is desirable for gas turbines that supply preheated combustion air to fired process heaters C R

A82-35330 # Carbon formation by the pyrolysis of gas turbine fuels in preflame regions of gas turbine combustors. C D Hurley (National Gas Turbine Establishment, Farnborough, Hants , England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-84* 7 p 8 refs Members, $2 00, nonmembers, $4 00

A series of experiments is carried out to investigate the formation of carbon from the pyrolysis of gas-turbine fuels, in both the gas and liquid phases, over the temperature range 573-1300 K Two fuels are examined, a kerosene and a diesel, spanning the range of current and possible future aviation fuels It is found that only gas-phase pyrolysis can account for the formation of carbon and that there is no difference in the carbon-forming tendencies of kerosene and diesel The kinetics of the reaction is determined, making it possible to predict the amount of decomposition of the fuels at temperatures up to those typical of the preflame regions of combustors C R

A82-35331 # Casing treatments on a supersonic diffuser for high pressure ratio centrifugal compressors. Y Ribaud (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) and P Avram (ONERA, Palaiseau, Essonne, France) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-85* 9 p 8 refs Members, $2 00, nonmembers, $4 00 Research supported by the Direction des Recherches, Etudes et Techniques

While centrifugal compressors with pressure ratios in the 7-10 range often exhibit slow mass flow margins, such casing treatments as the use of large openings at the diffuser throat which are connected to annular plenums have been found to broaden the reduced mass flow range of the diffuser during supersonic inlet operation While diffuser flow reduction is associated with a drop in efficiency in the region of reduced mass flow variation, the use of a backswept centrifugal rotor is shown to overcome this efficiency Attention is given to both the experimental apparatus employed and the mechanical design details of the diffuser equipped with near-throat large apertures O C

A82-35332 # Liquid particle dynamics and rate of evaporation in the rotating field of centrifugal compressors. O Pinkus *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-86* 10 p 5 refs Members, $2 00, nonmembers, $4 00 Contract No W-7405-eng-26

Attention is given to an approach in which for an improvement in performance isothermal conditions in centrifugal compressors are achieved in connection with the injection of a coolant from the rotating blades along the path of compression By full or partial vaporization, the injected liquid would cool the gas, or superheated vapor, and keep it below adiabatic compression temperatures The particular attraction of such an injection system in centrifugal compressors is that no special equipment is needed for the delivery and compression of the coolant A study of the process of liquid injection has to take into account the flow of the liquid, aspects of particle dynamics, the rate of vaporization, and two-phase flow In a study of the injection system, it is found that a large number of orifices with a small diameter should be used It is desirable to use for the injection liquids of low viscosity G R

A82-35333 # Two-phase transpiration cooling M A El-Masri (MIT, Cambridge, MA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-89* 10 p 20 refs Members, $2 00, nonmembers, $4 00

The history of cooling technologies for gas turbines is briefly considered It is pointed out that two-phase transpiration cooling offers significant benefits A major incentive to study two-phase transpiration cooling is the thermodynamic benefit if fuel could be used as the transpiration coolant The heat transfer problem in a transpired wall is composed of two matched subproblems, including the internal heat transfer between the coolant and the porous wall and the interaction of the transpired stream with the external boundary layer An analysis of two-phase transpiration cooling is conducted, taking into account a model physical description, governing equations, regimes and modes of operation, and the two-phase range On the basis of the analysis, two-phase transpiration is identified as a potentially-powerful cooling scheme for gas turbines Moderate blade temperatures may be maintained in very high temperature gas streams without separating the boundary layer or incurring large aerodynamic or cooling penalties G R

A82-35335 # **The effect of inlet distortion on the performance characteristics of a centrifugal compressor.** I Ariga, S Masuda (Keio University, Yokohama, Japan), Y Watanabe (Japan Air Lines, Overhaul Center, Tokyo, Japan), I Watanabe (Kanto Gakuin University, Yokohama, Japan), and N Kasai *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-92* 9 p 9 refs Members, $2 00, nonmembers, $4 00

The effects of inlet pressure distortion on the performance characteristics and surge margin of a centrifugal compressor have been investigated experimentally using a low-speed compressor test rig with the inlet honeycomb acting as the distortion generator Results indicate that inlet distortion has a negative effect on the efficiency and surge margin of the compressor, with radial distortion having a much stronger effect than circumferential distortion Various distortion indices are examined in order to correlate the compressor performance to inlet distortion, and a distortion index related to the shock loss of the inducer is shown to be a suitable parameter for estimating the total pressure ratio in the case of inlet distortions V L

A82-35336 # **A two-dimensional boundary-layer program for turbine airfoil heat transfer calculation** R M C So (Arizona State University, Tempe, AZ), I H Edelfelt, D M Kercher (General Electric Co , Schenectady, NY), and E Elovic (General Electric Co , Aircraft Engine Group, Cincinnati, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-93* 8 p 23 refs Members, $2 00, nonmembers, $4 00 Contract No DE-AC01-76-ET-10340

Modern gas turbines operate at turbine inlet gas temperature levels which are substantially above the structural capability of the high-temperature alloys used in gas turbine components It is, therefore, necessary to cool these components The design of suitable cooling procedures is currently a complex, expensive process, involving the adjustment of calculated values by empirical test factors The development of a heat transfer calculation procedure could, in this connection, lead to faster and much more economical procedures for the design of suitable cooling processes The two-dimensional boundary-layer program STAN5 reported by Crawford and Kays (1976) is used as a basis for the development of a program which can be used with confidence by heat transfer design engineers to calculate the heat transfer on turbine airfoil surfaces G R

A82-35337 # **Development of hybrid gas turbine bucket technology.** L G Peterson, D E Hrencecin, W F Schilling, and W J Ostergren (General Electric Co , Gas Turbine Div , Schenectady, NY) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-94* 10 p Members, $2 00, nonmembers, $4 00 Contract No DE-AC01-80ET-17005

A program has been initiated to evaluate the feasibility of producing a composite large-scale industrial gas turbine bucket using different nickel base superalloys in the airfoil and dovetail sections Preliminary studies involve microstructure and high temperature tensile test evaluation of three directionally solidified alloys and two powder metal alloys DS nickel base alloys include MAR-M200 plus Hf, René 80H and 441 (modified Rene 150) while the powder metals are low carbon versions of Astroloy (AP1) and PA-101 Hot isostatic pressing has been used to diffusion bond DS and powder alloys together Powder densification and bonding take place simultaneously Three separate solution temperatures have been used to HIP diffusion and bond each DS/powder alloy combination Subsequent heat-treating to simulate a coating cycle and aging are being evaluated Metallurgical evaluation as well as high temperature tensile testing have been used to assess bondline cleanliness and mechanical integrity (Author)

A82-35338 # **Net shape components for small gas turbine engines.** W P Schimmel and G J Quill (Williams International, Walled Lake, MI) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-96* 9 p Members, $2 00, nonmembers, $4 00

Advanced manufacturing methods producing net shape components for both current and next-generation high performance gas turbine engines are described A coordinated development program is being conducted to provide near-net shape components which will minimize machining costs, save critical materials, and in some cases improve component performance The techniques used include the isothermal forging of titanium, titanium casting, hot isostatic pressing of titanium powder, diffusion-bonded dual property techniques, and a diffuser case fabrication process Emphasis is placed on the unique demands of small gas turbine engines O C

A82-35339 # **Design and investigations of a three dimensionally twisted diffuser for centrifugal compressors.** M Jansen and M Rautenberg (Hannover, Universität, Hanover, West Germany) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-102* 9 p 8 refs Members, $2 00, nonmembers, $4 00 Research supported by the Forschungsvereinigung Verbrennungskraftmaschinen, Deutsche Forschungsgemeinschaft *Contract No SFB-61*

A vaned diffuser has been designed for a 90 deg centrifugal compressor impeller having a highly distorted exit flow distribution, where the maximum flow angle difference across the diffuser width at the entrance is 29 deg The vane inlet angle is matched to this flow angle distribution by imparting a three-dimensional twist to the diffuser vanes Mappings of total pressure ratio and efficiency against mass flow for the cases of a twisted diffuser compressor and a compressor using a conventional, cambered vane and straight channel diffuser are compared Twisted diffuser performance is discussed in light of detailed flow field measurements both before and behind the diffuser, as well as the static pressure distribution along the diffuser O C

A82-35340 # **Influence of casing treatment on the operating range of axial compressors.** J Paulon (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) and D Dehondt (Turboméca, S A , Bordes, Pyrenees-Atlantiques, France) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-103* 9 p 9 refs Members, $2 00, nonmembers, $4 00

A theoretical study has been conducted in order to clarify the effect of casing treatment by cutting circular grooves on the performance of axial flow compressors Rules for determining the groove depths have been established which account for the surge margin improvement obtained in some cases and make it possible to dismiss inefficient geometric configurations Such parameters as groove length and position do not seem to be critical, however, optimum results are obtained when the treated length is smaller than the chord projection on the axis, and the groove is centered on that chord or slightly shifted upstream V L

A82-35342 # **The effect of NaCl/g/ in high temperature oxidation.** J G Smeggil and N S Bornstein (United Technologies Research Center, East Hartford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-106* 5 p 6 refs Members, $2 00, nonmembers, $4 00

Experiments have been carried out to investigate the effect of gaseous NaCl on the oxidation of materials used in gas turbines The materials investigated included NiAl, Mar M-509, NX-188, Ni-10Mo, Ni-25Cr, Ni-40Cr, and Ni-40Cr-5Si It is found that very low levels of gaseous NaCl (0 1-100 ppm) approaching those expected for some marine and industrial turbine applications are sufficient to markedly increase the oxidation rate of turbine alloys and coatings, with the magnitude of the effect related to the alloy substrate chemistry Alloys rich in molybdenum appear to be most susceptible to this form of corrosion V L

A82-35344 # **Effect of the rear stage casing treatment on the overall performance of a multistage axial-flow compressor** Y -L Gao (Shenyang Aeroengine Co , Shenyang, People's Republic of China) and K -M Li (Shenyang Aeroengine Research Institute, Shenyang, People's Republic of China) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-110* 5 p 10 refs Members, $2 00, nonmembers, $4 00

The effect on high speed stall margin and efficiency of tip treatment at the rear stages of a compressor is discussed A nine-stage engine compressor was tested in a rig with and without casing treatment on the tip sections of the last three rotors, and another series of tests was conducted on a modified compressor with twisted rotor blades in the rear stages The results showed that the casing treatment of rear stages in a multistage axial-flow compressor could effectively improve the surge margin of the compressor at high speeds The casing treatment had almost no effect on the efficiency of the compressor with blades untwisted, while at the inlet stage it mainly improved the distortion tolerance and the performance of the compressor at low and medium speeds C D

A82-35345 # **On the performance prediction of a centrifugal compressor scaled up.** T Mashimo (Meiji University, Kawasaki, Japan), I Ariga (Keio University, Yokohama, Japan), T Sakai (Tokyo Science University, Tokyo, Japan), and I Watanabe (Kanto Gakuin University, Yokohama, Japan) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-112* 9 p 18 refs Members, $2 00, nonmembers, $4 00 Research sponsored by the Dengyosha Machine Works, Ehara Manufacturing Co , Fuji Electric Co , Hitachi, Ltd , Hitachi Shipbuilding and Engineering Co , et al

A centrifugal compressor performance prediction method, in which each loss generated within the compressor stage is estimated by recognizing the individual relationship between it and the velocity distribution, the Reynolds number, and the Mach number, was investigated over a wide range of sizes and types Three compressors having impellers of 154, 112, and 78 mm diameters were employed in the test, and the results were analyzed to obtain calculation formulas for the losses By referring to unpublished test data, it was confirmed that the formulas could be applied to predict the performance levels of larger compressors with impellers up to 640 mm From the results, it could be deduced that (1) the wall friction losses and the secondary flow losses within the compressor decreased with increase of impeller size, and (2) the leakage flow losses increased when scaling up the compressor, even when tip clearance or blade height were held constant C D

A82-35346 # **Cryogenic turbine testing** R J Iannuzzelli and R E Filippi (Air Products and Chemicals, Inc , Allentown, PA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-113* 9 p 8 refs Members, $2 00, nonmembers, $4 00

Problems encountered in data acquisition during turbine machinery testing in a cryogenic environment are discussed with reference to measurement and sensing errors, overall data uncertainty and its implications, and surface roughness effects on wheel losses It is shown that data quality can be insured by using the power balance as an indicator of data uncertainty Data uncertainty due to heat transfer effects can be minimized by adequately insulating the test vehicle The measurement of temperature downstream of a turbine wheel should be made after a flow-mixing device to avoid adverse temperature distributions which could lead to sensing errors And, finally, computerization of the data acquisition function can significantly reduce data uncertainty V L

A82-35348 * # **A computational design method for transonic turbomachinery cascades.** H Sobieczky (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur theoretische Stromunsgmechanik, Gottingen, West Germany) and D S Dulikravich (NASA, Lewis Research Center, Cleveland, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-117* 10 p 17 refs Members, $2 00, nonmembers, $4 00

This paper describes a systematical computational procedure to find configuration changes necessary to modify the resulting flow past turbomachinery cascades, channels and nozzles, to be shock-free at prescribed transonic operating conditions The method is based on a finite area transonic analysis technique and the fictitious gas approach This design scheme has two major areas of application First, it can be used for design of supercritical cascades, with applications mainly in compressor blade design Second, it provides subsonic inlet shapes including sonic surfaces with suitable initial data for the design of supersonic (accelerated) exits, like nozzles and turbine cascade shapes This fast, accurate and economical method with a proven potential for applications to three-dimensional flows is illustrated by some design examples (Author)

A82-35350 # **A critical appraisal of some current incidence loss models for the stator and rotor of a mixed flow gas turbine.** F Fairbanks (Hatfield Polytechnic, Hatfield, Herts , England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-120* 6 p 5 refs Members, $2 00, nonmembers, $4 00

Current models predicting the loss due to incidence in radial turbomachinery are briefly reviewed, and a new incidence loss model, designated the shock loss model, is proposed As with the other models, the shock loss model assumes a change in the tangential components of the kinetic energy at entry but thereafter uses only fundamental principles, obviating the difficulty of changing the definition of the loss according to the flow conditions Analysis is carried out for the stator blades of a radial turbine, and it is found that the shock loss model, as derived, overestimates by approximately 80% the overall loss parameter for the stator passage It is concluded that none of the loss models reviewed, including the shock loss model, is satisfactory since they do not account for flow pattern in the rotor or stator passages V L

A82-35351 # **A mixed-flow cascade passage design procedure based on a power series expansion.** R A Novak and G Haymann-Haber *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-121* 15 p 10 refs Members, $2 00, nonmembers, $4 00

A blade-to-blade design technique is presented which will quickly develop the unique blade shape implied by the meridional-plane input specifications, which could then be treated as a preliminary version of a final blade shape, to be modified in accordance with the designer's perception of neglected real flow effects The flow is assumed to be steady, two-dimensional on surfaces of revolution, nonviscous, and nonrotational The process readily gives solutions for subsonic, supersonic, or mixed-flow conditions The solutions are channel solutions, and realistic only in situations where a shock-free flow is possible Particularly for supersonic compressor cascades, the results must be treated with caution Numerous examples are given, with comparisons with experimental data and other analytic solutions C D

A82-35352 # **Development and application of a performance prediction method for straight rectangular diffuser.** F S Bhinder and M H Al-Modafar (Hatfield Polytechnic, Hatfield, Herts , England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-122* 5 p 7 refs Members, $2 00, nonmembers, $4 00 Research supported by Rolls-Royce, Ltd

A brief description of a step-by-step method for predicting the performance of straight rectangular diffuser is given The theory has been used to predict the performance of rectangular diffusers for which comprehensive experimental data are available and the agreement between experimental and predicted results is very close The method is shown to be applicable over a wide range of inlet Mach numbers, aspect ratios, and Reynolds numbers When the diffuser divergence angle is less than 8 deg, the static pressure recovery coefficient is only slightly dependent on the aspect ratio, provided the latter is greater than one However, for diffuser divergence angle greater than 12, the optimum entry aspect ratio is around unity The inlet blockage has a significant influence on the pressure recovery for all geometical configurations, entry Mach numbers, and entry Reynolds numbers C D

A82-35353 # **Performance analysis of the test results on a two-stage transonic fan** C Baoshi and Z Tianyi (Shenyang Aeroengine Research Institute, Shenyang, People's Republic of China) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-123* 5 p Members, $2 00, nonmembers, $4 00

Test results obtained from a two-stage fan are analyzed and the reasons for failure to attain the design performance target are presented It was found that the design airflow and pressure ratio of the fan were attained, but the efficiency and stall margin were far lower than the design values The problems found in stage one were that the design performance parameters selected on the basis of the original tests were too high, that the partspan shroud added onto the rotor degraded the performance and completely changed the spanwise flow field, and that the modifications on the flowpath and chord length of the stator caused an excessively high inlet Mach number at the stator hub, resulting in high losses and flow separation there The high load and high incidence at the hub of the second rotor caused higher losses and reduced the stall margin of the fan, and the stages were inadequately matched C D

A82-35358 # **Accuracy expectations for gas turbine and centrifugal compressor performance testing** T C Heard and E J Hipp (General Electric Co , Schenectady, NY) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-128* 13 p 13 refs Members, $2 00, nonmembers, $4 00

A simple procedure for estimating instrument errors and for assessing their influences on the final results is outlined The procedure uses the statistical approach of first estimating the uncertainty of each measurement or piece of data to be used, and then combining their effects in prescribed ways to estimate the uncertainties of performance functions Probable error uncertainty is defined as a band of such width that there is a 50 percent chance of including the true value As an example, the p/e uncertainties are estimated for testing a gas turbine driven compressor operating at 25,000 horsepower and at a relatively low pressure ratio on natural gas Uncertainties are found for the compressor shaft power, the gas turbine shaft power, the gas turbine heat rate, and the gas turbine and compressor considered as a single package C D

A82-35362 # **The potential impact of future fuels on small gas turbine engines.** J A Saintsbury (Pratt and Whitney Aircraft of Canada, Ltd , Longueuil, Quebec, Canada) and P Sampath *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-133* 8 p 11 refs Members, $2 00, nonmembers, $4 00

The present investigation is based on the assumption that in the not too distant future aviation gas turbine fuels as they are known today will not be available and that it will be necessary to accept either degraded fuels or fuels derived from sources presently considered unconventional The investigation addresses gas turbine fuels in general and their effect on combustion systems, giving particular attention to small gas turbine engine combustion systems It is found that the impact of future fuels on aircraft gas turbine engines will vary depending on engine size and type, because of differences in fundamental design criteria, and constraints of weight, cost, and size As a first step towards fuel conservation pending availability of viable alternate energy sources, broadened specification fuels with modest relaxations in aromatics, and freeze point will likely be in use in the near term, but fuels from alternate sources will be longer term because of the need to develop an appropriate production industry G R

A82-35363 **An inviscid-viscous interaction treatment to predict the blade-to-blade performance of axial compressors with leading edge normal shock waves.** W J Calvert (National Gas Turbine Establishment, Farnborough, Hants , England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-135* 12 p 23 refs Members, $2 00, nonmembers, $4 00

An inviscid-viscous interaction treatment has been developed to predict the blade-to-blade flow in axial compressors operating with supersonic inlet conditions and a normal shock wave at inlet to the blade passage The treatment uses both direct and inverse modes of operation for the inviscid and viscous calculations, and thus it can model the separation of the suction surface boundary layer produced by the strong interaction with the shock wave The inviscid flow is calculated by a time marching method and the viscous flow by integral methods for laminar and turbulent boundary layers (Author)

A82-35366 # **Application of high bypass turbofan computer simulation to flight and test data processing.** J F Chapier and L Levine (Avco Corp, Avco Lycoming Div, Stratford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-141* 8 p Members, $2 00, nonmembers, $4 00

This paper describes the computer program used to compare gas turbine engine flight and static test results with a predicted standard engine computer simulation model The program is conceived not only for a final presentation of engine performance, but also as a research tool to further analyze the validity of measurements and the assumptions used in data reduction (Author)

A82-35371 # **Effect of crossflows on the discharge coefficient of film cooling holes** N Hay, D Lampard, and S Benmansour (Nottingham University, Nottingham, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London England, Apr 18-22, 1982, Paper 82-GT-147* 6 p 9 refs Members, $2 00, nonmembers, $4 00

Film cooling is the standard method of cooling the stator and rotor blades in an aircraft gas turbine engine Many parameters govern film cooling performance, but the most pertinent is the 'blowing parameter', a nondimensionalized parameter reflecting the mass flow emerging from the cooling hole Knowledge of the discharge coefficient, Cd, of film cooling holes is vital in sizing film cooling holes at the design stage The discharge coefficient depends both on the local geometry and the flow conditions upstream and downstream of the hole The effect of coolant crossflow was examined by Rohde et al (1969) No data are available on the combined effects of mainstream and coolant crossflows The present investigation was undertaken to provide a more extensive data base Further data on Cd for film cooling holes have been obtained, taking into account data on both the coolant and mainstream sides For the simpler situation of crossflow on one side only, the data agree well with earlier published results G R

A82-35373 * # **The use of optimization techniques to design controlled diffusion compressor blading** N L Sanger (NASA, Lewis Research Center, Cleveland, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-149* 11 p 17 refs Members, $2 00, nonmembers, $4 00
(Previously announced in STAR as N82-14094)

A82-35374 # **A practical approach to the design of multivariable control strategies for gas turbines.** A M Foss (National Gas Turbine Establishment, Farnborough, Hants, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-150* 12 p 15 refs Members, $2 00, nonmembers, $4 00

The requirement for gas turbine engines to operate over wider ranges has resulted in today's more sophisticated engines with multiple controls Current control philosophy for such powerplants is to adopt separate control systems for each of the major components However, interactions between the various control parameters involved may be large enough to degrade the transient performance of the overall system In such cases a design strategy specifically aimed at such a system, may be better In the considered multivariable approach, a multivariable design strategy has been applied to derive a multivariable controller According to the definition of the term, a multivariable design strategy is a strategy which takes into account interactions in the plant to be controlled A multivariable controller contains interaction terms in the controller The practical application of a multivariable control scheme to an aircraft engine has been made feasible in connection with the development of the microprocessor G R

A82-35380 # **Scaling effects on leakage losses in labyrinth seals** S L K Wittig, L Dorr, and S Kim (Karlsruhe, Universitat, Karlsruhe, West Germany) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-157* 5 p 8 refs Members, $2 00, nonmembers, $4 00

The accurate prediction of leakage losses through labyrinth seals in gas turbine engines depends largely on exact measurements As tolerance effects are important, scaled-up models are used for experimental analysis Application to real size engine conditions is of predominant importance Measurements in a newly developed test section over wide pressure ranges with geometrically similar straight-through seal models of different scale indicate that the flow coefficient is not independent of the scale chosen In a first attempt to clarify these questions, the results obtained from various models were correlated using Fanno-line analysis with dimensionless integral friction coefficients The results obtained reveal the necessity for simultaneous consideration of Reynolds and Mach-number effects as well as relatively small geometrical deviations (Author)

A82-35383 # **Dry friction damping mechanisms in engine blades.** A V Srinivasan and D G Cutts (United Technologies Research Center, East Hartford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-162* 14 p 11 refs Members, $2 00, nonmembers, $4 00

In the context of jet engines, significant vibration damping due to dry friction can occur at (1) shroud interfaces of fans and (2) the platform of turbine blades fitted with 'platform dampers' Analytical and experimental studies in regard to this important source of nonaerodynamic damping of blade vibration are presented in this paper Comparisons between results from analytical models and laboratory test data are made and discussed (Author)

A82-35384 * # **The influence of Coriolis forces on gyroscopic motion of spinning blades** F Sisto, A Chang, and M Sutcu (Stevens Institute of Technology, Hoboken, NJ) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-163* 6 p 5 refs Members, $2 00, nonmembers, $4 00 Grant No NAG3-47

Turbomachine blades on spinning and precessing rotors experience gyroscopically induced instabilities and forcing With vehicle-mounted turbomachines, either constant or harmonic precession occurs, depending on vehicle or mount motion Responses of uniform cantilever beams at arbitrary stagger, subjected to the noted rotor motion, are predicted in both self-excited and forced-excitation modes taking into account Coriolis acceleration (Author)

A82-35385 # **Integrated aircraft avionics and powerplant control and management systems.** J McNamara (Rolls-Royce, Ltd, Aero Div, Bristol, England) and A G Seabridge (British Aerospace Public, Ltd, Co, Warton Div, Preston, Lancs, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-165* 12 p 7 refs Members, $2 00, nonmembers, $4 00

The need for integration of the powerplant, intake, and airframe in an aircraft has long been recognized as an essential requirement for maximizing performance achievement in combat aircraft, and the emergence of highly maneuverable and highly unstable aircraft configurations has enhanced the need for this integration In the present study of powerplant control systems, a systems approach has, therefore, been adopted to ensure that the results obtained for an integrated control system are truly applicable to the combined system Attention is given to a powerplant control system configuration, the data highway system, the powerplant control and management system, a system for the 1990's, and the benefits provided by an ideal system It is pointed out that the optimum solution will ultimately be dictated by the constraints and objectives of the aircraft project G R

A82-35387 # **Measurements of heat transfer coefficients on gas turbine components. I - Description, analysis and experimental verification of a technique for use in hostile environments.** B Barry, A E Forest, and A J White (Rolls-Royce, Ltd, Derby, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-174* 9 p 9 refs Members, $2 00, nonmembers, $4 00 Research supported by the Ministry of Defence (Procurement Executive)

A method of determining local convective heat transfer coefficients around internally cooled components in a hostile flow environment is described The method involves the measurement of the response of the wall temperature to perturbations in the coolant flow A companion paper includes results obtained in cascades of turbine aerofoils using refined versions of the method (Author)

A82-35388 # **Measurements of heat transfer coefficients on gas turbine components. II - Applications of the technique described in part I and comparisons with results from a conventional measuring technique and predictions** R J Beacock, F G Horton, T J Kirker, and A J White (Rolls-Royce, Ltd, Derby, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-175* 7 p 5 refs Members, $2 00, nonmembers, $4 00 Research supported by the Ministry of Defence (Procurement Executive)

A82-35389 * # **NASA research in aircraft propulsion.** M A Beheim (NASA, Lewis Research Center, Cleveland, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-177* 10 p Members, $2 00, nonmembers, $4 00
(Previously announced in STAR as N82-13146)

A82-35390 # **HC and CO emission abatement via selective fuel injection** D W Bahr (General Electric Co, Aircraft Engine Business Group, Cincinnati, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-178* 9 p 5 refs Members, $2 00, nonmembers, $4 00

The results of investigations to develop carbon monoxide (CO) and unburned hydrocarbons (HC) abatement methods for use in aircraft turbofan engines are reviewed Specifically, the use of selective fuel injection patterns at ground idle operating conditions in CF6 engines was assessed and evolved in combustor and engine tests These fueling patterns were obtained by valving fuel to selected combinations of fuel nozzles at idle, rather than to the full complement of engine fuel nozzles, and were intended to provide localized fuel-air ratio enrichment within the combustor annulus In addition to the effects of such fueling patterns on HC and CO levels, their effects on engine performance at starting, sub-idle, and idle conditions were determined The use of repetitive clusters of fueled nozzles around the combustor annulus was determined to provide the best overall emission abatement, performance, and operational characteristics (Author)

A82-35391 # Status report of the USAF's Engine Model Derivative Program. M S Coalson (USAF, Wright-Patterson AFB, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-183* 9 p Members, $2 00, nonmembers, $4 00

An investment strategy, known as the Engine Model Derivative Program has resulted in the prototype development of a new fighter engine, a new turboprop engine, and promises the future development of a second fighter engine The rationale for prototype, rather than full-scale development is presented and a brief overview of the F101 derivative fighter engine, XT56-100 and F100 advanced derivative is described (Author)

A82-35392 # Demonstration of ceramic hot-section static components in a radial flow turbine J P Arnold, W McGovern (U S Army, Mobility Equipment Research and Development Command, Fort Belvoir, VA), J C Napier, and A P Batakis (Solar Turbines, Inc , San Diego, CA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-184* 6 p 9 refs Members, $2 00, nonmembers, $4 00 Army-sponsored research

Ceramic hot-section turbine components allow higher temperature for up-rated power and improved fuel economy The methodology used in arriving at a successful 200-hr engine demonstration of an all ceramic nozzle is presented along with current progress in demonstrating the remaining ceramic hot-section static components (Author)

A82-35394 # A stage-by-stage dual-spool compression system modeling technique. M W Davis, Jr (Sverdrup Technology, Inc , Arnold Air Force Station, TN) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-189* 11 p 16 refs Members, $2 00, nonmembers, $4 00

Mathematical compressor models are major tools used in resolving engine problems and evaluating the influence of compressor modifications on performance and stability This paper discusses the development of a one-dimensional, time-dependent, dual-spool, stage-by-stage compression system mathematical model and its application to a current compression system The dual-spool model was constructed by extending a current single-spool modeling technique to include dual-spool compression systems To improve the numerical stability characteristics of the compressor modeling technique, the dual-spool model was formulated using MacCormack's (1969) explicit differencing scheme and a method of characteristics boundary treatment The dual-spool model was applied to a current compression system, and several types of planar destabilizing disturbances were studied to determine their effect on compression system stability Model predictions were validated against experimental data whenever possible (Author)

A82-35396 # TURBOTRANS - A programming language for the performance simulation of arbitrary gas turbine engines with arbitrary control systems. J R Palmer (Cranfield Institute of Technology, Cranfield, Beds , England) and C -Z Yan (Shenyang Aeroengine Research Institute, Shenyang, People's Republic of China) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-200* 8 p 8 refs Members, $2 00, nonmembers, $4 00

TURBOTRANS is a new computer program, written in FORTRAN IV and implemented on various computers, which satisfies the requirements of flexibility, accuracy, ease of use, and suitability The component performance, steady-state performance simulation, and transient performance simulation are analyzed The configuration of the gas turbine engine and control system can be described in the program by using codewords corresponding to the various components and processes of both engine and control systems A flow diagram of TURBOTRANS and a brief description of the function of each main subroutine are given Illustrations of the program's capabilities are presented C D

A82-35398 # Aeropropulsion research for the U.S Army R E Singleton (U S Army, Research Office, Research Triangle Park, NC) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-203* 11 p 20 refs Members, $2 00, nonmembers, $4 00

Examples are presented of U S Army-supported research in aeropropulsion static and rotating component design and manufacture, with emphasis on anticipated improvements in engine reliability, life cycle costs, and fuel consumption The investigations extend to centrifugal flow compressor rotors and variable area nozzles, counterflow film-cooled combustors, felt-ceramic liner annular combustor concept development, turbine blade thermal barrier coatings, gear tooth dynamics, turbine seals, such advanced ceramics as silicon nitride, and polyimide composite fan blades O C

A82-35400 # Adaptive fuel control feasibility investigation for helicopter applications T Morrison, R D Zagranski (Chandler Evans, Inc , West Hartford, CT), and J J Howlett (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-205* 11 p Members, $2 00, nonmembers, $4 00

A United States Army-sponsored, computer-aided study of a twin engine helicopter is being conducted to determine the feasibility of incorporating into the engine microprocessor-based control system, airframe signals and control strategies that improve helicopter capability Investigations are considering online changes to the control characteristics which adapt to abnormal engine operation due, for example, to engine deterioration, surge or failure The anticipation of power recovery from a split needle condition is accomplished with rotor speed feedback, which allows increased transient load factors and improved handling qualities in maneuvering flight An improvement in torsional damping is achieved with software filters which reduce the dependence of the drive train stability on the blade lag dampers (Author)

A82-35401 # Local heat transfer to staggered arrays of impinging circular air jets A I Behbahani and R J Goldstein (Minnesota, University, Minneapolis, MN) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-211* 7 p 16 refs Members, $2 00, nonmembers, $4 00

Measurements are made of the local heat transfer from a flat plate to impinging arrays of staggered circular air jets Fluid from the spent jets is constrained to flow out in one direction Two different jet-to-jet spacings, 4 and 8 jet diameters, are employed The parameters that are varied include jet-orifice-plate to impingement-surface spacing and jet Reynolds number Local heat transfer coefficients vary periodically both in the flow direction and across the span with high values occurring at stagnation regions Stagnation regions of individual jets as determined by local heat transfer coefficients move further in the downstream direction as the amount of crossflow due to upstream jet air increases Local heat transfer coefficients are averaged numerically to obtain spanwise and streamwise-spanwise averaged heat transfer coefficients (Author)

A82-35402 # Acquisition of F-100/3/ high pressure compressor entrance profiles. D C Rabe, W W Copenhaver, and M S Perry (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-215* 5 p 6 refs Members, $2 00, nonmembers, $4 00

A transportable automatic data acquisition system to obtain high pressure compressor entrance profiles in an F-100 Series 3 gas turbine engine is described The system was developed, assembled, and tested at Wright-Patterson Air Force Base and transported to a remote location for implementation in a sea level engine test Acquisition of data was controlled through a Hewlett Packard Model 9825T desktop calculator, preprogrammed to display airflow data in engineering units during the test Entrance profiles of total and static pressure, temperature, and flow angle for two axial locations are presented A wedge probe sensing element was positioned at 12 radial locations by remote traversing mechanisms to obtain these profiles For a total pressure range of 18 to 46 psia (0 13 to 0 32 MPa), acquisition uncertainties in static and total pressure were reduced to below + or - percent of measured values by optimizing data system component uncertainties (Author)

A82-35404 # Advanced turboprop engines for long endurance naval patrol aircraft R Hirschkron and R H Davis (General Electric Co , Aircraft Engine Business Group, Lynn, MA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-217* 7 p Members, $2 00, nonmembers, $4 00 Navy-sponsored research

Long endurance naval patrol aircraft of the future will require more efficient advanced turboprop powerplants Engines used in this kind of application will have performance requirements emphasizing prolonged endurance and very low specific fuel consumption for cruise and part-power loiter operation Regenerative, regenerative/intercooled and advanced conventional cycle screening studies were carried out to select the cycle pressure ratio and turbine temperature for each type, considering the effects on installed performance and weight Design and cycle choices were studied in each engine category including recuperator types, effectiveness, pressure drop, bypass bleed and variable area turbine nozzle The engine characteristics of each type were then compared using a representative mission The advanced conventional engine showed the largest potential, the regenerative second and the regenerative/intercooled the least promise for lower installed fuel consumption and improved mission performance (Author)

A82-35409 * # **The effect of rotor blade thickness and surface finish on the performance of a small axial flow turbine** R J Roelke (NASA, Lewis Research Center, Cleveland, OH) and J E Haas (U S Army, Propulsion Laboratory, Cleveland, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-222* 6 p 9 refs Members, $2 00, nonmembers, $4 00 (Previously announced in STAR as N82-13114)

A82-35411 # **Effect of impeller extended shrouds on centrifugal compressor performance as a function of specific speed.** L Sapiro *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-228* 11 p Members, $2 00, nonmembers, $4 00

Centrifugal compressors for gas compression applications usually employ low-pressure ratio, backward-swept impellers with vaneless diffusers To increase the compressor flow range and speed, impeller blades are occasionally trimmed, resulting in an extended shroud configuration The effect of extended front and back impeller shrouds on the performance of centrifugal compressors with vaneless diffusers, and the variation of this effect as a function of specific speed, is thus of concern and is the subject of this paper An investigation was carried out on two backward-swept shrouded impellers of common blade tip and inducer hub diameters, but different inducer tip diameters (corresponding to low and high specific speeds), with the front and back shrouds extending 20 percent above the blade's outside diameter (Author)

A82-35412 # **The calculation of deviation angle in axial-flow compressor cascades.** L C Wang (Nanjing Aeronautics Institute, Nanjing, People's Republic of China), R Hetherington (Cranfield Institute of Technology, Cranfield, Beds , England), and A Goulas *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-230* 6 p 17 refs Members, $2 00, nonmembers, $4 00

The deviation angles of axial flow compressor cascades have been predicted by solving the Reynolds averaged fully turbulent Navier-Stokes equations A finite element method has been used To close the problem an algebraic eddy viscosity turbulent model has been chosen The introduction of the idea of vorticity to the governing equation enables the establishment of a relation between the entropy and the vorticity fields, and the vorticity transport differential equation in the stream function-vorticity method is replaced by a differential operation A series of calculations have been carried out to examine the influence of cascade geometry on the deviation angle Very good agreement has been obtained for small angles of incidence with the correlations produced by NASA and using Carter's rule Good agreement has also been shown for the variation of deviation angle with the angle of incidence with the experimental data of Felix and Emery, as well as for the distribution of the pressure coefficient along the blade axial chord (Author)

A82-35413 # **Transient vibration of high speed lightweight rotor due to sudden imbalance** M Sakata (Tokyo Institute of Technology, Tokyo, Japan), H Ohnabe (Ishikawajima-Harima Heavy Industries Co , Ltd , Tanashi, Tokyo, Japan), and T Aiba *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-231* 8 p 11 refs Members, $2 00, nonmembers, $4 00

A transient vibration analysis is carried out on a flexible disk-flexible shaft system or rigid disk-flexible shaft system subjected to a sudden imbalance which is assumed to represent the effect of blade loss Galerkin's method is used to solve the basic equation governing a rotating flexible disk, and the equation of motion of the rotor system is numerically solved using the Runge-Kutta method A model rotor with a blade loss simulator is examined, and shaft vibrations are measured For subcritical blade loss or sudden increase of imbalance, the maximum amplitude increases with disk flexibility and the analysis with cycloidal front step-type imbalance increase predicts larger peak values in the response curves than that with unit step balance increase D L G

A82-35415 # **Experimental evaluation of squeeze film supported flexible rotors** M D Rabinowitz (SCITEC Corp , Sydney, Australia) and E J Hahn (New South Wales, University, Kensington, Australia) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-233* 10 p 15 refs Members, $2 00, nonmembers, $4 00 Research supported by the Australian Research Grants Committee

This paper describes the experimental investigations which were conducted to verify existing theoretical vibration amplitude predictions for centrally preloaded, squeeze film supported flexible rotors The influence of measurement errors and operating condition uncertainties are quantified The agreement between theory and experiment was excellent, and it is shown that any discrepancy can be explained in terms of errors in determining the mean lubricant viscosity and the orbit magnitudes Hence, for the range of parameters investigated, the theoretical model and predictions therefrom are validated (Author)

A82-35418 # **Next generation turboprop gearboxes.** W L McIntire and D A Wagner (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-236* 9 p 7 refs Members, $2 00, nonmembers, $4 00

A new generation of fuel-efficient turboprop propulsion systems is under consideration now that fuel is a significant portion of the direct operating cost of aircraft Systems in the 5000- to 15,000-hp (3730- to 11,185-kW) range that use conventional propellers or the new propfan are being studied Reduction gearing for this next generation of turboprops is of significant interest due to new requirements for cruise speed life, and reliability Detroit Diesel Allison's past experience with the T56 family of turboprop reduction gearboxes is recounted Probable requirements of the next generation of reduction gearboxes are discussed since new requirements for gearboxes combined with past experience should determine the profile of the next generation of gearboxes A discussion of gearbox general arrangement and its impact on airframe installation is included, along with comments on reduction ratio, gear arrangement, accessory drives, reliability goals, and probable technology needs (Author)

A82-35425 # **Engine experience of turbine rotor blade materials and coatings.** F N Davis and C E Grinnell (Rolls-Royce, Ltd , Coventry, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-244* 9 p 9 refs Members, $2 00, nonmembers, $4 00

Corrosion resistance of hot end components was evaluated on Rolls-Royce industrial and marine gas turbines Early materials and coatings assessment trials were performed, and extended cyclic running of up to 2500 hours for a single test was carried out to assess component reliability and various material/coating combinations Results of cyclic running under agressive conditions suggest the need for two layer coating systems The change from wrought Nimonic alloys to cast superalloys for turbine rotor blades has produced a marked increase in corrosion resistance, and to date, platinum aluminide has demonstrated best overall protection characteristics and can be standardized for production engines D L G

A82-35426 **Heat transfer measurements of a transonic nozzle guide vane.** M R Litchfield (National Gas Turbine Establishment, Farnborough, Hants , England) and R J G Norton (Rolls-Royce, Ltd , Aero Div , Derby, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-247* 10 p 12 refs Members, $2 00, nonmembers, $4 00

The heat transfer and aerodynamic characteristics of a turbine nozzle guide vane with a supersonic exit velocity have been measured in a transient cascade facility The vane possesses a convergent-divergent passage, and this, together with a low trailing edge wedge angle, is seen to control the supersonic flow efficiently at design conditions Heat transfer measurements have been taken on both suction and pressure surfaces On the suction surface, transition is marked by a rapid increase in heat transfer, whereas on the pressure surface a slow increase in heat transfer indicates the gradual onset of turbulence The measurements also indicate possible relaminarisation of the suction surface boundary layer at the impingement of the trailing edge shock Predictions are presented of aerodynamic flow, using an inviscid time-marching calculation, and heat transfer, using a differential method applied to the vane surface (Author)

A82-35429 # **An advanced helicopter engine control system.** A F Saunders (Dowty and Smiths Industries Controls, Ltd , Cheltenham, Glos , England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-250* 12 p Members, $2 00, nonmembers, $4 00

A full-authority digital engine control and intelligent cockpit command box has been designed and developed in order to (1) demonstrate continued improvement in IC technology, with its associated increases in computing power, (2) employ control laws more relevant to electronic control, thereby obviating precise fuel metering by a hydromechanical unit, and (3) significantly improve engine and system performance monitoring methods The control system described has undergone successful engine tests with a GEM helicopter engine, and is scheduled to be tested in prototype form aboard a Lynx military helicopter O C

A82-35430 # **An approach to software for high integrity applications** W C Dolman and J P Parkes (Lucas Aerospace, Ltd , Birmingham, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-251* 10 p Members, $2 00, nonmembers, $4 00

This paper outlines one approach taken in designing a software system for the production of high quality software for use in gas turbine control applications Central to the approach is a special control language with its inherent features of visibility, reliability and testability, leading to a software system which can be applied to applications in which the integrity of the units is of prime importance The structure of the language is described together with the method of application in the field of aircraft gas turbine control The provision of documentation automatically is an integral part of the system together with the testing procedures and test documentation A description of how these features are combined into the total software system is also given (Author)

A82-35432 # **Ceramic components for automotive and heavy duty turbine engines - CATE and AGT 100.** H E Helms and J A Byrd (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-253* 10 p 9 refs Members, $2 00, nonmembers, $4 00

Detroit Diesel Allison is actively applying advanced ceramic materials to components in gas turbine engines Silicon carbide, silicon nitride, aluminum silicate, lithium aluminum silicate, and mullite are materials being used in various components in both the DDA GT 404-4 and AGT 100 engines Approximately 9400 hr of ceramic component operating time in the GT 404 engine has been accumulated, and design, component processing, proof testing, and engine testing experience have begun to show the applicability of ceramic materials in production engines Material variability, processing procedures, strength characterization, and nondestructive evaluations are emerging as critical but controllable factors Ceramic components offer the potential of significant fuel consumption improvements in gas turbine engines for vehicles and other applications (Author)

A82-35433 # **The influence of engine characteristics on patrol aircraft life cycle cost optimization.** A J Schuetz (Lockheed-California Co , Burbank, CA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-256* 6 p Members, $2 00, nonmembers, $4 00

Peacetime utilization is postulated in an estimation of the engine duty cycle of a novel, land-based patrol aircraft, whose propulsion system incorporates high-speed turboprop engines and whose flight profile is that of the antisubmarine mission It is determined that, where aircraft design has been optimized for minimum takeoff gross weight and life cycle costs, performance requirements and design constraints circumscribe the optimization process to the extent that the same point design is obtained for the takeoff weight and life cycle cost criteria Engine cost contribution to overall life cycle costs is examined, and the sensitivity of aircraft optimization to such aircraft characteristics as specific fuel consumption, length, diameter and cost is analyzed It is found that specific fuel consumption is the most significant engine characteristic O C

A82-35436 # **Cycle considerations for tactical fighters in the early 1990's.** H D Snyder (United Technologies Corp , Pratt and Whitney Aircraft Group, West Palm Beach, FL) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-259* 5 p 6 refs Members, $2 00, nonmembers, $4 00

The possibility of a new tactical fighter for the 1990s is considered, and various aspects of such a fighter are discussed, including maneuverability, avionics, takeoff and landing, observables, supersonic persistence, and range A probable peacetime training syllabus is set out It is concluded that a jet cycle is preferable than a fan cycle in such an aircraft, and that combustor inlet temperatures will be increased for maneuverability and supersonic persistence The overall engine pressure ratio will be moderate (18-22) and the engine pressure ratio will be high (3 5-4 5) The engine will probably have a two-dimensional reversing/vectoring nozzle and the radar cross section of the inlet will be reduced A longer engine development cycle will be necessary to improve engine capability, while also improving operability, reliability, and maintainability C D

A82-35446 # **Performance improvement features of General Electric turbofan engines.** D J Lennard and W A Fasching (General Electric Co , Cincinnati, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-270* 7 p 10 refs Members, $2 00, nonmembers, $4 00

Turbofan engine performance improvement features are presented, for engines already in operation and those currently undergoing development, with attention to fuel consumption reduction Several of the performance improvement features incorporated have emerged from the NASA Engine Component Improvement program, and include fan, compressor, and high and low pressure turbine clearance modifications Fan and exhaust nozzle aerodynamics improvements, reduced flowpath losses, and high efficiency turbine cooling are discussed The evolutionary process of feature incorporation has yielded a specific fuel consumption improvement in the CF6-80C engine of 8% over the original CF6-50 design O C

A82-35447 * # **Interim review of the Energy Efficient Engine /E3/ Program.** W B Gardner, W Hannah, and D E Gray (United Technologies Corp , Commercial Products Div , East Hartford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-271* 10 p 12 refs Members, $2 00, nonmembers, $4 00 NASA-sponsored research

The NASA-sponsored Energy Efficient Engine (E3) Program, which is now in its fourth year, is assessed from the viewpoint of one of its research contractors Attention is given to the development status of the shroudless fan, segmented combustor and exhaust mixer components which are encompassed by the program The shroudless fan blades are two-thirds hollow for lightness, and are fabricated by means of plies and cores subjected to hot isostatic pressing diffusion bonding The combustor's segmented liner is cast from turbine blade materials Exhaust mixer flow visualization tests are described Consideration is given to the effects of integrating the technology described with the low and high pressure advanced turbines whose development is also part of the E3 program O C

A82-35448 * # **NASA ECI programs - Benefits to Pratt and Whitney engines.** W O Gaffin (United Technologies Corp , Pratt and Whitney Aircraft Group, East Hartford, CT) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-272* 8 p 5 refs Members, $2 00, nonmembers, $4 00 NASA-sponsored research

Proprietary research conducted under the NASA-sponsored Engine Component Improvement program is shown to have advanced the state of such component technologies as thermal barrier coatings, ceramic seal systems, advanced turbine clearance control, and JT9D engine fan design In addition, the tests conducted have demonstrated the advantages of updated cooling, sealing and aerodynamic designs in the high pressure turbine and compressor of the JT8D engine These technological advances are being transferred to such novel engine configurations as the PW2037 and NASA Energy Efficient Engine Attention is given to the results of the thermal coating refinement tests of convectively cooled vanes, and to the development of a single shroud fan design applicable to the JT9D and next-generation engines O C

A82-35450 * # **Progress in the development of energy efficient engine components** R W Bucy (General Electric Co , Cincinnati, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-275* 7 p 8 refs Members, $2 00, nonmembers, $4 00 Contract No NAS3-20643

Component test results are presented for the NASA Energy Efficient Engine program, whose design goals relative to the CF6-50C reference engine include a 12% reduction in specific fuel consumption, 5% reduction in direct operating costs, and 50% reduction in specific fuel consumption deterioration rate over the course of commercial service Emphasis is placed on the engine's high pressure compressor, which has a design pressure ratio of 23 1, and has completed a series of component tests whose resulting configuration is expected to meet all major objectives of the program Descriptions are given of the core engine and integrated core/low spool tests, and system test benefits are discussed Attention is given to the design features of the engine's double annular combustor, high and low pressure air turbines, and scale model exhaust mixer O C

A82-35453 # **Material and process impact on aircraft engine designs of the 1990's.** R A Sprague (GE Material and Process Technology Laboratories, Cincinnati, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-278* 10 p Members, $2 00, nonmembers, $4 00

Major material and process technology areas are discussed in terms of their impact on future engine performance Airfoil materials development will concentrate on enhancing high temperature mechanical properties New single-crystal or eutectic alloys, and overlay and/or thermal barrier coatings will permit increases of up to 250 F in allowable metal temperature capability Increases in turbine inlet temperature and the desire to reduce engine weight and life cycle costs will drive disk material development toward attainment of higher tensile, creep, and fatigue strengths through development of dual-property disks, which combine new alloy compositions with novel processing techniques, and by increased application of polymeric composites Rapid solidification plasma deposition technology promises to permit fabrication of complex, multialloy structural parts with improved mechanical properties and environmental resistance Definition of new laboratory testing procedures and analyses will lead to better management of life cycle costs through enhanced materials utilization C D

A82-35454 # **Investigation of the transonic calibration characteristics of turbine static pressure probes.** R W Langford, K R Keeley, and N B Wood (Central Electricity Generating Board, Central Electricity Research Laboratories, Leatherhead, Surrey, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-280* 9 p 12 refs Members, $2 00, nonmembers, $4 00

Measurement of static pressure in transonic turbines is made difficult because of the need to use probes with substantial support stems in the measurement plane, enabling them to traverse in the confined axial spaces between blade rows Problems arise because of shock interactions with the probes and the close proximity of shock-reflecting surfaces Tests show that the calibration can depend on the proportion of probe support immersed in the transonic flow The wind tunnel gives only partial representation of the turbine transonic flow field, but by using turbine measured and computed static pressures the most representative calibration is selected (Author)

A82-35455 # **Solution to a bistable vibration problem using a plain, uncentralized squeeze film damper bearing.** J A Palladino and T W Gray (General Electric Co , Aircraft Engine Business Group, Lynn, MA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-281* 9 p 5 refs Members, $2 00, nonmembers, $4 00

A study was carried out to investigate vibration related problems, namely cabin noise and high engine vibration levels, encountered during service introduction of an upgraded turbojet engine having a three-bearing support system with an overhung turbine The problem was found to be due to an interaction between a rotor mode and a stator mode through bearing clearance, and it was proposed to use a plain, uncentralized, squeeze film damper to lower the turbine rotor critical speed and to eliminate the interaction between the rotor and stator modes It is shown that with this design, the turbine critical speed is reduced to 25-30% of the rate speed, corresponding to a 50% reduction in the critical speed, and eliminates the bistable vibration The effects of the exhaust system weight on the engine vibration and cabin noise are also discussed V L

A82-35456 * # **Structural dynamics of shroudless, hollow, fan blades with composite in-lays** R A Aiello, M S Hirschbein, and C C Chamis (NASA, Lewis Research Center, Cleveland, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-284* 7 p Members, $2 00, nonmembers, $4 00 (Previously announced in STAR as N82-22266)

A82-35457 # **The effect of journal misalignment on the oil-film forces generated in a squeeze-film damper** R A Cookson (Cranfield Institute of Technology, Cranfield, Beds , England), X H Feng (Chinese Aeronautical Establishment, Aero-Gas Turbine Research Institute, Beijing, People's Republic of China), and S S Kossa (Military Technical College, Cairo, Egypt) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-285* 5 p 8 refs Members, $2 00, nonmembers, $4 00

The effect of journal misalignment in a two-land, squeeze-film damper on the oil-film pressure distribution and the resulting oil-film forces is investigated using a finite-difference technique implemented in a FORTRAN 1V computer program It is found that the effect of misalignment can lead to a significant increase in the transmission of unbalance force through the oil film This effect becomes more pronounced in the case of large ratio of land-length to radial clearance, large level of unbalance, or large bearing orbit Although at this stage there is no clear indication of the range of operating conditions wherein allowance for misalignment should be made, a threshold of 0 0005 radians has been adopted in a current theoretical study into the effectiveness of uncentralized squeeze-film dampers V L

A82-35462 * # **Engine dynamic analysis with general nonlinear finite element codes. II - Bearing element implementation, overall numerical characteristics and benchmarking.** J Padovan, M Adams, P Lam (Akron, University, Akron, OH), D Fertis, and I Zeid (Northeastern University, Boston, MA) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-292* 9 p 12 refs Members, $2 00, nonmembers, $4 00 Grant No NsG-3283

Second-year efforts within a three-year study to develop and extend finite element (FE) methodology to efficiently handle the transient/steady state response of rotor-bearing-stator structure associated with gas turbine engines are outlined The two main areas aim at (1) implanting the squeeze film damper element into a general purpose FE code for testing and evaluation, and (2) determining the numerical characteristics of the FE-generated rotor-bearing-stator simulation scheme The governing FE field equations are set out and the solution methodology is presented The choice of ADINA as the general-purpose FE code is explained, and the numerical operational characteristics of the direct integration approach of FE-generated rotor-bearing-stator simulations is determined, including benchmarking, comparison of explicit vs implicit methodologies of direct integration, and demonstration problems C D

A82-35463 # **Ceramic turbine housings.** A F McLean (Ford Motor Co , Dearborn, MI) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-293* 10 p 12 refs Members, $2 00, nonmembers, $4 00 Research supported by the U S Department of Energy and DARPA

A development program aimed at the application of ceramics to automotive gas turbine engine inner housings is described After a review of the design concepts considered, and the comparison of candidate ceramic designs with conventional sheet metal or cast iron structures for internal hot gas transition ducts, consideration of the properties of reaction bonded silicon nitride, reaction bonded silicon carbide, and lithium aluminum silicate (LAS) led to the selection of LAS because of its low bulk thermal expansion characteristics Forming processes such as slip casting and glass forming are considered, along with thermal and mechanical problems that inhere in such large ceramic components The performance potential of ceramic turbine housings is established in light of the engine and rig tests evaluated O C

A82-35465 # **A procedure for evaluating fuel composition effects on combustor life** H L Foltz and M J Kenworthy (General Electric Co , Advanced Engineering and Technology Programs Dept , Cincinnati, OH) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-296* 6 p 6 refs Members, $2 00, nonmembers, $4 00 Contract No N00140-80-C-2269

A generalized method is presented for estimating the effects of fuel composition on liner life This method avoids the detailed temperature and stress distribution calculations required when using conventional cyclic material property charts The simplified approach became possible when it was found that cyclic life ratios due to fuel change were very similar when correlated with a convenient temperature parameter that had already been used in the past to correlate fuel composition with metal temperature change This life ratio was found to be relatively independent of (1) the peak temperature existing with the base fuel, (2) the coolant temperature, and (3) the actual detailed stress calculation A trend of increased life ratio effect at longer cyclic lives for crack initiation was found This trend can be incorporated into life ratio estimates from the prepared curves by using the actual observed service life without the need for a calculated absolute life (Author)

A82-35469 # **Heat transfer optimised turbine rotor blades - An experimental study using transient techniques.** J H Nicholson, A E Forest (Rolls-Royce, Ltd , Derby, England), M L G Oldfield, and D L Schultz (Oxford University, Oxford, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-304* 11 p 10 refs Members, $2 00, nonmembers, $4 00

Conventionally, high pressure turbine blading is optimized for aerodynamic performance without any film cooling applied to the surfaces of the blades It is considered that modern boundary layer prediction techniques are now sufficiently accurate to allow the heat transfer to be considered at the profile design stage Two turbine rotor profiles were designed, each with a heat-transfer-optimised pressure surface, and a detailed experimental study using transient techniques in the Oxford cascade tunnel was made The results show that significant reductions in pressure surface heat transfer can be achieved by boundary layer optimization without compromising the aerodynamic efficiency of the blades A description of the profiles is given, together with transfer rate measurements, pressure distribution, and aerodynamic loss measurements (a technique developed to measure aerodynamic loss in a transient cascade is described) and flow visualisation photographs (Author)

A82-35470 # **The effect of temperature ratios on the film cooling process.** P J Loftus and T V Jones (Oxford University, Oxford, England) *American Society of Mechanical Engineers, International Gas Turbine Conference and Exhibit, 27th, London, England, Apr 18-22, 1982, Paper 82-GT-305* 6 p 11 refs Members, $2 00, nonmembers, $4 00 Research supported by the Rolls-Royce, Ltd and Ministry of Defence (Procurement Executive) of England

Film cooling experiments have been conducted at conditions which realistically simulate gas turbine environment Heat transfer has been measured using a short duration wind tunnel Mainstream injection and wall temperatures have been varied independently in order to conduct a systematic investigation of the injection process A model of the film cooling process based on the principle of superposition is used to interpret the experimental results The effect of gas to wall temperature ratio on heat transfer to an uncooled plate has also been investigated (Author)

A82-35479 # **Technology advancements for energy efficient aircraft engines.** R W Bucy (General Electric Co , Cincinnati, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1051* 9 p 9 refs

The rapid increase in fuel costs since 1973 has been a major influence on the economics of the commercial aircraft fleet The development of more fuel efficient aircraft engines has, therefore, become an important priority for aircraft engine manufacturers and NASA Major goals of a program designed to achieve better fuel efficiency include, relative to the CF6-50C reference engine, 12% reduction in installed Specific Fuel Consumption (SFC), 5% reduction in Direct Operating Costs (DOC), and 50% reduction in the SFC deterioration rate in commercial service A description is presented of the progress made, in connection with the considered program, over the past four and one-half years Attention is given to component and engine development tests, the fan component test, high pressure compressor component tests, combustor component tests, high and low pressure turbine component tests, and overall systems integration G R

A82-35555 # Commercial transports - Aerodynamic design for cruise performance efficiency. F T Lynch (Douglas Aircraft Co , Long Beach, CA) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 81-147 35 refs

After a preliminary discussion of basic differences in the transonic flow problems addressed by designers of military aircraft and commercial transports in their efforts to increase cruise performance efficiency, the cruise drag efficiency of existing commercial transport aircraft is examined to determine areas for intensive future development It is shown that, in order to permit the development of computational design procedures for the accurate calculation of three-dimensional swept wing drag and buffet-onset characteristics, collaboration is needed between developers of transonic potential flow techniques and viscous and inviscid-viscous interaction techniques In addition, exploitation of the high Reynolds number capability of the National Transonic Facility requires additional development of instrumentation and of testing techniques aimed at flow visualization O C

A82-35556 # Practical aerodynamic problems - Military aircraft R G Bradley (General Dynamics Corp , Fort Worth, TX) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 149-187 28 refs

The compromises required by tactical military aircraft design, because of the multiple design point requirements associated with missions which require good low-speed efficiency, and both transonic and supersonic cruise and maneuver characteristics, are discussed for the case of such existing aircraft as the F-16 and similar experimental aircraft It is shown that the wing design of tactical aircraft is heavily influenced by supersonic requirements for minimum thickness and low camber It is suggested that the development of methods for the analytical design of wings relying on simple leading and trailing edge flaps in transonic maneuvers be emphasized It is noted that aeroelastic tailoring is a valuable tool in providing favorable camber and twist for thin-winged fighter configurations, and that analytical methods for the calculation of operational store loads and separation trajectories are not satisfactory in the transonic regime O C

A82-35557 # Experimental testing at transonic speeds. J A Blackwell, Jr (Lockheed-Georgia Co , Marietta, GA) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 189-238 30 refs

The process of experimental design for wind tunnel tests of aircraft configurations and components at transonic speeds are explored, along with suggestions for the solutions of problems encountered in experimental testing Accounting for uncontrollable variables such as the wall effect, through computational allowances, model sizing, and streamlined tunnel walls is described The tailoring of models for trials is examined for cases of basic research, concept development, code verification, configuration development, and production aircraft models Minimization of model support systems' flow interference is discussed for wall mounts and sting mounts, as well as for power plant configurations Finally, methods of accurately producing scaled-down Reynolds number flows which will retain their applicability to the real world are detailed M S K

A82-35560 # Transonic design using computational aerodynamics. M E Lores and B L Hinson (Lockheed-Georgia Co , Marietta, GA) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 377-402 16 refs

Design methods for improving aircraft performance in transonic regimes are reviewed in terms of inverse solution and numerical optimization methods Inverse schemes involve computation of the surface velocity potential from surface pressures to obtain a Dirichlet boundary condition A geometry is then developed by solving a potential flow equation and integration of a tangential flow equation Weaknesses of the method are discussed, noting the inverse methods are useful for initial wing design Numerical optimization requires choice of a starting geometry, defining the design objective, and then specifying the constraints The design proceeds in a series of searches in which variables are perturbed to test the effects on the design objectives and constraints An example of the numerical optimization of a C-141B to include a 0 03 increase in the Mach cruise speed is presented M S K

A82-35561 # Application of computational methods to transonic wing-design. I C Bhateley and R A Cox (General Dynamics Corp , Fort Worth, TX) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 405-430 23 refs

Available transonic computational methods for wing design are examined and examples are provided The governing equations, differencing techniques, geometry modeled, the necessity for viscous corrections, and the Mach number range of presently used computer codes are detailed The schemes considered include the Bailey-Ballhaus, Pandora-Boppe, Jameson FLO-22 Caughey, the Jameson FLO-27 Caughey, and the advanced Jameson FLO-28/30 codes Design techniques which employ one or several codes for the simulation of aircraft components or combinations of components in a transonic flow regime are outlined Specific examples are made of a trainer wing refinement, and an advanced fighter flap design The codes are concluded to be deficient in treating complex configurations such as fuselages, and also to require large amounts of computational time M S K

A82-35562 # A-7 transonic wing designs. H P Haney (Lockheed-Georgia Co Marietta, GA) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 431-450 10 refs

The problems encountered in applying available computer codes to the computational design of new wings for the A-7 aircraft are reported The Navy and NASA performed the study in the period 1976-1980 to correlate the FLO-22 code wing analysis with wind tunnel data, to optimize transonic airfoils, numerically optimize wing design, design two different wings for different criteria, wind tunnel test the pressure models of the new wings, and compare experimental results with the model predictions Simulation of the existing A-7 wing by means of the FLO-22 code showed agreement satisfactory enough for the study to proceed Design constraints on the new airfoil included a 0 4 lift coefficient and 0 78 Mach number It was found that only a few of 25 design variables could be used in each wing section, thereby requiring rerunning the code for each variable when gradients were needed Correlations drawn from wind tunnel tests were concluded unsatisfactory for optimization purposes M S K

A82-35563 # Transonic computational experience for advanced tactical aircraft. E Bonner and P B Gingrich (Rockwell International Corp , Aircraft Group, Los Angeles, CA) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 451-465 10 refs

Three-dimensional transonic numerical analysis performed for the HiMAT and FSW wing definition is described, along with comparisons with experimental results HiMAT maneuver wings were analyzed with the Bailey-Ballhaus classical small disturbance theory, which was found to predict the entire upper surface flow after modifications of the Karman-Guderly transonic small disturbance equation Multiple surface interactions are noted to be necessarily studied instead of in isolated components at subsonic and supersonic speeds An approximate procedure was found for changing the wing twist to account for the canard downwash, and a full potential assessment is presented, along with comparisons for a near maneuver condition of Mach 0 9 at an angle of attack of 10 deg Forward swept wing analysis is discussed, noting that test results were not well predicted by small disturbance or full potential analysis M S K

A82-35564 # Extension of FLO codes to transonic flow prediction for fighter configurations. A Verhoff and P J O'Neil (McDonnell Aircraft Co , St Louis, MO) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 467-487 11 refs Research supported by the McDonnell Douglas Independent Research and Development Program

The applications of FLO and equivalent simple body (ESB) computer codes to simulating transonic behavior of various fighter aircraft are described The ESB program is employed to model complex geometries such as the wing/fuselage combination using a panel method The models are valid at small angles of attack and linear and Mach independent, thereby suitable for the transonic regime When employed with the FLO codes, the ESB technique allows determination of the perturbation velocity distributions of a complex fuselage Correlations are then available for FLO code results at subcritical Mach numbers, and the FLO program can be used for transonic regimes The results of applications to the F-15 geometry are presented, and further use for modeling the F/A-18, the

AV-8B, and the F-4 to test the range of the combined method are indicated
M S K

A82-35565 # **A series of airfoils designed by transonic drag minimization for Gates Learjet aircraft.** M L Hinson (Gates Learjet Corp , Wichita, KS) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 489-509 13 refs

Airfoils designed for reduced transonic drag using various versions of numerical optimization programs are described and compared with experimental results Focussing on evolutionary models of the Gates Learjet, efforts to find an airfoil to replace the currently used NACA 64A109 profile are explored Noting a preference for flight around Mach 0 81 and the long range cruise design point of Mach 0 7, efforts were made to maintain low stall speeds, eliminate aileron buzz, minimize the structural components which needed changing, and fit the new wing within existing contours The CONMIN constrained function minimization program was employed to find a minimum value of an objective function and simultaneously satisfy a set of constraints such as drag coefficient FLO-6 was employed for aerodynamic parameters One- and two-point optimization results are given for airfoils chosen and wind tunnel tests Five airfoils with reduced drag were constructed
M S K

A82-35566 # **Applied computational transonics - Capabilities and limitations.** P A Henne, J A Dahlin, and C C Peavey (Douglas Aircraft Co , Long Beach, CA) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 511-543 19 refs

Computational transonic methods which feature nonconservative solution of the full-potential equation for airfoils and wings are examined from the viewpoint of utilization in a production framework Attention is given to direct solutions in defining the aerodynamic flow about a body and to inverse solutions obtained in the design process The direct solutions comprise the Program H and FLO-22 codes and involve finite difference schemes to describe the potential flow The concept of surface transpiration is the basis for the two- and three-dimensional inverse methods, those of Tranen and Henne, respectively Direct solutions entail simulation of viscous effects through boundary layer additions to the airfoil surface, in addition to approximate fuselage volume and cross flow effects in the three-dimensional case Inverse methods require the inclusion of the capability of airfoils to produce shocks Comparisons are made between predicted and observed airfoil performance in transonic flows
M S K

A82-35567 # **Evaluation of full potential flow methods for the design and analysis of transport wings.** L R Miranda (Lockheed-California Co , Burbank, CA) In Transonic aerodynamics, Transonic Perspective Symposium, Moffett Field, CA, February 18-20, 1981, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1982, p 545-561

The applicability and limitations present with the use of currently available full potential flow computer codes for the analysis of transport-type wings in the transonic regime are investigated It is noted that the design process involves definition of the target pressure distributions for analytical generation of a tentative design which is then analyzed numerically through the available codes The FLO-22 scheme employs a nonconservative difference scheme with a computational grid generated by a series of sheared and parabolic coordinate transformations The FLO-28 and -30 codes are based on the finite volume conservative difference scheme Use of the three schemes for the design of a wing and subsequent verification in the NASA-Ames Transonic Tunnel is described Inclusion of viscous effects was found to enhance the accuracy of the modeling process
M S K

A82-35727 **Triggered lightning.** D W Clifford (McDonnell Aircraft Co , St Louis, MO) and H W Kasemir (Colorado Scientific Research Corp , Berthoud, CO) *IEEE Transactions on Electromagnetic Compatibility,* vol EMC-24, May 1982, pt 1, p 112-122 41 refs

The present investigation is concerned with the possible triggering of lightning as a result of introducing an aircraft or other aerospace vehicle into the atmospheric electrical system, taking into account the study of natural lightning processes reported by Uman and Krider (1981) The evidence and arguments for aircraft-triggered lightning are reviewed, drawing upon the ground-based triggering experience for insights into the triggering process The triggering arguments which have been advanced are examined and compared with in-flight lightning-strike reports to deduce the flight and weather conditions most likely to produce triggered lightning Based upon the conclusions drawn about the triggering process, the probable characteristics of aircraft-triggered lightning are discussed in light of their effects on aircraft safety
G R

A82-35729 **Airborne warning systems for natural and aircraft-initiated lightning.** L W Parker (Lee W Parker, Inc , Concord, MA) and H W Kasemir (Colorado Scientific Research Corp , Berthoud, CO) *IEEE Transactions on Electromagnetic Compatibility,* vol EMC-24, May 1982, pt 1, p 137-158 83 refs Contract No F19628-79-C-0161

A needs exists for reliable and inexpensive (light-weight) airborne lightning warning and avoidance systems In one application of such a system warnings would be provided of distant storms, enabling a pilot to avoid severe weather In another application warnings of possible imminent lightning strikes would be given to the aircraft in electrified clouds Two general classes of lightning warning systems are considered, including systems providing distant warnings and systems giving near-zone warnings Dectors providing near-range warnings are discussed These are electrostatic-field detectors which can be useful for warning and avoidance of lightning strikes to the aircraft They warn of the presence of high electric fields A description is also given of detectors providing distant warnings Attention is given to RF sferics bearing detection (direction-finding) by magnetic loops, HF-VHF-UHF bearing detectors, optical bearing detectors, RF-sferics range detection, and bearing errors
G R

A82-35730 **The direct effects of lightning on aircraft.** J A Plumer (Lightning Technologies, Inc , Pittsfield, MA) and J D Robb (Lightning and Transients Research Institute, St Paul, MN) *IEEE Transactions on Electromagnetic Compatibility,* vol EMC-24, May 1982, pt 1, p 158-172 24 refs

In the case of early wooden aircraft, lightning could produce catastrophic results However, the conventional aluminum airframes of the aircraft replacing the early aircraft types have, by virture of their excellent electrical conductivity, rarely suffered critical damage from lightning strikes But now the situation is changing again with the advent of aircraft constructed partly (and sometimes entirely) of new, fiber-reinforced plastics with desirable lightweight and high-strength properties, but with poor electrical conductivity The designers of nonmetallic structures must, therefore, give particular attention to the lightning environment, taking positive measures to protect against its adverse effects lest safety of flight be endangered A review is conducted of the physical-damage effects, called direct effects, of lightning on aircraft structures and fuel systems, taking into account the implementation of basic protective methods Attention is given to metallic structures, nonmetallic structures, and fuel systems
G R

A82-35731 **Electromagnetic interaction of lightning with aircraft.** R A Perala, T Rudolph, and F Eriksen (Electro-Magnetic Applications, Inc , Denver, CO) *IEEE Transactions on Electromagnetic Compatibility,* vol EMC-24, May 1982, pt 1, p 173-203 127 refs

The electromagnetic interaction of lightning with aircraft is a complex event Because of new aircraft technologies, it is becoming more important to be able to predict and understand lightning-induced transients on avionics systems In this paper, a review of state-of-the-art of lightning-interaction modeling is presented The overall interaction process is discussed, and specific modeling techniques are given for external interaction, internal interaction, and internal propagation Some examples are given for lightning strokes attached to an aircraft A discussion of nonlinear effects is also given, and comparison between nuclear electromagnetic pulse and lightning environments are presented Finally, an overview of hardening techniques is given An extensive bibliography is included
(Author)

A82-35732 **Static charging and its effects on avionic systems.** J E Nanevicz (SRI International Electromagnetic Sciences Laboratory, Menlo Park, CA) *IEEE Transactions on Electromagnetic Compatibility,* vol EMC-24, May 1982, pt 1, p 203-209 15 refs

It is pointed out that the effects of electrostatic charging first became apparent when aircraft began operation under all-weather conditions Frictional charging of the aircraft occurred when precipitation particles struck the aircraft and deposited a charge on its surface The charging, in turn, led to electrical discharges from the aircraft, which generated noise which interfered with the communication and navigation equipment Techniques were developed to mitigate the undesirable effects of charging and discharging processes Investigations related to the occurrence of static electrification are discussed, and a description is provided of interference sources and their effects on systems Attention is given to corona discharges, streamer discharges, discharges from helicopter blades, and spark discharges
G R

A82-35733 **Lightning simulation and testing** D W Clifford, E H Schulte (McDonnell Aircraft Co , St Louis, MO), and K E Crouch (Lightning Technologies, Inc , Pittsfield, MA) *IEEE Transactions on Electromagnetic Compatibility,* vol EMC-24, May 1982, pt 1, p 209-224 34 refs

Laboratory simulation testing is relied upon for assessing the effects of lightning on aircraft and other aerospace systems This paper reviews the laboratory equipment, techniques, and test waveforms used in simulating the important effects of atmospheric electricity on aerospace systems Test criteria and techniques are well established for simulating the direct physical damage effects of lightning, but tests for determining the indirect, induced-coupling effects of lightning are still in the development stage These last tests are necessary for evaluating the effects of the lightning environment on modern aircraft which make extensive use of computerized flight-control systems
(Author)

A82-35734 **Assessment of aircraft susceptibility/vulnerability to lightning and development of lightning-protection design criteria.** J C Corbin (USAF, Aeronautical Systems Div , Wright-Patterson AFB, OH) and W W Cooley (Boeing Military Airplane Co , Seattle, WA) *IEEE Transactions on Electromagnetic Compatibility,* vol EMC-24, May 1982, pt 1, p 225-237 21 refs

Possible approaches for assessing the susceptibility/vulnerability of aircraft to both the direct and indirect (induced) effects of lightning and for developing lightning-protection design criteria are examined Particular emphasis is focused on methods that can be used to achieve a high level of confidence in aircraft safety and survival Assessment factors and their uncertainties are qualitatively and quantitatively discussed Lightning-protection design approaches involving both test and analysis as applied to the F-16 fighter aircraft and the NASA Space Shuttle are reviewed A probabilistic or statistical approach is outlined (with examples) for predicting single and/or redundant equipment failure due to indirect lightning effects (Author)

A82-35767 # **Laser application in weapon guidance and active imaging** V V Rampal (Instruments Research and Development Establishment, Dehra Dun, India) *Indian Journal of Physics, Section B,* vol 54B, no 4-5, Aug - Oct 1980, p 465-470 10 refs

The application of lasers in weapon guidance and active imaging is reviewed Modern low flying aircraft used for ground attack are fitted with suitable laser instrumentation to provide range finding and target capabilities for seeking the target, and to measure its range, sending the weapon into it and thus reducing human element to the minimum The principle of laser guidance is discussed, and the cost effectiveness of the weapon system is considered Laser imaging using a high average power Nd YAG laser is described, and evidence for the possibility of using high repetition rate pulsed lasers for illumination and imaging of distant targets at night is presented D L G

A82-35820 # **Aerodynamic lag functions, divergence, and the British flutter method.** W P Rodden and E D Bellinger (MacNeal-Schwendler Corp , Los Angeles, CA) *Journal of Aircraft,* vol 19, July 1982, p 596-598 18 refs

Results of calculations of flutter and divergence instabilities for a two-dimensional airfoil are presented in a comparison of the transient method, which includes the transient aerodynamic representation explicitly, and the British flutter method, which only includes transient aerodynamics implicitly The calculations involve airfoils mounted on bending and torsion springs, with the center of gravity located at 37% or 45% chord, aerodynamic center at 25% chord, and elastic axis at 40% chord Both the transient and the British flutter method using either the exact Theodorsen function or the Jones approximation to the Theodorsen function show that flutter occurs when the torsion root becomes unstable, whereas divergence occurs when an aerodynamic lag root becomes unstable It is concluded that the British flutter method adequately predicts all of the instabilities of aeroelastic systems without any need for approximations to aerodynamic transfer functions S C S

A82-35821 # **STOL aircraft response to turbulence generated by a tall upwind building** L D Reid (Toronto, University, Toronto, Canada) *Journal of Aircraft,* vol 19, July 1982, p 601-603 8 refs Research supported by Environment Canada and Natural Sciences and Engineering Research Council of Canada

The influence of building-induced turbulence on the landing approach of an STOL aircraft is predicted by the use of the turbulence correlation technique Measurements of turbulence intensity and the turbulence correlation matrix were made in a planetary boundary layer wind tunnel with a simulated 152 4-m tall building and a steep (15-deg) glideslope located in the wind field Calculations based on the measured turbulence correlation matrix for the case of a twin-engine turboprop light STOL transport executing a constant airspeed landing approach with fixed controls in the presence of a constant headwind indicate the presence of the building to result in a general increase in the dispersion of the longitudinal state vector of the aircraft, with the extent of increase becoming greater towards the bottom of the glideslope as the aircraft nears the building It is noted, however, that the upwind building has only a minor impact on the turbulence-induced disturbance to the landing approach S C S

A82-35869 **Multiple aircraft tracking system for coordinated research missions.** P N Johnson and J L Fink (National Center for Atmospheric Research, Boulder, CO) *American Meteorological Society, Bulletin,* vol 63, May 1982, p 487-491

The Multiple Aircraft Position System was developed in response to the need for aircraft position in the coordination of large field projects involving several research aircraft Radio interferometer techniques are used to provide rapid, accurate determination of positions for up to 10 aircraft furnished with special airborne radio beacons Three remote interferometer array sites receive the signals from the airborne beacons, each transmitting at a unique frequency Each remote site is tuned to one beacon frequency at a time according to a programmable polling sequence, several phase difference measurements are made from the received signal These data then are telemetered to a central control station where they are transferred to a computer that calculates the direction cosines from each remote site to the airborne beacon, and thus determines the position of the beacon The aircraft positions then are immediately available for display (Author)

A82-35874 † **The effect of erosion wear on the vibration characteristics of axial-turbine blades (Vliianie erozionnogo iznosa na vibratsionnye kharakteristiki lopatok osevykh turbomashin).** R G Perel'man, V V Bodryshev, V V Priakhin, E B Karpin, L V Matrosova, and V N Chebotarev (Moskovskii Aviatsionnyi Institut, Moscow, Ob'edinenie Kaluzhskii Turbinnyi Zavod, Kaluga, USSR) *Energetika,* Apr 1982, p 60-64 5 refs In Russian

A variational method based on the theory of twisted rods with nonrectilinear axis is used to analyze the effect of erosion wear on the vibration characteristics of axial-turbine blades It is shown that relative variations of vibration frequencies of free blades for static and dynamic modes of operation almost coincide Theoretical results agree well with experimental data B J

A82-35876 **Certification of an airborne Loran-C navigation system.** F D MacKenzie (U S Department of Transportation, Transportation Systems Center, Cambridge, MA) *Navigation,* vol 29, Spring 1982, p 69-79 5 refs Research supported by the Research and Special Programs Administration

The requirements, FAA approval process, testing, and analysis which led to acceptance of a Loran-C navigational system certification for the state of Vermont are detailed NASA personnel from Langley Research Center designed, fabricated, installed, and calibrated the on-board data collection instrumentation, as well as the software for analysis of the airborne and ground-based records Flights were required during visual and instrument conditions, day and night, through all seasons, and during twilight conditions, while the Loran-C signal characteristics were measured at ground stations for EM compatibility, predictability, temporal stability, and ease of airborne acquisition Standard deviations were either calculated or measured for the equipment, for parts of the system, and for the pilot's contribution to the errors The Loran-C system was determined to meet or exceed all relevant criteria M S K

A82-35881 **Propellers come full circle.** R DeMeis *High Technology,* vol 2, July-Aug 1982, p 16-18

The use of the propfan in future aircraft is discussed With the large external fan generating more thrust per engine revolution than a small internal fan, propfan jets could achieve fuel savings as high as 25 percent in commercial operations and 35 percent for military patrol missions, while retaining the vibration-free operation and mechanical simplicity of turbojet engine cores The propfan would have as many as 12 stiff composite blades that would be highly swept, thinner, and shorter than conventional blades in order to reduce noise and drag The gearbox would be reintroduced to permit operation at maximum efficiency with the best blade rotation speed for the airflow conditions A double-wall insulated fuselage and shaped wing-nacelle interface would deal with internal aircraft noise and propfan-swept wing integration problems The development of the propfan may depend on continued government funding to NASA's program C D

A82-36047 # **Prospects for Navsat - A future worldwide civil navigation-satellite system** C Rosetti (ESA, Directorate of Applications Programmes, Paris, France) *ESA Bulletin,* no 30, May 1982, p 54-59

Air navigational problems which inhibit flying optimal routes and which could be aided by a worldwide navigational satellite system (Navsat) are examined Satellite systems are noted to alleviate ground- and air-based equipment constraints for the airlines, developing nations in need of mapping assistance, offshore oil drilling operations, and geodetic surveys A Navsat system, following the design adopted by military GPS operations, involves a receiver capable of detecting time-lapsed signals from well-positioned satellites The transmission is broadcast in terms of a lock-on signal and a signal carrying tens of bits/sec of information regarding ephemerides Either mobile or fixed receivers can gain precise location data by tuning in to two or three satellites simultaneously A potential system involving 24 satellites is described, which would offer 95 6% availability from anywhere on earth M S K

A82-36054 **Aircraft measurements of icing in supercooled and water droplet/ice crystal clouds.** M Bain and J F Gayet (Clermont-Ferrand II, Université, Aubiere, Puy-de-Dôme, France) *Journal of Applied Meteorology,* vol 21, May 1982, p 631-641 19 refs Direction des Recherches, Etudes et Techniques *Contract No 79-34-183*

Some results of icing rate measurements connected with meteorological parameters during penetrations into stratiform and cumuliform clouds are described Icing measurements were carried out in Spain during a precipitation enhancement project experiment in 1979, using an instrumented DC-7 aircraft The meteorological parameters determined include the temperature, concentration of large ice particles, liquid water content, cloud droplet concentration, and median volume diameter The energy balance at the riming surface of a cylinder is analyzed and the critical liquid water concentration determined in order to predict the ice growth regime (wet or dry), with an 85 percent success rate An expression is derived for the dependence of the icing rate upon the studied parameters and comparison is made with the measured icing rate For a range of temperatures from -21 to -8 C, the icing rate appears to be reduced by about 50 percent by the presence of large ice particles in concentrations above 5/L C D

A82-36065 ***Evaluation criteria for aero engine materials*** **(Bewertungskriterien fur Werkstoffe des Flugtriebwerkbaues).** P Esslinger (Motoren- und Turbinen-Union Munchen GmbH, Munich, West Germany) *Metall,* vol 36, June 1982, p 654-659 In German

The criteria examined include lightweight construction, technological and economic properties, and reliability Energy and raw materials consumption is a criterion steadily increasing in importance, especially when critical elements such as cobalt and chromium are involved Substitutes for scarce materials are indicated The quantitative prediction of materials failure is analytically discussed, and failure probability curves for a homogeneously stressed, rotating bar are given Wohler curves for strain tests on nickel materials are found along with maximum strain amplitudes for nickel materials of various yield points and failure values C D

A82-36175 # An alternate test procedure to qualify future fuels for Navy aircraft C A Moses, N R Sefer, and M L Valtierra (Southwest Research Institute, San Antonio, TX) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1233* 9 p 22 refs Contract No N00140-80-C-2269

The U S Navy is experiencing pressures to modify the JP-5 fuel specification because of the growing shortage of high-quality crude oils from which kerosene can be simply distilled, and the increased costs of refining lesser quality crude oils to meet the current specification A program has been initiated with the objective to study and develop a qualification procedure for future fuels The purpose of the Alternative Test Procedure (ATP) would be to reduce the number of large-scale engine and flight tests required to develop confidence that a new fuel type will perform satisfactorily Attention is given to future Navy aircraft fuels, the impact of future fuels on aircraft systems, aspects of hot section durability, materials compatibility, lubricity, cold day ignition, and thermal stability It is concluded that an ATP to qualify future fuels is both necessary and feasible G R

A82-36191 Digital spectral analysis of the noise from short duration impulsively started jets I S Hodge, D J Smith, and N H Johannesen (Manchester, Victoria University, Manchester, England) *Journal of Sound and Vibration,* vol 82, May 22, 1982, p 171-179

Techniques in which a shock tube is used to produce short duration jets are discussed briefly The method adopted involves using the shock tube as a static reservoir with the jet exhausting through a nozzle originally closed by a diaphragm Short duration noise samples of a Mach 0 9 air jet are recorded digitally and narrow band and one-third octave spectra are evaluated Average spectra from a number of samples are presented Comparison with both digital and analog spectra from the equivalent continuous jet demonstrates that it is possible to obtain meaningful spectra by averaging short duration samples of impulsively started jets The technique is therefore suitable for the relatively cheap exploration of the noise field of jets of a wide variety of gases (Author)

A82-36281 * # A single-frequency multitransmitter telemetry technique. V A Carreno (NASA, Langley Research Center, Flight Control Systems Div , Hampton, VA) *Instrument Society of America, International Instrumentation Symposium, 28th, Las Vegas, NV, May 3-6, 1982, Paper* 9 p

A telemetry technique for a special data collection system being developed for use on general aviation aircraft involved in aeronautical research programs is described The system consists of a number of sensor-transmitter units at different locations on the aircraft, with individual signal conditioning and logic, which send sampled data signals to a single receiver in the airplane The transmitters operate independently on the same frequency and are not synchronized to the receiver The problem of reception of multiple samples simultaneously is treated by discarding such samples An overlap detection technique for the frequency shift keyed modulation system is described The amount of predicted data loss due to overlap is presented and compared with results obtained with a circuit implementation, the effects of discarded data on accuracy is discussed (Author)

A82-36673 † Evaluating the effectiveness of hydrorefining of the low-stability component of T-1 fuel (Otsenka effektivnosti gidroochistki malostabil'nogo komponenta topliva T-1). A A Aliev, Kh A Akhmedov, L G Ismailova, and M A Mardanov (Akademiia Nauk Azerbaidzhanskoi SSR, Institut Neftekhimicheskikh Protsessov, Baku, Azerbaidzhan SSR) *Khimiia i Tekhnologiia Topliv i Masel,* no 6, 1982, p 27, 28 In Russian

An experimental study has been carried out to investigate the possibility of improving the thermal stability of T-1 jet fuel by hydrorefining the component responsible for the low stability of T-1 The physicochemical properties of T-1 are presented along with the results of thermal stability tests before and after hydrorefining, showing that the thermal stability of the fuel increases by 3 8 times following hydrorefining V L

A82-36937 The computerized cockpit for the one-man crew. M Lambert *Interavia,* vol 37, June 1982, p 608, 609

The Demonstration Advanced Avionics System (DAAS), a NASA experiment, is an integrated computer system designed to produce information, guidance and control for the pilots of light aircraft, similar to that already in use in fighters and airliners The DAAS system uses integrated displays from a central computer to provide data about navigation, flight status, aircraft configuration items and other similar matters to general aviation pilots An improved version of the DAAS system offering greater reliability, smoother integration of analog sensors and with weather radar incorporated might become commercially available by the mid-1980s A detailed block diagram of the system in included N B

A82-36947 † The powerplants of the Yak-40 and M-15 aircraft (Silovaia ustanovka samoletov Iak-40 i M-15). V K Frantsev and N A Sherlygin Moscow, Izdatel'stvo Transport, 1981 232 p 17 refs In Russian

The work examines the design, parameters, and operation of the powerplants of the Yak-40 and M-15 aircraft Attention is given to the effect of changes in the modes and conditions of operation on the loading and mechanical stability of the engine parts The physical principles underlying engine processes are described theoretically, and particular emphasis is placed on the operation of the engine, its systems and components B J

A82-36950 † Assembly of aircraft instruments (Sborka aviatsionnykh priborov). A V Seleznev and V A Volokhov Moscow, Izdatel'stvo Mashinostroenie, 1981 312 p 10 refs In Russian

The fundamentals of aircraft instrument manufacture are reviewed with reference to the design and performance characteristics of various instruments and basic fabrication processes In particular, consideration is given to mechanical assembly, electrical assembly, testing, adjustment, and calibration of instruments Instruments discussed include mechanical instruments with elastic sensing elements (e g , pressure gages), electromechanical instruments, and gyroscopic instruments The discussion also covers instrument reliability, process mecnanization and automation, quality assurance, and, finally, worker safety and fire prevention V L

A82-36969 * Justification for, and design of, an economical programmable multiple flight simulator. J G Kreifeldt (Tufts University, Medford, MA), J Wittenber, and G Macdonald In Manned systems design Methods, equipment, and applications, Proceedings of the Conference, Freiburg im Breisgau, West Germany, September 22-25, 1980 New York, Plenum Press, 1981, p 427-448 9 refs Grant No NsG-2156

The considered research interests in air traffic control (ATC) studies revolve about the concept of distributed ATC management based on the assumption that the pilot has a cockpit display of traffic and navigation information (CDTI) via CRT graphics The basic premise is that a CDTI equipped pilot can, in coordination with a controller, manage a part of his local traffic situation thereby improving important aspects of ATC performance A modularly designed programmable flight simulator system is prototyped as a means of providing an economical facility of up to eight simulators to interface with a mainframe/graphics system for ATC experimentation, particularly CDTI-distributed management in which pilot-pilot interaction can have a determining effect on system performance Need for a multiman simulator facility is predicted on results from an earlier three simulator facility G R

A82-36972 † Aviation meteorology (Aviatsionnaia meteorologia). A M Baranov and S V Solonin Leningrad, Gidrometeoizdat, 1981 384 p 132 refs In Russian

The effect of meteorological conditions on airplanes and helicopters is considered In the light of new aviation standards, the principles governing the use of meteorological data in aviation in order to improve the performance and safety of aircraft are set forth Also considered are questions pertaining to the use of new equipment, including computers, for the collection, processing, and display of the meteorological information intended for aviation C R

A82-36999 # Analysis of rotating structures using image derotation with multiple pulsed lasers and moiré techniques. J C MacBain, W A Stange (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH), and K G Harding (Dayton, University, Dayton, OH) In Society for Experimental Stress Analysis, Spring Meeting, Dearborn, MI, May 31-June 4, 1981, Proceedings Brookfield Center, CT, Society for Experimental Stress Analysis, 1982, p 227-232 10 refs

Experiments were carried out on a bladed disk to study dual resonant modes under rotating conditions using image derotated holography and a Q-switched double-pulsed ruby laser It is shown that hologram interferometry using image derotation is a valuable tool in studying the structural response of rotating bladed disks It is also shown that the versatility and usefulness of the method can be extended even further by the use of triple-pulsed laser holography and some form of moire analysis V L

A82-37031 The PATRIOT Radar in tactical air defense D R Carey (Raytheon Co , Bedford, MA) and W Evans In EASCON '81, Electronics and Aerospace Systems Conventions, Washington, DC, November 16-19, 1981, Record New York, Institute of Electrical and Electronics Engineers, Inc , 1981, p 64-70

The PATRIOT Radar is a C-band, phased array, multifunction radar that under the control of the Weapon Control Computer in the Engagement Control Station performs target search and track, missile search, track, and communications during midcourse guidance, and target-via-missile (TVM) terminal guidance This paper describes the functions the radar performs and provides brief descriptions of the subsystems The use of a multichannel, multifunction receiver and digital signal processor is emphasized to demonstrate the control and processing for multiple radar actions required to support the tactical air defense mission A summary of results of an extensive test program at the White Sands Missile Range is presented (Author)

A82-37034 Simplified digital design tools. S M Seltzer (Control Dynamics Co , Huntsville, AL) In EASCON '81, Electronics and Aerospace Systems Conventions, Washington, DC, November 16-19, 1981, Record New York, Institute of Electrical and Electronics Engineers, Inc , 1981, p 145-150 8 refs

This paper presents a design philosophy for developing a digital control (or, guidance and control) system The philosophy takes advantage of high-fidelity, high-order digital simulation tools coupled with low order analysis techniques that permit mathematical tractability After describing that philosophy, the major portion of the paper is devoted to a description of three analytical digital design tools and how they can be used in concert These tools are (1) the Systematic Analytical Method (SAM) which is a method for obtaining mathematical relationships between desired system inputs and system outputs, (2) the Cross-Multiplication Method which provides a means of obtaining the time-domain response from the system closed-loop transfer function, and (3) the Digital Parameter Space Method which permits one to examine and specify the dynamics of a system The use of these tools together is demonstrated in a simple example (Author)

A82-37035 C band spectral tracking for FM/CW altimetry T O Perkins, III (Kollsman Instrument Co , Merrimack, NH) In EASCON '81, Electronics and Aerospace Systems Conventions, Washington, DC, November 16-19, 1981, Record New York, Institute of Electrical and Electronics Engineers, Inc 1981, p 166, 167

It is shown that the spectrum leading edge detection concept offers a highly accurate and reliable radar altimeter design with low transmit power and narrow receiver bandwidth By avoiding frequency counters and short time measurements, many of the problems of more classical approaches can be eliminated It is noted that the approach is also suitable for other applications where accurate distance measurement is required Aside from the narrow bandwidth, the tracking discriminator response is balanced to cancel noise effects Since propagation losses are 6 dB/octave for the entire altitude range, it is feasible to measure altitudes to 100,000 feet C R

A82-37037 An accurate Doppler navigator with microwave simplicity S Monfort and G Schaffner (Teledyne, Inc , San Diego, CA) In EASCON '81, Electronics and Aerospace Systems Conventions, Washington, DC, November 16-19, 1981, Record New York, Institute of Electrical and Electronics Engineers, Inc , 1981, p 174-178

This paper describes the extremely simple microwave circuitry of one of the most accurate Doppler navigation radars in use today The radar consists of four microwave assemblies, a single diode solid state transmitter, a beam switch with one integrated circuit module, a fixed antenna assembly and a two-channel receiver in a single stripline board (Author)

A82-37039 # FAA tests on the Navstar GPS Z-set. R J Esposito and E M Sawtelle (FAA, Technical Center, Atlantic City, NJ) In EASCON '81, Electronics and Aerospace Systems Conventions, Washington, DC, November 16-19, 1981, Record New York, Institute of Electrical and Electronics Engineers, Inc , 1981, p 208-216 6 refs

The FAA independently determined the applicability of Navstar GPS for civil aviation through the flight and laboratory test of a Z-set receiver after this unit was acceptance tested aboard a USAF System Command C-141 aircraft The acceptance flight tests were performed over the Yuma Proving Ground instrumented range The FAA conducted initial tests in a twin turboprop engine Grumman Gulfstream from the Technical Center The Z-set operated in a stand-alone (non-instrumented) configuration Testing included satellite shielding studies, non-precision approaches to different airports, and operations in high noise/RFI environments (in the vicinity of airports, urban areas, radio and TV antenna towers, etc) This paper summarizes the acceptance and the FAA familiarization test results The paper also contains a brief description of completed and future tests for the instrumented Z-set with automated data acquisition systems (Author)

A82-37040 Navstar - Global Positioning System: A revolutionary capability W C Euler and J W Breedlove (Magnavox Advanced Products Co , Torrance, CA) In EASCON '81, Electronics and Aerospace Systems Conventions, Washington, DC, November 16-19, 1981, Record New York, Institute of Electrical and Electronics Engineers, Inc , 1981, p 217-224

A GPS user can obtain an accurate navigation fix at any time in any weather condition and in the presence of interference Analyses sponsored by the DOD indicate that much of the initial cost of GPS (approximately five billion dollars) can be offset by discontinuing some present-day navigational systems On the other hand, force enhancement considerations and other cost benefits could reach 50 billion dollars This paper examines various aspects of GPS, including global navigation accuracy, support for CCCI, military capability, survivability, cost effectiveness in regard to Nudet detection, tactical-warfare applications, and force enhancement B J

A82-37061 # Use of CGHRP in transport. D Short and J Summerscales (Plymouth Polytechnic, Plymouth, Devon, England) In Reinforced Plastics/Composites Institute, Annual Conference, 36th, Washington, DC, February 16-20, 1981, Preprints New York, Society of the Plastics Industry, Inc , 1981 (Session 11-D) 4 p 80 refs

The appplications of carbon fiber and glass fiber hybrid reinforced plastics in transport are reviewed with emphasis on benefits achieved by the reduction of weight or the improvement in performance relative to conventional structures The applications discussed include car bodies, automotive driveshafts, automotive engine parts, yacht hulls hovercraft blades, airframe structures, and helicopter rotors Current trends in the field of hybrid plastics are the use of materials with intimately mixed finely dispersed fibers and wider use of thermoplastic matrices instead of the thermosets V L

A82-37062 * # Composite containment systems for jet engines. G T Smith (NASA, Lewis Research Center, Cleveland, OH) In Reinforced Plastics/-Composites Institute, Annual Conference, 36th, Washington, DC, February 16-20, 1981, Preprints New York, Society of the Plastics Industry, Inc , 1981 (Session 12-A) 8 p
(Previously announced in STAR as N81-17480)

A82-37065 # A significant role for composites in energy-efficient aircraft G A Alther (Composite Aircraft Corp , Midland, TX) In Reinforced Plastics/Composites Institute, Annual Conference, 36th, Washington, DC, February 16-20, 1981, Preprints New York, Society of the Plastics Industry, Inc , 1981 (Session 12-D) 4 p 7 refs

The structural advantages and a 10-year in-service history of the Windecker Eagle all fiberglass/epoxy airframes are discussed In these airframes the skins are composed of one or more plies of nonwoven unidirectional fiber cloth, the wing spars and other laminates are also composed of multiple oriented plies of fiber cloth, and a ply of nonwoven 0/90 cloth is used for the outermost plies of the laminates and skins to enhance the finish Stiffening for the skin laminates is provided by composite laminate stringers varying in thickness from 1/4 to 1 inch spaced with polyurethane foam The fuselage is molded in one-piece halves complete with vertical tail, wing root, and stabilizer junctures, and bonded together at mating flanges along the top and bottom body lines It is shown that apart from aerodynamics and energy efficiency, the all fiberglass/epoxy airframe provides greater strength, toughness, and redundancy compared to aluminum for equivalent structural weight V L

A82-37071 # Fabrication and test of integrally stiffened graphite/epoxy components L M Poveromo and J A Suarez (Grumman Aerospace Corp , Bethpage, NY) In Reinforced Plastics/Composites Institute, Annual Conference, 36th, Washington, DC, February 16-20, 1981, Preprints New York, Society of the Plastics Industry, Inc , 1981 (Session 17-A) 8 p Contract No F33615-78-C-5234

A program has been initiated to demonstrate and validate low-cost skin stabilization manufacturing methods for composite designs which are cost-competitive with conventional full-depth aluminum honeycomb structures The demonstration component selected is the trailing edge of the EF-111A horizontal stabilizer, for which cost data and maintenance experience are available A production-suitable, vacuum-bag-cure manufacturing method developed for this integrally stiffened graphite/epoxy component is described, and static test results are presented for a full-size trailing edge The life-cycle cost benefits derived from the use of the proposed manufacturing techniques are discussed V L

A82-37074 # Application and testing of metallic coatings on graphite/epoxy composites. C J Staebler, Jr , G Lubin (Grumman Aerospace Corp , Bethpage, NY), and M Stander (U S Naval Air Systems Command, Materials and Processes Branch, Washington, DC) In Reinforced Plastics/Composites Institute, Annual Conference, 36th, Washington, DC, February 16-20, 1981, Preprints New York, Society of the Plastics Industry, Inc, 1981 (Session 17-D) 5 p Contracts No N00019-77-C-0250, No N00019-78-C-0602, No N00019-80-C-0059

Metallic coating systems for graphite/epoxy aircraft structures have been developed to provide protection against the strength-degrading effects of moisture penetration, electromagnetic interference (EMI), paint strippers, and lightning strikes The effectiveness of these coatings in providing protection against impact damage and laser impingement is also being determined Perforated and solid aluminum-foil coatings, applied by either secondary bonding or cocuring, significantly improve the moisture resistance and electromagnetic shielding of graphite/epoxy laminates Aluminum-foil coatings also provide protection against the other threats investigated The substrate corrosion compatibility, machinability, and repairability of selected coatings have been determined Forming and bonding techniques to fabricate and apply metal-foil preforms to graphite/epoxy hardware are being developed (Author)

A82-37080 # **Evaluation of sensitivity of ultrasonic detection of disbonds in graphite/epoxy to metal joints.** S W Schramm, I M Daniel, and W G Hamilton (IIT Research Institute, Chicago, IL) In Reinforced Plastics/Composites Institute, Annual Conference, 36th, Washington, DC, February 16-20, 1981, Preprints New York, Society of the Plastics Industry, Inc, 1981 (Session 23-D) 6 p 16 refs

A study was conducted to evaluate, improve and optimize ultrasonic techniques for the detection of disbonds in composite laminate to metal joints Four graphite/epoxy laminates joined to metal plates were investigated using matched pairs of compression and shear wave ultrasonic transducers of three frequencies (1, 2 25, and 5 MHz) Pulse-echo and through transmission modes were used and A-scans, C-scans and frequency spectra were analyzed It was found that the higher frequency (5 MHz) compression wave transducer operated in the through transmission mode gave the best results in most cases Shear wave transducers were found to be cumbersome to use and unsuitable for the cases studied (Author)

A82-37097 # **Efficient part removal processes.** G Lubin In Reinforced Plastics/Composites Institute, Annual Conference, 37th, Washington, DC, January 11-15, 1982, Preprints New York, Society of the Plastics Industry, Inc, 1982 (Session 15-E) 8 p

A study is undertaken to determine possibilities for cost reduction in the removal of plastic airframe components from their molds A method based on the use of a thin Tedlar or Nylon strip is described which has demonstrated significant cost reductions through tool wear and part removal time improvements in bag-molding processes The thin plastic strips are used to delineate the outside edge contours of the bag-molded part's layup, and prevent the formation of resin edge flash and excess resin flow Where the contour of the molded part is too complex, use may be made of two or more wedges at the edge of the part after the layup is completed The thin strip technique has demonstrated a 73% saving in part removal labor time, or about 30 min O C

A82-37123 **A method for observing the deterioration of airframe life in operational conditions (Metodika pro sledovani odcerpavani zivotnosti draku letounu v provoznich podminkach).** V Kahanek *Zpravodaj VZLU,* no 6, 1981, p 273-283 8 refs In Czech

The paper considers the use of an onboard recording device (Parez) to monitor reductions in airframe fatigue life, this device continuously records load factor, aircraft weight, and speed Attention is given to an algorithm for calculating the extremum values of the load factor, a method for determining stress at critical locations by means of a transfer function, and the analysis of the random process representing this stress by the method of complete cycles The appropriate S-N curve, mean-load corrections, and fatigue-test results can be used in determining a two-parameter stress distribution, the accumulation of fatigue damage, and the expected life of the aircraft B J

A82-37127 **A gust damper (Tlumic poryvu).** V Pokorny *Zpravodaj VZLU,* no 1, 1982, p 15-21 In Czech

The paper examines a gust damper, i e, an automatic device which diminishes the effect of gusts on the longitudinal motion of the aircraft by deflecting part of the flaps The possibility of implementing this type of damper by its inclusion into the autopilot system is considered Calculations performed for a small passenger aircraft, show that the use of this damper enhances the comfort of the crew and passengers, improves the piloting of the aircraft, and reduces stresses in the structure B J

A82-37220 # **A spark ignition model for liquid fuel sprays applied to gas turbine engines.** J E Peters (Illinois, University, Urbana, IL) and A M Mellor (Purdue University, West Lafayette, IN) *Journal of Energy,* vol 6, July-Aug 1982, p 272-274 14 refs Army-supported research

The characteristic time model for ignition is used to describe the spark ignition of liquid fuel sprays in gas turbine combustors The model states that for ignition to occur, the energy of a spark must heat up an initial volume such that the heat release rate within that volume is greater than the loss rate Heat generation is limited first by a droplet evaporation time and then a kinetic time, heat loss (for gas turbine applications) is due to turbulent diffusion and, hence, is controlled by a mixing time Data from two can-type combustors and seventeen fuels are correlated by a single ignition limit curve The key to applying the model to engine data is the estimation of drop sizes and equivalence ratios at the spark gap (Author)

A82-37377 **Electric field detection and ranging of aircraft** H Trinks and J L ter Haseborg (Hamburg, Hochschule der Bundeswehr, Hamburg, West Germany) *IEEE Transactions on Aerospace and Electronic Systems,* vol 18, May 1982, p 268-274 7 refs

The electric field transported by charged aircraft during free flight can be observed quantitatively in distances of up to some 100 m A system of three plane sensors arranged in the corners of a triangle on the earth's surface is described, by which the flight path of aircraft is detected in the range of 40 to 500 m with velocities of approximately 50 m/s The theory and typical experimental results are discussed (Author)

A82-37378 **Medium PRF performance analysis** S A Hovanessian (Hughes Aircraft Co, Electro-Optical and Data Systems Group, El Segundo, CA) *IEEE Transactions on Aerospace and Electronic Systems,* vol 18, May 1982, p 286-296 9 refs

A discussion of various types of x-band airborne radars is presented, together with an account of their development It is related how, starting with simple, low pulse-repetition frequency (PRF) radars for measuring radar-target range, airborne radar development proceeded with more sophisticated high PRF Doppler radars where radar-target range and range rate were measured simultaneously The use of Doppler (frequency) in signal processing allowed the separation of moving from nonmoving targets (ground), making possible the detection of moving targets in the presence of ground clutter It is pointed out that more recent advances in waveform generation and selection have led to the development of medium PRF radars, whereby a greater degree of tactical flexibility in target detection is attained by combining the desirable features of both low and high PRF radars The systematic evolution of these radars is emphasized, and the necessary theoretical background is given for their performance calculations C R

A82-37380 **Instrument failure detection in partially observable systems.** J E Hertel (NORPAC Engineering, Inc, Seattle, WA) and R N Clark (Washington, University, Seattle, WA) *IEEE Transactions on Aerospace and Electronic Systems,* vol 18, May 1982, p 310-317 11 refs

Instrument failure detection using the dedicated observer scheme (DOS) depends on partial state observability through each instrument which is monitored For instrument fault detection by the DOS technique, a quantitative measure of partial state observability is established for each instrument and used to determine a necessary condition on the output structure of the system This measure, called the internal redundancy of the instrument, indicates the complexity of the logic required for failure detection, and it also indicates where some hardware redundancy can be introduced into the system to improve the fault detection capability of the DOS The principles developed are applied to a simulation of the pitch axis autopilot of the A7 jet aircraft (Author)

A82-37381 **Implementing aircraft identification schemes by public key cryptosystems.** B Arazi and N Ekstein (Negev, University, Beersheba, Israel) *IEEE Transactions on Aerospace and Electronic Systems,* vol 18, May 1982, p 318-322 11 refs

The use of public key cryptosystems for identification purposes has already been suggested The practical aspects of using such systems for aircraft identification are discussed It is shown that the digital signature property is not mandatory for implementing an identification procedure It is then shown how public key distribution systems can be used for identification purposes The technical difficulties in implementing an identification scheme are finally discussed with possible solutions offered (Author)

A82-37446 * **Formal specification and mechanical verification of SIFT - A fault-tolerant flight control system.** P M Melliar-Smith and R L Schwartz (SRI International, Computer Sciences Laboratory, Menlo Park, CA) *IEEE Transactions on Computers,* vol C-31, July 1982, p 616-630 11 refs Contract No NAS1-15428

The paper describes the methodology being employed to demonstrate rigorously that the SIFT (software-implemented fault-tolerant) computer meets its requirements The methodology uses a hierarchy of design specifications, expressed in the mathematical domain of multisorted first-order predicate calculus The most abstract of these, from which almost all details of mechanization have been removed, represents the requirements on the system for reliability and intended functionality Successive specifications in the hierarchy add design and implementation detail until the PASCAL programs implementing the SIFT executive are reached A formal proof that a SIFT system in a 'safe' state operates correctly despite the presence of arbitrary faults has been completed all the way from the most abstract specifications to the PASCAL program B J

A82-37466 # On the vortex flow over delta and double-delta wings. H W M Hoeijmakers, W Vaatstra (Nationaal Lucht- en Ruimtevaart-laboratorium, Amsterdam, Netherlands), and N G Verhaagen (Delft, Technische Hogeschool, Delft, Netherlands) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St Louis, MO, June 7-11, 1982, AIAA Paper 82-0949* 13 p 44 refs Research supported by the Royal Netherlands Air Force

An experimental and theoretical investigation is described of the flow above, and downstream of, a 76 deg delta wing and two double-delta wings (sweep 76 deg/60 deg and 76 deg/40 deg, respectively, with kink at 50% chord) The flow pattern is visualized by means of a laser light-sheet technique For the case of the delta wing, experimental results are compared with numerical results of a free vortex sheet method for computing three-dimensional flow about slender wings, a free vortex sheet method for the limiting case of conical flow, and a computational procedure for computing two-dimensional time-dependent vortex wake roll-up Based on the laser light-sheet investigation, a vortex-sheet model is proposed for the flow about double-delta wings with leading-edge vortex separation on both wing panels (Author)

A82-37467 * # Approximate boundary condition procedure for the two-dimensional numerical solution of vortex wakes. R P Weston and C H Liu (NASA, Langley Research Center, Analytical Methods Branch, Hampton, VA) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St Louis, MO, June 7-11, 1982, AIAA Paper 82-0951* 9 p 19 refs

Research on efficient computational methods for general vorticity fields has been conducted in connection with a need for basic research on vortex-dominated flows The present investigation is concerned with the evolution of vortex wakes behind aircraft wings An efficient procedure is presented for the calculation of the boundary values used in the numerical solution of the unsteady, incompressible, two-dimensional Navier-Stokes equations for an unbounded flow field The extent of the computational grid can be reduced compared to methods utilizing standard boundary conditions, without loss of accuracy The efficiencies realized make it feasible to calculate the vortex wake development for realistic wing configurations, including the merging of multiple vortices, for Reynolds numbers of about 10,000 based on wing chord G R

A82-37477 # A grid interfacing zonal algorithm for three-dimensional transonic flows about aircraft configurations. E H Atta and J Vadyak (Lockheed-Georgia Co , Advanced Flight Sciences Dept , Marietta, GA) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference, 3rd, St Louis, MO, June 7-11, 1982, AIAA Paper 82-1017* 9 p 9 refs

An efficient grid interfacing zonal algorithm has been developed for computing the transonic flow field about three-dimensional multicomponent configurations The algorithm uses the full-potential formulation and the fully-implicit approximate factorization scheme (AF2) The flow field solution is computed using a component adaptive grid approach in which separate grids are employed for the individual components in the multicomponent configuration, where each component grid is optimized for a particular geometry The component grids are allowed to overlap, and flow field information is transmitted from one grid to another through the overlap region An overlapped-grid scheme is implemented for a wing and a wing/pylon/nacelle configuration Numerical results show that the present algorithm is stable, accurate, and can be used effectively to compute the flow field about complex configurations (Author)

A82-37493 Boeing's new transports in a flight-test marathon P Condom *Interavia,* vol 37, July 1982, p 695-697

Flight testing is proceeding on two totally new aircraft, the Boeing 757 and 767 each with two alternative powerplants and FAA certifications for these aircraft are expected to be received in record time during the second half of 1982 New test facilities and more flight-test engineers have been required to keep the assigned deadlines Radically updated acquisition and processing facilities for flight-test data also have been introduced utilizing an 'on-line data-acquisition system, the principal components of which include a new data analysis and monitor system, a gross weight/center of gravity computer, a microwave aircraft positioning system, a data processing ground station, a ground data analysis station and a flight test computing system A schematic diagram showing the positioning of the components of the data-acquisition system is included N B

A82-37521 The DRAPO system - Materials means and logic functions (La CFAO en mécanique le système DRAPO - Moyens matériels et fonctions logicielles). M Neuve Eglise (Avions Marcel-Dassault-Bréguet Aviation, Vaucresson, Hauts-de-Seine, France) *Revue Française de Mecanique,* 2nd Quarter, 1982, p 37-43 In French

Components and functioning of DRAPO (Definition and Realization of Aircraft by use of a Computer) system are described The system comprises procedures, materials, and logistics, and interconnection of remote terminals with a centralized data base serving all fields of aerospace production The system is used by aerospace CAD/CAM personnel in the fabrication of parts for industrial production A description of the computers forming the central processing units and the remote terminals is provided, noting the links established through telephone lines Interactive graphics consoles permit remote access to cataloged design shapes after entry of an alphanumeric code Programming logic, internal to the main system offers design with light pens, electrostatic design, and large surface graphics Logic functions for the entire system are noted, including methods of changing and rotating the objects in two- and three-dimensions Finally, flow charts of the computer operations are given M S K

A82-37526 Traffic flow control in the Frankfurt/Main airport area (Verkehrsflusssteuerung im Anflugbereich Frankfurt/Main) R Onken (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugfuhrung, Braunschweig, West Germany) *DFVLR-Nachrichten,* June 1982, p 23-27 In German

Traffic records at the Frankfurt/Main airport are analyzed in order to determine traffic flow patterns in both the spatial and the temporal dimensions The effect of various strategies of coordinating traffic flow are assessed A new computerized traffic planning system concept is explained and evaluated C D

A82-37676 # Investigation of subsonic nacelle performance improvement concept. D Dusa, D J Lahti (General Electric Co , Cincinnati, OH), and D Berry (Boeing Commercial Airplane Co , Seattle, WA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23 1982, AIAA Paper 82-1042* 9 p

Investigations have been conducted with the objective to identify aircraft and nacelle performance improvement concepts aimed at improving the overall aircraft system installed performance The present study is specifically concerned with exhaust system design technology and impacts on both internal performance and installed drag A goal of 1% improvement in specific fuel consumption (SFC) and a reduction of 1% in aircraft drag was established Attention is given to analytical studies, static performance tests, wind tunnel tests, nacelle calibration/thrust-drag bookkeeping, isolated nacelle testing, and installed nacelle testing G R

A82-37677 * # Transonic wind tunnel test of a supersonic nozzle installation J A Yetter (Boeing Military Airplane Co , Seattle, WA), G B Evelyn (Boeing Commercial Airplane Co , Seattle, WA), and C Mercer (NASA, Langley Research Center, Hampton, VA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1045* 14 p 8 refs

The design of the propulsion system installation affects strongly the total drag and overall performance of an aircraft, and the concept, placement, and integration details of the exhaust nozzle are major considerations in the configuration definition As part of the NASA Supersonic Cruise Research (SCR) program, a wind tunnel test program has been conducted to investigate exhaust nozzle-airframe interactions at transonic speeds First phase testing is to establish guidelines for follow-on testing A summary is provided of the results of first phase testing, taking into account the test approach, the effect of nozzle closure on aircraft aerodynamic characteristics, nozzle installation effects and nacelle interference drag, and an analytical study of the effects of nozzle closure on the aircraft G R

A82-37678 * # Kevlar/PMR-15 polyimide matrix composite for a complex shaped DC-9 drag reduction fairing. R T Kawai, R F McCarthy, M S Willer (Douglas Aircraft Co , Long Beach, CA), and F J Hrach (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1047* 9 p 6 refs

The Aircraft Energy Efficiency (ACEE) Program was established by NASA to improve the fuel efficiency of commercial transport aircraft and thereby to reduce the amount of fuel consumed by the air transportation industry One of the final items developed by the program is an improved fairing which is the aft closure for the thrust reverser actuators on the JT8D nacelles on DC-9 aircraft The reduced-drag fairing uses, in the interest of weight savings, an advanced composite construction The composite material contains Kevlar 49 fibers in a PMR-15 matrix Attention is given to the aerodynamic configuration, the material system, and aspects of fabrication development G R

A82-37679 # Development of counter-rotating intershaft support bearing technology for aircraft gas turbine engines. W L Gamble (United Technologies Corp , Government Products Div , West Palm Beach, CA) and R Valori (U S Naval Air Propulsion Test Center, Trenton, NJ) *AIAA, SAE, and*

ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1054 9 p

Analytical studies on intershaft cylindrical roller bearings for advanced gas turbine engines configured with counter-rotating shafts showed advantages in fatigue life and internal radial clearance control when the outer ring was mounted on the low speed rotor and the inner ring on the high speed rotor Parametric rig tests on eight bearings showed that the primary drivers on roller end wear were roller-to-guide flange end clearance, outer race preload and internal radial clearance Test results showed concentric roller end wear patterns on all test bearings and varying levels of wear The performance data was used to improve prediction techniques for bearing heat generation and temperatures (Author)

A82-37682 # **Evaluation of a multivariable control design on a variable cycle engine simulation.** S J Przybylko (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH)and S M Rock (Systems Control Technology, Inc , Palo Alto, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1077* 8 p 13 refs Contract No F33615-77-C-2096

It is pointed out that aircraft turbine engine propulsion control systems have been the focus of extensive development in recent years Future engine cycles have been defined and include a significant variable geometry capability to the extent that the thermodynamic engine cycle varies over wide limits The number of actuated variables was expanded, and resulting control strategies require extension of the current advanced multivariable control methodologies The present investigation is concerned with the evaluation of a multivariable control designed for the JTDE GE 23 variable cycle engine Attention is given to a description of the Joint Technology Demonstrator Engine (JTDE), the control requirements, a control structure overview, and the computer simulation and evaluation procedure G R

A82-37683 * # **Flight evaluation of a digital electronic engine control system in an F-15 airplane** L P Myers, K G Mackall, F W Burcham, Jr (NASA, Ames Research Center, Edwards AFB, CA), and W A Walter (United Technologies Corp , Pratt and Whitney Aircraft Group, West Palm Beach, FL) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1080* 14 p 6 refs

Benefits provided by a full-authority digital engine control are related to improvements in engine efficiency, performance, and operations An additional benefit is the capability of detecting and accommodating failures in real time and providing engine-health diagnostics The digital electronic engine control (DEEC), is a full-authority digital engine control developed for the F100-PW-100 turbofan engine The DEEC has been flight tested on an F-15 aircraft The flight tests had the objective to evaluate the DEEC hardware and software over the F-15 flight envelope A description is presented of the results of the flight tests, which consisted of nonaugmented and augmented throttle transients, airstarts, and backup control operations The aircraft, engine, DEEC system, and data acquisition and reduction system are discussed G R

A82-37685 # **Prediction of cruise missile inlet peak instantaneous distortion patterns from steady state and turbulence data using a statistical technique.** J A Forner and J M Manter (USAF, Aeronautical Systems Div , Wright-Patterson AFB, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1085* 10 p 7 refs

The commonly accepted method of assessing inlet engine compatibility is to evaluate the engine capability to operate stall-free with the peak instantaneous distortion levels delivered by the inlet The development of inlet systems for aircraft and missiles requires, therefore, an assessment of peak instantaneous distortion The present investigation is concerned with a statistical procedure for predicting instantaneous peak distortion patterns, taking into account an approach based on a method considered by Stevens et al (1980) The investigation has the objective to expand the data base supporting the method by comparing predicted distortion values to analog screened values for three cruise missile inlets G R

A82-37688 # **Electronic control for small engines.** W H Hermann, J A Weber, and E E Ervin (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1126* 8 p

A description is presented of an electronic system for the control of the small engines of the Model 250 series, which are used in many helicopter applications (single and twin) and in selected turboprop applications The requirements for developing the Model 250 electronic control concept are examined The electronic control is active throughout the engine operating regime The principal features of the electronic control system are related to start temperature limiting, altitude-compensated surge avoidance, rotor speed governor, loss-of-load protection, backup analog governor, backup loss-of-load protection, manual backup, and diagnostics and readout The principal components of the Model 250 electronic fuel control system are shown in a graph A digital control unit is a new component which is currently being developed for this system G R

A82-37689 # **Reliability design study for a fault-tolerant electronic engine control** D E Warner and W H Hermann (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1129* 8 p

The Advanced Turbine Engine Study (ATES) has the objective to define the engines which are to power the advanced aircraft of the late 1980's Digital electronic controls are required for the operation of advanced variable cycle engines for high performance aircraft Problems of failure tolerance and reliability arising in connection with the control system were investigated in a study on Full-Authority, Fault-Tolerant Electronic Engine Controls (FAFTEEC) A description is presented of the highlights and the significant results of the study Attention is given to the baseline system which was defined to meet mission, aircraft, and engine requirements derived from the ATES program The module database is considered along with alternate fault-tolerant system designs, specific design tools utilized in the design of fault-tolerant systems, and aspects of system evaluation G R

A82-37690 # **Design concepts of an advanced propulsion monitoring system.** A R Mulukutla and V W Lawson (General Electric Co , Cincinnati, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1130* 5 p Contract No F33615-79-C-2092

A number of tests of engine health monitoring systems have demonstrated the feasibility of acquiring and recording some of the engine health related data An American aerospace company is developing an Advanced Propulsion Monitoring System (APMS) to remedy some of the shortcomings of previous systems with regard to automatic analysis and presentation of data in useful form After the conduction of tests of the APMS in the laboratory, some of the hardware and software are being modified for a demonstration test on a different engine with a different operating cycle A description is presented of some of the details of the demonstration configuration Attention is given to the demonstration test objectives, a system overview, and a software overview G R

A82-37691 * # **Optical tip clearance sensor for aircraft engine controls.** G L Poppel (General Electric Co , Aircraft Engine Business Group, Cincinnati, OH), D T F Marple (General Electric Co , Schenectady, NY), and R J Baumbick (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1131* 9 p Contract No NAS3-21843

Aircraft gas turbine performance and efficiency are related to airfoil tip clearance The possibility has been considered to obtain optimum performance and efficiency by reducing clearance to a safe minimum with the aid of a closed-loop tip clearance control system, which utilizes a tip clearance sensor The use of optical sensing methods appears to represent a potential solution to the tip clearance measurement problem Principles of sensor operation are discussed along with dimensional considerations and diffraction limitations A description is presented of the study of the feasibility of a certain sensor, taking into account the test rig system, the optical components, and the mounting tube Attention is also given to the operation of the feasibility-study sensor, performance estimations, the optical fiber bundle, light beam refraction, and aspects of aircraft engine implementation G R

A82-37692 # **Advanced exhaust nozzle concepts using spanwise blowing for aerodynamic lift enhancement** J G Doonan and W H Davis, Jr (Grumman Aerospace Corp , Bethpage, NY) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1132* 16 p 8 refs Contracts No F33615-79-C-3009, No F33615-77-C-3045

Underwing and wing trailing edge flap spanwise blowing configurations employing a secondary nozzle were tested in a wind tunnel investigation in order to assess their STOL performance enhancement effects, for the case of a 1990s-technology twin-engined fighter with close-coupled canard planform The two spanwise blowing concepts were incorporated in a two-dimensional, thrust vectoring and convergent-divergent flow geometry primary exhaust nozzle The advantages of spanwise blowing are identified through an analysis of wind tunnel 1/8-scale model aircraft force and surface pressure data The underwing and trailing edge methods have demonstrated induced lift coefficients equal to 33% and 28% of the unpowered aerodynamic lift coefficient, respectively Consideration is also given to lift augmentation by means of the primary thrust-vectoring nozzles O C

A82-37693 # **Thrust reverser induced flow interference on tactical aircraft stability and control.** C Chiarelli, D Lorincz, and B Hunt (Northrop Corp , Aircraft Div , Hawthorne, CA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1133* 11 p 6 refs

It is pointed out that the vulnerability of runways to bomb damage is a major threat to the operational effectiveness of tactical aircraft Future designs will, therefore, very likely be required to operate from short undamaged portions of runway The most critical problem in achieving STOL is to reduce landing distance because conventional tactical aircraft require landing lengths which are several times greater than their takeoff lengths An approach involving the use of a thrust reverser represents a possible solution to the problem Attention is given to a study of reverser jet/tunnel wall interference conducted in a low speed wind tunnel, results for a thrust reversing version of the F/A-18A aircraft, and wind tunnel data for reverser effects on the stability and control characteristics of an advanced fighter configuration G R

A82-37694 # Advanced nozzle integration for air combat fighter application H W Wallace (McDonnell Aircraft Co, St Louis, MO) and D L Bowers (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1135* 13 p

Analytical and experimental investigations have been conducted in an Advanced Nozzle Concepts program, with a view to establishing design guidelines for future tactical fighters The configurations studied include high and low aspect ratio two-dimensional nozzles, as well as advanced axisymmetric nozzle, installed in air-to-air and air-to-surface primary mission tactical aircraft of generically different design Attention is given to the air-to-air vehicle, for which nozzle configurations were wind tunnel tested at speeds from Mach 0 6 to 1 5 in order to determine relative installation drag and aerodynamic interaction effects due to thrust vectoring and reversing It is shown that thrust reversal for STOL operation and thrust vectoring for trim enhancement at high lift coefficients may be achieved with a small penalty in takeoff gross weight O C

A82-37695 # Experimental performance evaluation of 'ventilated mixers' - A new mixer concept for high bypass turbofan engines. J S Sokhey (Boeing Commercial Airplane Co, Seattle, WA) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1136* 13 p 7 refs

An experimental investigation of two Ventilated Mixer cold/hot dual flow nozzle models is presented in which total axial thrust, mixer surface static pressures are measured, and rake surveys are taken of total pressure and temperature taken at the charging station, mixing plane, and nozzle exit plane Greater accuracy than that normally obtainable was achieved in the definition of nozzle model surfaces through the numerically controlled fabrication of each unit from a single stainless steel block Ventilation slots were machined through the mixer lobe walls in order to improve mixer performance through boundary layer energization, which inhibits primary flow separation Analysis of the test results shows the ventilation concept to yield a significant reduction in total mixer pressure loss, with additional improvements noted in mixing effectiveness and jet noise reduction Ventilated mixer flow characteristics are compared with those of unventilated mixers, and the consequence of this nozzle design's applications to existing turbofan engines is discussed O C

A82-37698 # A cost modeling approach to engine optimization D G Culy and R C Gunness (Garrett Turbine Engine Co, Phoenix, AZ) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1185* 8 p Navy-USAF-sponsored research

An outline is provided of an engine optimization study carried out as part of the Navy Advanced Technology Engine Study (ATES) Program The objective of the study was to determine a set of engine cycle parameters, and then to establish a set of component technologies and a development strategy which would result in the lowest peacetime Life Cycle Cost (LCC) for six different aircraft fleets For simplicity, one tactical system (using an engine in the middle of the study size range) is discussed Preliminary sizing was based on conventional optimization criteria The LCC model used is briefly described, and the scenario for the mission is given The study results are shown in terms of both LCC and aircraft takeoff gross weight G R

A82-37709 # Models for a turbulent premixed dump combustor. N Darabiha, S M Candel (Ecole Centrale des Arts et Manufactures, Châtenay-Malabry, ONERA, Châtillion-sous-Bagneux, Hauts-de-Seine, France), and E Esposito (Ecole Centrale des Arts et Manufactures, Châtenay-Malabry, Hauts-de-Seine, France) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1261* 9 p 23 refs Research supported by the Société Nationale d'Etude et de Construction de Moteurs d'Aviation

The modeling of the process of ignition and flame spreading in a premixed dump combustor is discussed The treatment, which is essentially numerical, relies on a time-split finite difference method Mass-averaged conservation equations are used in order to represent the flow dynamics A simple chemically reacting system is assumed, and combustion is simulated using two models The reaction rate is kinetically controlled in the first model The second model is based on the coherent flame concept of Marble and Broadwell (1977) Time-dependent flame spreading calculations are described in some detail C R

A82-37710 * # Turbulence measurements in a confined jet using a six-orientation hot-wire probe technique. S I Janjua, D K McLaughlin (Dynamics Technology, Inc, Torrance, CA), D G Lilley (Oklahoma State University, Stillwater, OK), and T Jackson *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1262* 13 p 22 refs Contract No NAG3-74

The six-orientation hot-wire technique is applied to nonreacting axisymmetric flowfields, obtaining measurements of time-mean and rms voltages at six different orientations, thus providing enough information to determine the time-mean velocities, turbulence intensities, and shear stresses At each location in the flow, there are six different values of each of the above quantities that can be obtained using six sets of measurements of three adjacent orientations Flowfield surveys of both swirling and nonswirling confined jets are used to calculate estimates of the mean velocity components and the normal and shear turbulent stresses, and comparisons with independent data are made A sensitivity analysis of the data reduction technique demonstrates that the largest uncertainties are to be expected in the turbulent shear force estimates C D

A82-37712 # Current techniques for jet engine test cell modeling. R J Freuler (Ohio State University, Columbus, OH) and R A Dickman (General Electric Co, Aircraft Engine Group, Cincinnati, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1272* 16 p

A model test program to demonstrate acceptable aerodynamic performance for a jet engine test cell with a 26 ft by 26 ft cross section is described Utilizing a 1/17 6 scale plexiglass model of the full-scale jet engine test cell and a modified turbine powered simulator, a technique is developed in conjunction with an online data acquisition system (outlined in a block diagram) by which a maximum amount of test information can be acquired, processed, and presented to the jet cell model test engineer in a manner responsive enough to permit the 'immediate' analysis of a test point A matrix of inlet/cell/exhaust geometries is model tested to demonstrate their interaction on the test cell system aerodynamics This model test demonstrates acceptable test cell aerodynamics for a 26 ft by 26 ft cell geometry with a three to six inch water inlet pressure drop and a cell bypass ratio greater than 1 Specifically no vortices are formed in the simulated engine bellmouth, the front cell velocity distortion is less than 0 20, the tip circumferential inlet distortion is less than 0 5% and the tip radial distortion is less than 0 25% The axial pressure gradients as measured on cell walls and the simulated engine fan cowling are well below 0 5 inches of water, which corresponds to less than 0 1% correction to measured thrust due to base pressure differences N B

A82-37716 * # Aerodynamic performance of high turning core turbine vanes in a two-dimensional cascade. J R Schwab (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1288* 19 p 6 refs

Experimental and theoretical aerodynamic performance data are presented for four uncooled high turning core turbine vanes with exit angles of 74 9, 75 0, 77 5, and 79 6 degrees in a two-dimensional cascade Data for a more conservative 67 0 degree vane are included for comparison Corection of the experimental aftermix kinetic energy losses to a common 0 100 centimeter trailing edge thickness yields a linear trend of increased loss from 0 020 to 0 025 as the vane exit angle increases from 67 0 to 79 6 degrees The theoretical losses show a similar trend The experimental and theoretical vane surface velocity distributions generally agree within approximately five percent, although the suction surface theoretical velocities are generally higher than the experimental velocities as the vane exit angle increases (Author)

A82-37764 # R & D on composite rotor blades at Agusta V Giavotto (Milano, Politecnico, Milan, Italy), V Caramaschi, and G C Maffioli (Costruzioni Aeronautiche Giovanni Agusta S p A, Varese, Italy) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmisch-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 16 p 5 refs

An R&D program aimed at the development of improved methods for the construction of composite rotor blades is reviewed with reference to the development of a finite element code (Program HANBA 2) for blade section analysis and the development of reliable models for the study of composite behavior and failure criteria Program HANBA 2 is based on finite element discretization in the section plane only, thus allowing the computation of beam solutions for any shape and material anisotropy or inhomogeneity of the section concerned In particular, the code allows the evaluation of interlaminar and joint stresses in nonlinear material models with unbalanced anisotropy Composite rotor blades have been designed and manufactured using the methods developed and are now undergoing static and fatigue tests V L

A82-37765 * # A simple system for helicopter Individual-Blade-Control and its application to stall flutter suppression. N D Ham and T R Quackenbush (MIT, Cambridge, MA) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmisch-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 10 p NASA-sponsored research

A new, advanced type of active control for helicopters and its application to a system for stall flutter suppression is described The system, based on previously developed M I T Individual-Blade-Control hardware, employs blade-mounted accelerometers to sense torsional oscillations and feeds back rate information to increase the damping of the first torsion mode A linear model of the blade and control system dynamics is used to give qualitative and quantitative guidance in the design process as well as to aid in analysis of experimental results System performance in wind tunnel tests is described, and evidence is given of the system's ability to provide substantial additional damping to stall-induced blade oscillations (Author)

A82-37766 # **CFC drive shaft and GFC coupling for the tail rotor of the BO 105.** C M Herkert, D Braun, and K Pfeifer (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany) *Deutsche Gesellschaft für Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmisch-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 27 p

A new tail rotor drive system using a carbon fiber composite shaft and glass fiber composite couplings is being designed for the BO 105 instead of the existing metal version with a view to reducing the mass and the cost of the drive system The discussion covers general design requirements, analytical evaluation of several design concepts including bolted and bonded versions, manufacturing techniques, tool design, test results and cost effectiveness of the proposed designs It is shown that the composite version of the tail rotor drive system would provide a 10% reduction in the manufacturing cost, a mass reduction of 4 kg for the long shaft and 1 kg for the short shaft, and, possibly, a reduction in the number of parts V L

A82-37767 # **Quantification of helicopter vibration ride qualities.** C E Hammond and D D Hollenbaugh (U S Army, Applied Technology Laboratory, Fort Eustis, VA) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 14 p 8 refs

Absorbed power, a measure of the rate at which the body absorbs energy when subjected to vibration (as developed by the U S Army TACOM), is used as a means for quantifying helicopter vibration ride quality Vibration tests, performed on pilots of five different operational U S Army helicopters are converted to absorbed power using calculations derived for quantitative measures of ride quality for ground vehicles The results are compared to previously obtained data showing acceptable subjective response for helicopter vibration levels and ISO 2631 reduced proficiency boundaries (both converted to absorbed power) Absorbed power measurements from the operational helicopters are, in general, higher than the values from these comparative boundaries and fall between the levels for acceptable ride quality of automobiles and off-road vehicles (0 2-6 W) Further research using the NASA-Langley Research Center Passenger Ride Quality Apparatus, is planned N B

A82-37768 # **Practical application of a computerized flight by flight fatigue test system.** A Jorio and G Parenti (Costruzioni Aeronautiche Giovanni Agusta S p A , Varese, Italy) *Deutsche Gesellschaft für Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 17 p

Requirements related to the procedure leading to the certification of a helicopter, and general developments concerning the state of the art provided the motivation for modernizing the equipment used in fatigue testing The modernization made it possible to reduce the time required for testing, and to minimize needs for operator assistance during the test It was also possible to improve accuracy and reliability A flight test data survey is conducted, and flight by flight fatigue tests are discussed A description of a computer controlled system is presented, taking into account the system definition, the software philosophy, the system architecture, and a system functional description G R

A82-37769 # **Quasi-static and dynamic crushing of energy absorbing materials and structural components with the aim of improving helicopter crashworthiness.** C Kindervater (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkirchen, West Germany Sept 8-11, 1981, Paper* 26 p

Energy absorbing tests are performed on several materials and structural components, such as aluminum honeycomb, thin-walled aluminum and steel cylinders, PUR-foam cylinders, and fiber-reinforced cylindrical tubes, with the eventual goal of improving helicopter crashworthiness Axial crushing tests, under quasi-static and impact loading, are conducted to determine several key energy absorbing parameters for these materials and structures, including specific energy, energy dissipation density, stroke efficiency and operating stress Fiber-reinforced tubes gave the best results, having a specific energy value of about twice the maximum observed for aluminum honeycomb and about six times the best value for foam-filled metal cylinders Little difference is shown between the static and dynamic failure modes Finally a crash test structure is drop tested with some selected structural elements acting as energy absorbers and the results are compared to crash cases simulated using a computer program The comparison tests showed that accurate estimations of the dynamic response of the total structural assembly can be obtained by using statically-determined load deflection characteristics of the absorbing elements N B

A82-37770 # **Joint Anglo-American experience of the analysis of helicopter rotor blade pressure distribution.** D J Merkley (U S Army, Applied Technology Laboratory, Fort Eustis, VA), M J Riley, and C Young (Royal Aircraft Establishment, Farnborough, Hants , England) *Deutsche Gesellschaft für Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 21 p 8 refs

NASA, the U S Army, and the Royal Aircraft Establishment (RAE), UK, are collaborating in a study to develop interactive computer systems for use in analyzing helicopter rotor blade pressure distribution measurements Flight tests on AH-1G and Wessex helicopters provided data which were then analyzed using two different computer program systems The RAE interactive graphics programs perform curve fitting and integration routines which enable force and moment coefficient plots to be visually displayed, and for regions of interest, such as where blade section limitations are apparent, to be located for the more detailed study of chordwise pressure distribution The U S team incorporated and considerably extended the RAE programs into a computer software system called DATA-MAP, which offers the convenience of fully interactive graphics to display the pressure measurements in absolute values or coefficient form against time, chord or radius, to derive forces and moments, and to optimize scaling as the analysis proceeds Examples of the plots obtained from both systems are included Two joint workshops have been held to exchange information and to correlate the various data bases (test and analytic) Further cooperative efforts are planned N B

A82-37771 # **Ageing of composite rotor blades.** F Och (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) *Deutsche Gesellschaft für Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 16 p 6 refs

Long term effects of the environment on composite rotor blades used in different climatic zones are evaluated by means of coupon testing (sections cut out of blades) and tests of full-scale components Blades with 2600, 3700 and 6100 flight hours, flown over the Gulf of Mexico and the North Sea region, show a reduction in interlaminar shear strength due to accelerated aging, but no weathering influence is found on bending strength Artificial weathering of coupon specimens yields a significant reduction in the endurance limit of matrix controlled properties after sufficient time of exposure (500 hr) Full scale fatigue testing indicates that there is no adverse influence of service usage on composite rotor blades In general, composite material fulfills its expected advantages, making it the best structural material for rotory wing applications N B

A82-37772 # **Helicopter design synthesis.** O R Ramos and P Taylor (Southampton, University, Southampton, England) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th Garmish-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 22 p 16 refs Research supported by the Ministry of Defence (Procurement Executive)

A modular computer program is developed to aid the preliminary design analysis of the aerodynamic and dynamic characteristics for projected base-line helicopters of conventional configuration The computer program, called HELISOTON, allows time-efficient assessment of the multi-variable relationships between the various input design requirements in the earliest stages of project definition HELISOTON consists of an iteration procedure for automated prediction of a helicopter's AUW, installed power and size as a function of the aircraft role, specification and mission profile When the basic iteration is linked to a series of outer iterative loops, the program then carries out simple optimization decisions related to the preliminary stages of design and can be used to simply select design parameters, ruling out those solutions that cannot be expected to lead to efficient or practical final base-line designs HELISOTON can also be used for data generation in conjunction with external optimization programs covering fields wider than aerodynamics and dynamics and/or using more detailed, time-consuming computational models Sample program results are included to illustrate the potentialities of the program and the several modes in which the program can be advantageously operated N B

A82-37773 # **Factors shaping conceptual design of rotary-wing aircraft.** W Z Stepniewski *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 18 p 10 refs

The investigation is mainly concerned with the most important design parameter value trends as exhibited by the foremost design schools represented by the Soviet Union and the Western nations In addition to pure helicopters of various configurations, a few new rotary-wing concepts as the tilt rotor, ABC, and the X-wing are considered so that their competitive positions with respect to classical helicopters can be assessed A number of Soviet helicopters listed in a table include, in addition to examples of traditional Soviet design philosophy, also the Mi-24 and Mi-26 as examples of the new Soviet design philosophy adopted by the Tishchenko design team The Western rotorcraft selected for the comparative study include single-rotor and tandem helicopters ranging in maximum gross weights from about 5000 to almost 150,000 pounds The state of the art of powerplants is examined, taking into account Western and Soviet engines Attention is given to disk loading, power loading, tip speed, advancing blade-tip Mach number and advance ratio barrier, and weight and energy aspects G R

A82-37775 # An automatic map reader suitable for use in helicopters. G F Walker (Marconi Avionics, Ltd , Rochester, Kent, England) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkircnen, West Germany, Sept 8-11, 1981, Paper* 11 p 6 refs

The automatic map reader (AMR) is a portable, hand-held navigation device designed to greatly increase navigational accuracy in tactical helicopters, particularly in the Nap-of-the-Earth flight environment The AMR incorporates several features which make it attractive for use in helicopters, including the use of unprepared standard maps, the unlimited orientation of the map, low weight, and low cost The interface unit of the AMR converts data from the navigational computer into a form suitable for use by the display head, which contains two discs, drive mechanisms, display and processor electronics, and the system operational controls Flight position is indicated by the intersection of lines engraved on two separately movable circular discs Flight evaluation tests demonstrated the effectiveness of the AMR in terms of performance and cost at an overall weight and size suitable for helicopter use N B

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A82-37776 # Optimization of blade pitch angle for higher harmonic rotor control. H G Jacob (Braunschweig, Technische Universität, Brunswick, West Germany) and G Lehmann (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugmechanik, Braunschweig, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmish-Partenkirchen, West Germany, Sept 8-11, 1981, Paper* 29 p 7 refs

An achievement of improved harmonic control in the case of helicopter rotors makes it possible to reduce oscillatory hub forces and moments, decrease blade stresses, increase performance, and avoid instabilities of blade motion The present investigation is concerned with numerical studies which have been conducted to enhance the harmonic control of helicopter rotor blades Three different mathematical models are employed to show the effectiveness of improved harmonic blade control and to provide an overview concerning the sensitivity of the control inputs An optimization method is discussed, and the time dependent optimal control of the blade pitch angle is considered Attention is given to the mathematical model of a rotor with rigid blades and flap hinges, and a mathematical model of a rotor system with elastic blades G R

A82-37777 * General purpose research rotor. R Jones, H E Howes (Kaman Aerospace Corp , Bloomfield, CT), and L A Haslim (NASA, Ames Research Center, Moffett Field, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-9* 15 p

An analytical study, under a NASA contract, is performed on an advanced flight research rotor (four-bladed, 54 ft in diameter, with bearingless rotor retention characteristics) to determine the sensitivity of total rotor characteristics such as vibratory hub loads, rotor horsepower, and blade loads, to parametric variability of the rotor configuration The sensitivity of the rotor to various combinations of blade planform taper, percent of blade span that is tapered, tip sweep angle, built-in-twist, and torsional frequency is determined for specific configurations by randomly selecting combinations of these parameters Characteristics of other intermediate rotor configurations are determined by a regression analysis The results show that a wide range of rotor total performance characteristics can be obtained for a rotor trimmed to the same flight conditions The regression equations predict total performance of the rotor very well and appear to be a useful analytical tool for rotor design optimization Figures showing the results of the various tests are given along with a table of the regression coefficients N B

A82-37778 Low vibration design of AAH for mission proficiency requirements. B P Gupta and E R Wood (Hughes Helicopters, Inc , Culver City, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-2* 9 p 11 refs

The Army Advanced Attack Helicopter (AAH) considered in the investigation has a four-bladed fully articulated rotor which turns at 289 RPM The aircraft basic design gross weight is 14,660 lbs The two-man crew includes a pilot and a copilot gunner AAH design features for low vibration are considered, taking into account also a program to reduce even further the low vibration levels in the basic aircraft A flight spectrum approach to helicopter vibration specifications is discussed, giving attention to helicopter vibrations and airspeed, Miner's rule applied to helicopter vibrations, the primary mission profile for the AAH, and a typical structural component S-N curve The criterion of 'hours before proficiency degrades' relates the complex crew vibration environment to a single quantity which is physically significant G R

A82-37779 Army helicopter crew seat vibration - Past performance, future requirements. S T Crews and W W Hamilton (U S Army, Qualifications Directorate, St Louis, MO) *American Helicopter Society, Northeast Regional National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-3* 8 p 12 refs

The Army is interested in setting vibration specifications as a means to insure that pilot, copilot, and crew are able to perform whatever tasks they have to accomplish to make their mission a success Mission tasks vary in different flight regimes and for different missions The level of vibration which will interfere with task performance will vary consequently with flight regime and mission, and, correspondingly, the vibration specifications should vary also Investigations related to an establishment of suitable vibration specifications for Army helicopters are discussed, taking into account ride quality research, the intrusion index, flight test results, and Army ride quality specifications The results of the study show that the Army has achieved marginally acceptable vibration related ride quality on its operational helicopters G R

A82-37780 The Helicopter Ride Revolution. R W Balke (Bell Helicopter Textron, Fort Worth, TX) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-4* 15 p 33 refs

It is pointed out that the Helicopter Ride Revolution began in earnest with the stringent requirements of a draft in 1971 It will conclude with the achievement by the helicopter industry of a jet-smooth ride by the end of the century The major technological milestones which must be met to achieve this goal on schedule are developed through an evaluation of the interdependence of design and analytical techniques and the duration of a typical system-acquisition cycle The 30 years between the first impetus in 1971 and the year 2000, when the first helicopters with a jet-smooth ride are scheduled for completion, can be characterized by three 10-year periods, including the reactive era, the technological development era, and the application or maturity era For the achievement of a jet-smooth ride it will be necessary that the vibration levels, along all axes and across the frequency band, be equivalent to those of a typical jetliner In addition, all other factors affecting the sensory perceptions must also be equivalent G R

A82-37781 Improved methods in ground vibration testing. E J Nagy (Kaman Aerospace Corp , Bloomfield, CT) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-6* 10 p

Methods and procedures developed during ground vibration testing of an Army AH-1G helicopter airframe, which improve the validity of the test results and establish certain ground rules for the performance of this type of testing, are described The optimum excitation technique is found to be the logarithmic swept sinusoidal testing after the initial locations of modal natural frequencies are found with the random excitation technique Forcing levels need to be increased to levels unheard of in the industry (at least 300 lb) in order to reach the true linear range of the airframe Various sources of error are identified, including the high frequency residual (local mode) effect which may or may not appear at the various driving points of the structure The use of the autospectra, the coherence function, the transfer function, and the input and output signals displayed on a dual-channel oscilloscope are means of verification that good mobility spectra will be available for determination of the global parameters N B

A82-37782 Determination of in-flight helicopter loads and vibration. N Giansante, R Jones (Kaman Aerospace Corp , Bloomfield, CT), and N J Calapodas (U S Army, Applied Technology Laboratory, Fort Eustis, VA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-7* 8 p

It is pointed out that the helicopter industry has generally experienced difficulty in making analytical predictions of airframe vibrations A number of approaches have been developed in an attempt to solve the problems of helicopter vibratory response prediction The present investigation had the objective to explore merits and suitability of these approaches One technique, called Force Determination methodology, was found to make it possible to determine successfully the magnitudes and phase angles of vibratory forces acting on AH-1G airframe The 'Automated Dynamic Analytical Model Improvement Technique' could be implemented to improve a NASTRAN model of the AH-1G airframe The calculated forces were applied to the improved NASTRAN Analytical model and the predicted accelerations were in agreement with accelerations measured on the AH-1G airframe in flight G R

A82-37783 * # Design and evaluation of a state-feedback vibration controller. R W Du Val (NASA, Ames Research Center, Moffett Field, CA), C Z Gregory, Jr, and N K Gupta (Integrated Systems, Inc, Palo Alto, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-10* 14 p

The effectiveness and practicality of the state-feedback vibration controller is demonstrated by computer simulations It is shown that (1) the required measurements can be reduced to fuselage accelerations, (2) the system is stable over a wide range of flight conditions, (3) a discrete design for the controller provides effective digital implementation at 80-Hz sampling, (4) attenuation produced by the actuators does not create a problem, and a simple lead compensator provides vibration reduction, and (5) a design based on a hover model worked well at five knots At 40 and 120 knots, vibrations in all but the vertical acceleration were effectively suppressed The state-feedback vibration controller has a rapid convergence time and implementation is easier than with multicyclic control since no on-line harmonic analysis or identification algorithms are required C D

A82-37784 Rotor state estimation for rotorcraft. J W Fuller *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-11* 10 p 8 refs

Studies of rotor control indicate that helicopter ride quality in gusty conditions can be significantly improved if rotor state feedback is used in an automatic flight controller The present investigation is concerned with the design of an algorithm for estimating tip-path plane (TPP), and TPP rate for use in a feedback controller, given blade flapping measurements The presence of the direct rotor measurements means that the estimator does not need to rely on detailed knowledge of helicopter and rotor dynamics Therefore, a simple model of rotor dynamics is used One problem still remains The measurement equations, relating the measurements to the TPP states, are periodically time-varying Current steady-state estimator synthesis techniques require time-invariant system equations This problem is solved by analytically determining a coordinate transformation which converts the system equations to time-invariant forms G R

A82-37785 * A simple system for helicopter individual-blade-control and its application to stall-induced vibration alleviation. N D Ham and T R Quackenbush (MIT, Cambridge, MA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-12* 10 p NASA-sponsored research

A new, advanced type of active control for helicopters and its application to a system for stall flutter suppression is described The system, based on previously developed M I T Individual-Blade-Control hardware, employs blade-mounted accelerometers to sense torsional oscillations and feeds back rate information to increase the damping of the first torsion mode A linear model of the blade and control system dynamics is used to give qualitative and quantitative guidance in the design process as well as to aid in analysis of experimental results System performance in wind tunnel tests is described and evidence is given of the system's ability to provide substantial additional damping to stall-induced blade oscillations (Author)

A82-37786 * # Considerations of open-loop, closed-loop, and adaptive multicyclic control systems I Chopra (NASA, Stanford Joint Institute for Aeronautics and Acoustics, Stanford University, Stanford, CA) and J L McCloud, III (NASA, Ames Research Center, Moffett Field, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-13* 23 p 8 refs

Four different types of self-tuning regulators were studied for multicyclic control of helicopter vibration A numerical simulation of the helicopter is made, using a multivariable frequency-domain model, in terms of transfer function with six input control harmonics and six output harmonics The model characteristics vary with flight speed An off-line identification of model characteristics is made, using the least-squared-error method and using a succession of input and output measurements The on-line identification of model characteristics is made using the Kalman filter solution The optimal controls are calculated from the minimization of quadratic performance function based on response and multicyclic inputs The performance of various regulators or controllers is judged from the stability, transient response, convergence time, and amplitude of the steady state C D

A82-37787 Total main rotor isolation system D R Halwes (Bell Helicopter Textron, Fort Worth, TX) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-15* 8 p

An analytical study is described in which six LIVE (Liquid Inertia Vibration Eliminator) isolator elements are combined to establish the requirements, preliminary design, and verification procedures for a total main rotor isolation system at n/rev This approach provides the high potential for total isolation in all degrees of freedom necessary for any type rotor system without excessive weight and complexity The LIVE system has numerous advantages over mechanical inertia isolators, including reduced complexity, no bearings, a smaller envelope for installation, linear response at high g's, and much lower weight and cost Analysis of the system after installation in a 206 LM helicopter showed better than 95% isolation for a weight penalty of less than 3/4% of design gross weight N B

A82-37788 Flight demonstration of an integrated floor/fuel isolation system. R Gabel, P Teare, and R A Desjardins (Boeing Vertol Co, Philadelphia, PA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-16* 11 p

A vibration isolation system has been developed for the passenger cabin and the long range fuel tanks of the Boeing Commercial Chinook The passenger floor is isolated from the airframe on a series of passive isolation units The fuel tanks are also isolated so that their varying dynamic mass is effectively nulled at all fuel levels, thereby avoiding any deleterious effects on airframe natural frequency placement Analyses, component tests, an aircraft shake test and now flight tests have verified the effectiveness of the system Passenger cabin vibration levels are below 0 05 g at the 135 knot cruise speed and beyond These flight vibration levels are insensitive to fuel quantity, despite variation from 14,000 lb down to reserve (Author)

A82-37789 Semi-active fluid inertia - A new concept in vibration isolation. D L Margolis (California, University, Davis, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-17* 14 p 10 refs

A vibration isolation system which features semi-active control of fluid inertia for broad-band applications on helicopter rotor inputs is described Semi-active control theory is reviewed, along with the skyhook concept in a continuously variable configuration The fluid inertia based isolator is modeled numerically, noting that the use of a variable orifice and a control strategy presents a nonlinear control problem The actual proposed device consists of a cylinder of fluid with a piston, connected by means of a long tube to some mass The fluid-filled tube is an effective mass which provides isolation performance from, for example, helicopter downwash Modulating the orifice in the tube allows the semi-active control Applications during take-off and landing phases of flight, when variable engine speeds are encountered, are indicated M S K

A82-37790 Assessment of the dynamic response of a structure when modified by the addition of mass, stiffness or dynamic absorbers. S P King (Westland Helicopters Ltd, Yeovil, Somerset, England) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-18* 10 p

An algorithm suitable for estimating the modes and frequencies created by the introduction of reconfigured fuselages and mass spring systems to a new helicopter during the design and development phases is presented The new modes are expressed as linear combinations of known modes and the degree of coupling resulting from the projected structural changes can be assessed Application of the algorithm for the case of added stiffness is made, along with examples of added mass or an absorber It is shown that the model is useful for examining the effects of varying the same parameter and also for determining the additive effects of a number of structural modifications Comparison with the outcome of an eigenvalue analysis shows good agreement for a 39 degree of freedom two-dimensional lumped parameter model, with the algorithm underestimating the frequency reduction M S K

A82-37791 Monofilar - A dual frequency rotorhead absorber. T Mouzakis (United Technologies Corp, Sikorsky Aircraft Div, Stratford, CT) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-20* 9 p

A monofilar absorber is centrifugally tuned two degree of freedom device which reacts and reduces vibratory forces at two frequencies using a single active mass A mathematical model of the monofilar is presented together with both linear and nonlinear equations of motion It is shown that the desired natural frequencies (3P and 5P for a four bladed rotor) can be obtained with physically achievable mass, inertia and geometric properties and that the performance of the monofilar is equivalent to that of a standard bifilar Therefore, the monofilar absorber design will allow reductions in weight, parts, maintenance and production costs, relative to the conventional bifilar absorber (Author)

A82-37792 # A finite element analysis of coupled rotor fuselage vibration. M J Rutkowski (U S Army, Aeromechanics Laboratory, Moffett Field, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-21* 15 p 6 refs

The dynamic coupling between the rotor system and the fuselage of a simplified helicopter model in hover is investigated The rotor-fuselage model is based on a two-degrees-of-freedom beam finite element with polynomial mass and stiffness properties The linear matrix equations of motion for the system include centrifugal stiffness and quasi-steady aerodynamic damping matrices for the rotor elements and structural damping matrices for both rotor and fuselage elements Both real and complex eigenanalyses are carried out to obtain mode shapes and modal frequencies as a function of rotor speed Forced-response vibration results for the case of a radially uniform, harmonic load applied to the rotor are also described The uncoupled rotor-fuselage frequencies in vacuo are poor approximations to the actual coupled frequencies near rotor-fuselage frequency coalescence, but including rotor aerodynamic design provides some improvement The magnitude of the resonant response at the fuselage mode frequencies is highly dependent on their proximity to the blade mode frequencies C D

A82-37793 A unified approach to helicopter NASTRAN modeling. J J Brown, R A Christ, K L Kilroy, and G R Parker (Hughes Helicopters, Inc , Culver City, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-22* 8 p

An approach unifying stress and dynamics analysis is presented A common stress model is employed along with an automated method of assembling the mass data, and a variation of the subspace iteration technique is used to reduce the dynamic equations, resulting in timely, economical turnaround of any design changes and elimination of the problems associated with the use of two models The dynamics group adds mass data to the stress model to form the dynamic model, while the structures department develops and maintains a common NASTRAN bulk data base accessed by both groups The basic model supplies the stiffness data to predict internal loads for the stress analyst and to calculate modal data for the dynamicist Structural and nonstructural mass data are processed separately before being combined and added to the stiffness model to produce the dynamic model Application to the AHIP aircraft is demonstrated C D

A82-37794 # A nonlinear response analysis for coupled rotor-fuselage systems. D L Kunz (U S Army, Aeromechanics Laboratory, Moffett Field, CA) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-23* 22 p 11 refs

The governing equations for a fully coupled, rotor-fuselage vibration model are derived There are three sets of equations involved First are the equations of motion for a uniform, elastic blade that can undergo flap and lead-lag bending deflections The second set of equations comprises the hub-load equations For both the blade and hub-load equations, the aerodynamic forces are derived from quasi-steady strip theory In modeling the fuselage, beam finite-elements and generalized isolator elements are used to generate the third set of equations, the fuselage equations of motion The blade and fuselage responses, as well as the hub loads, are computed by an iterative, combined harmonic-balance, impedance-matching method In addition, the uncoupled blade and fuselage modes and frequencies, which are by-products of the blade and fuselage analyses, and the coupled system natural frequencies may be obtained (Author)

A82-37795 * Substructure program for analysis of helicopter vibrations. R Sopher (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-24* 21 p 12 refs Contract No NAS1-16058

A substructure vibration analysis which was developed as a design tool for predicting helicopter vibrations is described The substructure assembly method and the composition of the transformation matrix are analyzed The procedure for obtaining solutions to the equations of motion is illustrated for the steady-state forced response solution mode, and rotor hub load excitation and impedance are analyzed Calculation of the mass, damping, and stiffness matrices, as well as the forcing function vectors of physical components resident in the base program code, are discussed in detail Refinement of the model is achieved by exercising modules which interface with the external program to represent rotor induced variable inflow and fuselage induced variable inflow at the rotor The calculation of various flow fields is discussed, and base program applications are detailed C D

A82-37796 * Determination of rotor wake induced empennage airloads. S T Gangwani (United Technologies Research Center, East Hartford, CT) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-26* 16 p 10 refs Army-supported research, Contract No NAS1-16058

A computer program has been developed that predicts the unsteady aerodynamic forces that impinge on the empennage surface due to its interactions with the main rotor wake The program was utilized to determine the vibration airloads acting on the Black Hawk horizontal stabilizer and on the CH-53A stabilizer under high speed forward flight conditions The results demonstrate that it is possible to compute the high frequency empennage vibration airloads efficiently by utilizing suitable analysis techniques, a CH-53A case required only 1 3 minutes of computer time Numerical problems associated with the unsteady Kutta condition have been minimized Even though the analysis is of transient nature, the results for harmonic cases show a very fast convergence to periodicity In general, good correlation was shown between the predicted vibratory airloads and the measured stabilizer airloads for a CH-53A helicopter operating at high speed flight conditions C D

A82-37797 Use of optimization in helicopter vibration control by structural modification G T S Done (City University, London, England) *American Helicopter Society, Northeast Region National Specialists' Meeting on Helicopter Vibration Technology for the Jet Smooth Ride, Hartford, CT, Nov 2-4, 1981, Preprint 81-27* 8 p 7 refs Research sponsored by Westland Helicopters Ltd , and Royal Aircraft Establishment

A method is described of computing the structural changes necessary to reduce the vibration in part of a helicopter fuselage subject to a constant frequency excitation at the rotor head The method is applied to a simple two-dimensional 60 degree of freedom model A number of structural parameters considered suitable candidates for change are selected, and then values of these parameters are computed using an optimization routine such that a function involving the response over part of the structure is minimised The results provide the basis for useful discussion on various aspects of the selection and optimization exercises (Author)

A82-37832 # The DC-10 Chicago crash and the legality of SFAR 40 G Richard In Annals of air and space law Volume 6 (A82-37826 18-84) Montreal, McGill University, Toronto, Carswell Co , Ltd , Paris, Editions A Pedone, 1981, p 195-218 42 refs

Legal issues arising out of the invocation of SFAR 40 after the 1979 crash of a DC-10 passenger aircraft are discussed in terms of the effects on international agreements and on the Chicago convention The decision, made by the head of the U S agency, the FAA, grounded all foreign and domestic flights of DC-10s in the U S , thus extending sovereign jurisdiction to aircraft owned by other nations and/or foreign companies Standards for airworthiness established by the ICAO in signing the multinational Chicago Convention agreements are reviewed, and it is noted that empty foreign DC-10 aircraft were allowed to fly over the U S after the decision It is concluded that the decision to invoke the SFAR 40 provision was not legally sound because the head of the FAA had no jurisdiction over DC-10 aircraft under foreign registry M S K

A82-37854 * Performance of PTFE-lined composite journal bearings H E Sliney (NASA, Lewis Research Center, Cleveland, OH) and F J Williams (Rockwell International Corp , North American Aviation Div , Los Angeles, CA) *American Society of Lubrication Engineers, Annual Meeting, 37th, Cincinnati, OH, May 10-13, 1982, Preprint 82-AM-1A-1* 7 p 10 refs Contract No NAS3-22123
(Previously announced in STAR as N82-17263)

A82-37855 * Geometrical aspects of the tribological properties of graphite fiber reinforced polyimide composites. R L Fusaro (NASA, Lewis Research Center, Cleveland, OH) *American Society of Lubrication Engineers, Annual Meeting, 37th, Cincinnati, OH, May 10-13, 1982, Preprint 82-AM-5A-2* 11 p 21 refs
(Previously announced in STAR as N82-15198)

A82-37857 Wear by generation of electrokinetic streaming currents. T R Beck (Electrochemical Technology Corp , Seattle, WA) *American Society of Lubrication Engineers, Annual Meeting, 37th, Cincinnati, OH, May 10-13, 1982, Preprint 82-AM-6A-3* 6 p 16 refs

Hydraulic control valves in commercial aircraft are subject to 'erosion' in service with phosphate ester fluids, due to corrosion from generation of electrokinetic streaming currents This 'zeta corrosion' phenomenon is now well understood The theory is extended here to calculate current densities that would be generated on the surfaces of lubricated journal bearings and roller bearings Measurements of such current densities made with a disk electrode in a simulated journal bearing are in approximate agreement with the model Many aspects of bearing wear reported in the literature are consistent with the zeta corrosion mechanism (Author)

A82-37931 * # Chordwise and compressibility corrections for arbitrary planform slender wings. D Levin (NASA, Ames Research Center, Moffett Field, CA) and A Seginer (Technion - Israel Institute of Technology, Haifa, Israel) *AIAA Journal*, vol 20, Aug 1982, p 1025-1030 14 refs

The Lomax and Sluder method for adapting slender-wing theory to delta or rectangular wings by making chordwise and compressibility corrections is extended to cover wings of any arbitrary planform in subsonic and supersonic flows The numerical accuracy of the present work is better than that of the Lomax-Sluder results Comparison of the results of this work with those of the vortex-lattice method and Kernel function method for a family of Gothic and arrowhead wings shows good agreement A universal curve is proposed for the evaluation of the lift coefficient of a low aspect ratio wing of an arbitrary planform in subsonic flow The location of the center of pressure can also be estimated (Author)

A82-37945 # **Static and aeroelastic optimization of aircraft (Optimisation statique et aéroélastique des avions).** J M Thomas (Société Nationale Industrielle Aérospatiale, Toulouse, France) *Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, International Symposium on Aeroelasticity, Nuremberg, West Germany, Oct 5-7, 1981, Paper* 9 p In French

Techniques for the finite element modeling of the static and aeroelastic stresses on an aircraft are described The methods are intended to serve to define sustainable loads in aircraft structures which are built with minimized weight Attention is focussed on the components of the ASELF program, which comprises analyses of linear and nonlinear statics, crack propagation, thermal effects and static and dynamic aeroelastic characteristics Partial derivatives are obtained for the displacements, elastic, principal, and equivalent stresses, the rupture criteria, panel buckling, and internal interactions between groups of elements Constraints are placed on the optimization through formulation of the displacements, a rigidity matrix, and a determination of the external stresses An optimization example is provided for a composite sheets bordering openings in the aircraft or in the empennage using 1952 degrees of freedom with 3684 elements M S K

A82-37946 # **Survey of active and passive means to reduce rotorcraft vibrations.** G Reichert and H Strehlow (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany) *Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, International Symposium on Aeroelasticity, Nuremberg, West Germany, Oct 5-7, 1981, Paper* 50 p 56 refs

Methods employed and proposed for reducing rotorcraft vibrations are reviewed, with attention given to development and test programs Active vibration isolators such as force generators, springs, and dampers are noted to possess advantages over passive systems, due to the ability to supply variable power, to react to many variables in a local force, and modifiability to meet performance specifications Sources of rotorcraft vibrations are identified, along with options for controlling the vibrations, structural tuning, dynamic absorbers in the rotating and nonrotating system, rotor isolation, and multicyclic pitch or twist control The underlying principle is compensation, enacted by producing harmonic forces to offset disturbances The use of passive antiresonant force isolators as connecting members between the rotor-transmission unit and the fuselage is discussed as an effective combination of spring passive force generator M S K

A82-37947 **F-16 active flutter suppression program.** R P Peloubet, Jr, R L Haller, and R M Bolding (General Dynamics Corp, Fort Worth, TX) *Deutsche Forschungs- und Versuchsantstalt für Luft- und Raumfahrt, International Symposium on Aeroelasticity, Nuremberg, West Germany, Oct 5-7, 1981, Paper* 14 p 12 refs Contracts No F33615-77-C-3081, No F33615-80-C-3210

The F-16 military aircraft is required to carry a very large number of external store configurations, and new store configurations are continuously being added to its inventory Therefore, the probability increases that eventually store configurations might be added which would cause wing/store flutter that could not be easily stabilized by passive means The F-16 flutter suppression program has the objective to develop the technology for a flutter suppression system (FSS) which could be employed in case such stabilization difficulties with the F-16 should occur Attention is given to an overview of an F-16 FSS feasibility study, a description of an analog study of a technique for measuring the FSS open-loop frequency response functions (FRF) during wind tunnel tests, a description of wind tunnel tests of the F-16 flutter suppression model which were conducted from 27 January through 8 February 1979, and planned wind tunnel tests to be conducted during the fall of 1981 G R

A82-37969 **USAF ACES II progress report** R C Delgado (USAF, Air Force Inspection and Safety Center, Norton AFB, CA) *SAFE Journal,* vol 12, Summer 1982, p 10-12

A review of the operational experience for the Advanced Concept Ejection Seat (ACES II), in operational use in USAF aircraft since 1978, is presented The ejection survival rate using the ACES II (83%) exceeds the rate for other USAF escape systems (74%) Moreover none of the fatalities can be attributed to the ACES II seat In addition, the major injury rate for the ACES II was only 4%, compared to others 17% A series of tables providing injury definitions as well as statistical data (ejection speed, ejection altitude, etc) are presented N B

A82-37970 **Lear Fan 2100 egress system.** D W Newton (Lear Fan Corp, Reno, NV) *SAFE Journal,* vol 12, Summer 1982, p 18-22

This paper describes the crew emergency egress system developed and installed on the Lear Fan 2100 flight test prototype The unique configuration of the airplane, which includes a large Y tail and aft mounted propeller, required development of a method of escape which would assure positive clearance of crewmembers from the airframe during a bailout The total system which was developed includes an explosive door removal system, a crewmember rocket extraction system, and a seat mover system to transport the crewmember to the escape opening The philosophy which led the company to develop this particular system, together with its advantages and limitations, is discussed The system is unique in general aviation aircraft, and represents a considerable advancement in emergency escape capability for such aircraft Extensive testing of the system, including explosive cutting tests of the graphite/epoxy airframe structural members, a stationary test of the extraction system, and a 350 knot jet sled test, was conducted and is described (Author)

A82-37972 # **Strategic materials - Technological trends.** A Hurlich *Mechanical Engineering,* vol 104, July 1982, p 44-53 5 refs

The US is becoming increasingly dependent upon other countries for sources of strategic materials - raw materials such as cobalt, aluminum, manganese and chromium needed to supply military, industrial and civilian needs during a national emergency and found domestically in insufficient quantities Various ways of reducing the US vulnerability in these strategic materials are reviewed, emphasizing technological methods to reduce consumption The use of recycling, scrap recovery and conversation methods is expanding, but these efforts are insufficient Another approach is to develop materials management programs, such as devising lists of alternative materials that may be used in case the normally used materials become unavailable, and strategic planning to limit the use of critical materials that may pose serious problems if their supply is interrupted New materials and technologies are being developed and tested to reduce as much as possible the use of strategic materials - such as reducing the amount of chromium in certain stainless steels from 12-18% to 2-6% The use of near net shape technology also can save large amounts of materials by eliminating trimming waste Investigation and development of possible substitutes for strategic materials are now being conducted by government agencies and private industry Finally, stockpiling is mentioned as a way to ensure adequate supplies when no substitutes are available N B

A82-38025 **The recognition of air worthiness of aircraft - Comments to a remarkable judicial decision (Zur Anerkennung der Lufttüchtigkeit von Flugzeugen - Bemerkungen zu einem bemerkenswerten Urteil).** A Rudolf *Zeitschrift fur Luft- und Weltraumrecht,* vol 31, June 1982, p 124-128 15 refs In German

A judicial decision made by the U S Court of Appeals is discussed, taking into consideration the question whether a German judge might have arrived at the same decision as the American judge, and the legal consequences of such a decision The considered decision is related to a complaint filed by foreign airlines with respect to an act of the Federal Aviation Agency (FAA) After an aircraft accident involving the loss of a U S DC-10 airliner on May 25, 1979, at Chicago, the FAA had prohibited for U S airspace the operation of all DC-10 aircraft, including those registered in foreign countries The plaintiffs maintain that this act would constitute a violation of Article 33 of the Chicago Convention, which, in its turn, would violate Paragraph 1102 FAAct The Court agreed with the plaintiffs G R

A82-38077 * **Development and validation of preliminary analytical models for aircraft interior noise prediction.** L D Pope, D C Rennison (Bolt Beranek and Newman, Inc, Canoga Park, CA), C M Willis, and W H Mayes (NASA, Langley Research Center, Hampton, VA) *Journal of Sound and Vibration,* vol 82, June 22, 1982, p 541-575 19 refs Contract No NAS1-15782

Predictions are made of the transmission of sound into an unpressurized and unstiffened cylinder under random and harmonic excitations, in order to validate the preliminary version of an airplane interior noise prediction model which is based on an analysis of the power flow type The predictions are compared to experimental results, and statistically significant differences between predictions and measurements are found to be primarily due to input data deficiencies Because the model requires only the value of a simple integral for determining interior spatial coupling, and resonance frequencies to determine frequency coupling, the known dynamics of the fuselage can be utilized without difficulty O C

STAR ENTRIES

N82-26199*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
JOINT UNIVERSITY PROGRAM AIR FOR TRANSPORTATION RESEARCH, 1981
Jun 1982 235 p refs Proc of a Conf held at Washington D C, 11 Dec 1981
(Grants NGL-22-009-640 NGR-36-009-017, NGL-31-001-252)
(NASA-CP-2224 L-15346 NAS 1 55 2224) Avail NTIS HC A11/MF A01 CSCL 01B

Navigation, guidance control and display concepts, and hardware with special emphasis on applications to general aviation aircraft are discussed

N82-26200*# Massachusetts Inst of Tech, Cambridge Flight Transportation Lab
DYNAMIC SCHEDULING OF RUNWAY OPERATIONS
John Pararas *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res, 1981 Jun 1982 p 7-13

Avail NTIS HC A11/MF A01 CSCL 01C

Automated ATM/C decision making is discussed Runway scheduling and flight plan generator algorithms are considered Terminal area geometry, ATM/C schematics, vector controller display and simulation work are reported N W

N82-26201*# Massachusetts Inst of Tech, Cambridge Flight Transportation Lab
PPOD PROGRAMMABLE PILOT-ORIENTED DISPLAY
Antonio L Elias *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res, 1981 Jun 1982 p 15-30
Avail NTIS HC A11/MF A01 CSCL 01D

A general-purpose low cost research microprocessor system for general aviation was developed This system is intended to be the vehicle for individual research efforts in low cost airborne hardware and software as well as advanced microprocessor based navigation systems and techniques Two such research projects were undertaken, yielding results in the areas of micro hardware/software design, cost and performance, and pilot/computer interface Low-cost flight software reliability and a time-difference based Loran approach procedure that eliminates the need for propagation corrections and latitude/longitude transformations are also discussed Author

N82-26202*# Massachusetts Inst of Tech, Cambridge Flight Transportation Lab
THE P-POD PROJECT Progress Report
James A Littlefield *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 31-37
Avail NTIS HC A11/MF A01 CSCL 01D

The programmable pilot oriented display (P-POD), a multiprocessor based flight information processing and display unit, is discussed Communication protocols between the three Z-80 processors inside P-POD are reviewed The interface between the video processor, P2, and the main processor, P1, was tested Hardware and software were revised Data flow between P1 and P2 is illustrated While running diagnostic routines to exercise the P1/P2 interface at maximum speed an intermittent failure was observed A check of possible noise sources or race conditions in the hardware did not reveal the source of this failure Possible software timing problems were also fully investigated To eliminate the effects of this type of failure a performance monitor routine was used to detect these occasional failures and correct them The data transmission cycle between P1/P2 is either allowed to continue normal operation or is re-initialized and restarted when an error is detected N W

N82-26203*# Massachusetts Inst of Tech, Cambridge Flight Transportation Lab
MICROWAVE ICE PREVENTION
R John Hansman, Jr and Walter Hollister *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res, 1981 Jun 1982 p 39-51

Avail NTIS HC A11/MF A01 CSCL 01C

The concept of using microwave energy to provide aircraft ice protection, specifically an anti-icing system, and the feasibility of such a system are discussed In a microwave anti-icing system impinging supercooled water droplets are heated to above freezing by the resonant absorption of microwave energy located upstream of the aircraft This process is inherently more efficient than existing anti-icing devices due to the saving of the latent heat of fusion (a substantial 334 joules/gm (80 cal/gm)) and the fact that only the droplets are heated, thereby reducing convective losses to the air Author

N82-26204*# Ohio Univ, Athens Avionics Engineering Center
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT OHIO UNIVERSITY, 1981
Richard H McFarland *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 55-72 refs
Avail NTIS HC A11/MF A01 CSCL 01C

The increased availability of Loran signals in the United States encouraged consideration of Loran for airborne applications High quality ignal processing to obtain effective signal-to-noise ratios which permit good reliability in position determination consistent with airborne applications is considered Techniques for deriving air navigation quality information from Loran-C were investigated N W

N82-26206*# Ohio Univ Athens Avionics Engineering Center
LORAN-C PLOTTING PROGRAM FOR PLOTTING LINES OF POSITION ON STANDARD CHARTS
James P Roman *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res, 1981 Jun 1982 p 93-114 ref
Avail NTIS HC A11/MF A01 CSCL 17G

A set of programs designed to be run on the IBM System/370 computer is described These programs are used to plot Loran-C lines of position (LOP) on any common map or standard aviation sectional chart The Loran-C plotting program JRPLOT FORTRAN uses a standard Calcomp-compatible plotting subroutine package for the Hewlett-Packard 7203A graphic plotter A general description of the features of the Loran-C plotting program This program involves a simple add/substrate method to calculate the LOP A description on how to use the program and some methods of operation are included Author

N82-26207*# Ohio Univ Athens Avionics Engineering Center
A LORAN-C PROTOTYPE NAVIGATION RECEIVER FOR GENERAL AVIATION
Robert W Lilley and Daryl L McCall *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 115-137 refs

Avail NTIS HC A11/MF A01 CSCL 17G

An automatic gain control has been designed and fabricated to operate with the Loran-C prototype receiver and data collection system Author

N82-26208*# Ohio Univ, Athens Dept of Electrical Engineering
A LORAN-C PROTOTYPE NAVIGATION RECEIVER FOR GENERAL AVIATION
Robert W Lilley and Daryl L McCall *In* NASA Langley Research Centeer Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 121-137 refs

Avail NTIS HC A11/MF A01 CSCL 17G

The design fabrication and evaluation of a prototype Loran-C receiver is described Hardware and microcomputer programming for addition of area navigation capability are reported The receiver is an envelope processor offering simplicity of RF processor circuitry Author

N82-26209*# Ohio Univ Athens Avionics Engineering Center
COMMUTATED AUTOMATIC GAIN CONTROL SYSTEM

Stephen R Yost *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 139-155 refs
Avail NTIS HC A11/MF A01 CSCL 17G

The commutated automatic gain control (AGC) system was designed and built for the prototype Loran-C receiver is discussed The current version of the prototype receiver the Mini L-80 was tested initially in 1980 The receiver uses a super jolt microcomputer to control a memory aided phase loop (MAPLL) The microcomputer also controls the input/output latitude/ longitude conversion and the recently added AGC system The AGC control adjusts the level of each station signal such that the early portion of each envelope rise is about at the same amplitude in the receiver envelope detector Author

N82-26210*# Ohio Univ Athens Avionics Engineering Center
A PROTOTYPE INTERFACE UNIT FOR MICROPROCESSOR-BASED LORAN-C RECEIVER
Stanley M Novacki, III *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res, 1981 Jun 1982 p 157-164 refs

Avail NTIS HC A11/MF A01 CSCL 17G

A data/command entry ASCII keypad with a CRT display capable of alphanumeric and graphics mode operation which provides specialized data entry and graphics mode operation which receiver/processor was developed This unit will replace conventional communication terminal to simplify receiver operations to a level typical of current avionics systems E A K

N82-26212*# Princeton Univ N J Dept of Mechanical and Aerospace Engineering
INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT PRINCETON UNIVERSITY, 1981
Robert F Stengel *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 181-187 refs
Avail NTIS HC A11/MF A01 CSCL 01C

A summary of the air transportation technology program is presented The following topics were examined (1) fuel use characteristics of general aviation aircraft (2) dead-reckoning concept incorporating a fluidic rate sensor (3) experimentation with an ultrasonic altimeter (4) development of laser-based collision avoidance systems (5) flight path reconstruction from sequential DME data (6) application of fiber optics in flight control systems, and (7) voice recognition inputs for navigation/ communication receiver tuning E A K

N82-26213*# Princeton Univ N J
FLYING QUALITIES CRITERIA FOR GA SINGLE PILOT IFR OPERATIONS
Aharon Bar-Gill *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 189-210
Avail NTIS HC A11/MF A01 CSCL 17G

The flying qualities criteria in general aviation (GA) to decrease accidents are discussed The following in-flight research is discussed (1) identification of key aerodynamic configurations, (2) implementation of an in-flight simulator (3) mission matrix design (4) experimental systems, (5) data reduction (6) optimal flight path reconstruction Some of the accomplished work is reported an integrated flight testing and flight path reconstruction methodology was developd high accuracy in trajectory estimation was achieved with an experimental setup and a part of the flight test series was flown E A K

N82-26214*# Princeton Univ N J
AIR DATA MEASUREMENT USING DISTRIBUTED PROCESSING AND FIBER OPTICS DATA TRANSMISSION
Kristin A Farry *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 211-217
Avail NTIS HC A11/MF A01 CSCL 01D

Distributed processing fiber optics technology, and redundancy management in the aircraft environment are discussed The project features the development of an angle-of-attack and sideslip data collection system hich features (1) two independent microprocessor controlled data collection and calibration units (2) transmission of data to the control system on a fiber optic data bus and (3) software implemented error detection and recovery E A K

N82-26215*# Princeton Univ N J
INPUT/OUTPUT MODELS FOR GENERAL AVIATION PISTON-PROP AIRCRAFT FUEL ECONOMY
L M Sweet *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res 1981 Jun 1982 p 219-227

Avail NTIS HC A11/MF A01 CSCL 01C

A fuel efficient cruise performance model for general aviation piston engine airplane was tested The following equations were made (1) for the standard atmosphere (2) airframe-propeller-atmosphere cruise performance and (3) naturally aspirated engine cruise performance Adjustments are made to the compact cruise performance model as follows corrected quantities corrected performance plots algebraic equations, maximize R with or without constraints and appears suitable for airborne microprocessor implementation The following hardwares are recommended ignition timing regulator fuel-air mass ration controller microprocessor sensors and displays E A K

N82-26216*# Princeton Univ N J
WIDE FIELD OF VIEW LASER BEACON SYSTEM FOR THREE DIMENSIONAL AIRCRAFT RANGE MEASUREMENTS
E Y Wong *In* NASA Langley Research Center Joint Univ Program for Air Transportation Res, 1981 Jun 1982 p 229-236

Avail NTIS HC A11/MF A01 CSCL 20E

A system that measures accurately the distance from an aircraft to a helicoper for rotor noise flight testing was developed The system measures the range and angles between two aircraft using laser optics This system can be applied in collision avoidance robotics and other measurement critical tasks E A K

N82-26217*# National Aeronautics and Space Administration Langley Research Center Hampton Va
EFFECTS OF WING-LEADING-EDGE MODIFICATIONS ON A FULL-SCALE, LOW-WING GENERAL AVIATION AIRPLANE WIND-TUNNEL INVESTIGATION OF HIGH-ANGLE-OF-ATTACK AERODYNAMIC CHARACTERISTICS
William A Newsom Jr Dale R Satran and Joseph L Johnson Jr Jun 1982 107 p refs
(NASA-TP-2011 L-15101 NAS 1 60 2011) Avail NTIS HC A06/MF A01 CSCL 01A

Wing-leading-edge modifications included leading-edge droop and slat configurations having full-span partial-span or segmented arrangements Other devices included wing-chord extensions fences and leading-edge stall strips Good correlation was apparent between the results of wind-tunnel data and the results of flight tests on the basis of autorotational stability criterion for a wide range of wing-leading-edge modifications T M

N82-26218*# Spectron Development Labs Inc Costa Mesa Calif
OPERATING MANUAL HOLOGRAPHIC INTERFEROMETRY SYSTEM FOR 2 X 2 FOOT TRANSONIC WIND TUNNEL Final Report
James E Craig Nov 1981 58 p
(Contract NAS2-10297)
(NASA-CR-166344 NAS 1 26 166344 SDL-81-52002) Avail NTIS HC A04/MF A01 CSCL 01B

A holographic interferometer system was installed in a 2X2 foot transonic wind tunnel The system incorporates a modern 10 pps Nd YAG pulsed laser which provides reliable operation and is easy to align The spatial filtering requirements of the unstable resonator beam are described as well as the integration of the system into the existing Schieren system A two plate holographic interferometer is used to reconstruct flow field data For static wind tunnel models the single exposure holograms are recorded in the usual manner however for dynamic models such as oscillating airfoils, synchronous laser hologram recording is used S L

N82-26219*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
SUMMARY AND RECENT RESULTS FROM THE NASA ADVANCED HIGH SPEED PROPELLER RESEARCH PROGRAM
Glenn A Mitchell and Daniel C Mikkelson 1982 35 p refs Presented at the 18th Joint Propulsion Conf Cleveland, 21-23 Jun 1982 sponsored by AIAA SAE and ASME
(NASA-TM-82891, E-1269 NAS 1 15 82891) Avail NTIS HC A03/MF A01 CSCL 01B

Advanced high-speed propellers offer large performance improvements for aircraft that cruise in the Mach 0 7 to 0 8 speed regime The current status of the NASA research program on high-speed propeller aerodynamics, acoustics, and aeroelastics is described Recent wind tunnel results for five 8- to 10-blade advanced models are compared with analytical predictions Test results show that blade sweep was important in achieving net efficiencies near 80 percent at Mach 0 8 and reducing near-field cruise noise by dB Lifting line and lifting surface aerodynamic analysis codes are under development and some initial lifting line results are compared with propeller force and probe data Some initial laser velocimeter measurements of the flow field velocities of an 8-bladed 45 deg swept propeller are shown Experimental aeroelastic results indicate that cascade effects and blade sweep strongly affect propeller aeroelastic characteristics Comparisons of propeller near-field noise data with linear acoustic theory indicate that the theory adequate predicts near-field noise for subsonic tip speeds but overpredicts the noise for supersonic tip speeds Potential large gains in propeller efficiency of 7 to 11 percent at Mach 0 8 may be possible with advanced counter-rotation propellers B W

N82-26220*# Goodyear Aerospace Corp Akron, Ohio
PRELIMINARY STUDY OF GROUND HANDLING CHARACTERISTICS OF BUOYANT QUAD ROTOR (BQR) VEHICLES Final Report
Ronald G E Browning Jul 1980 275 p refs
(Contract NAS2-10448)
(NASA-CR-166130 NAS 1 26 166130) Avail NTIS HC A12/MF A01 CSCL 01B

A preliminary investigation of mooring concepts appropriate for heavy lift buoyant quad rotor (BQR) vehicles was performed A review of the evolution of ground handling systems and procedures for all airship types is presented to ensure that appropriate consideration is given to past experiences Two buoyant quad rotor designs are identified and described An analysis of wind loads on a moored airship and the effects of these loads on vehicle design is provided Four mooring concepts are assessed with respect to the airship design wind loads and mooring site considerations Basing requirements and applicability of expeditionary mooring at various operational scenarios are addressed B W

N82-26221# Applied Science Associates Inc Valencia Pa
MAINTENANCE TRAINING SIMULATOR DESIGN AND ACQUISITION ISD-DERIVED TRAINING EQUIPMENT DESIGN Interim Report
Rohn J Hritz and George R Purifoy, Jr Brooks AFB, Tex AFHRL Feb 1982 80 p
(Contract F33615-78-C-0019 AF Proj 2361)
(AD-A110871 AFHRL-TP-81-52) Avail NTIS HC A05/MF A01 CSCL 05/9

A model for documenting training equipment designs derived from an Instructional System Development (ISD) analysis is presented The model contains blanks to be completed by the ISD analyst(s) Instructions for applying the model are provided A method for communicating a specific training equipment design to the Simulator System Program Office (SimSPO) after the ISD analysis has established a need for a maintenance trainer is provided The model provides the ISD analysts an opportunity to specify such design information as (1) characteristics of the target population who will use the trainer (2) a list of the training objectives to be achieved using the trainer (3) a list of the tasks to be practiced and/or acquired on the trainer and a list of the malfunctions to be presented by the trainer for isolation and/or correction (4) a scenario discussing how the trainer will be used to achieve the specified training objectives, (5) a list of the physical and functional characteristics of the components to be represented on the trainer and (6) a description of the instructional features required on the trainer to facilitate training objective achievement When utilized the model will standardize the communication between ISD and SimSPO personnel Author

N82-26222# Logistics Management Inst Washington, D C
THE SORTIE-GENERATION MODEL SYSTEM VOLUME 1 EXECUTIVE SUMMARY
John B Abell Sep 1981 25 p 6 Vol
(Contract MDA903-80-C-0554)
(AD-A110897 LMI-DP101-Vol-1) Avail NTIS HC A02/MF A01 CSCL 15/5

The Sortie-Generation Model System provides the capability for relating aircraft spares and maintenance manpower levels to the maximal sortie-generation capability of tactical air forces over time Author (GRA)

N82-26223# Logistics Management Inst, Washington, D C
THE SORTIE-GENERATION MODEL SYSTEM VOLUME 2 SORTIE-GENERATION MODEL USER'S GUIDE
John B Abell, Robert S Greenberg, and Michael J Konvalinka Sep 1981 129 p 6 Vol
(Contract MDA903-80-C-0554)
(AD-A110898 LMI-DP101-Vol-2) Avail NTIS HC A07/MF A01 CSCL 15/5

This volume the second of six volumes, provides sufficient information to allow a user to run the Sortie-Generation Model (SGM) Volume III Sortie-Generation Model Analyst's Manual, describes the mathematical structures, derivations, assumptions, limitations, and data sources of the SGM at a very detailed level Volume IV Sortie-Generation Model Programmer's Manual, specifies the details of the computer programs file structures, job control language and operating environment of the SGM Volume V describes the maintenance subsystem and explains the construction of the maintenance input file to the SGM Volume VI describes the spares subsystem and shows a user how to build the spares file that is used by the SGM GRA

N82-26224# Logistics Management Inst, Washington, D C
THE SORTIE-GENERATION MODEL SYSTEM VOLUME 4 SORTIE-GENERATION MODEL PROGRAMMERS MANUAL
Michael J Konvalinka and John B Abell Sep 1981 193 p refs 6 Vol
(Contract MDA903-81-C-0166)
(AD-A110899 LMI-ML102-Vol-4) Avail NTIS HC A09/MF A01 CSCL 15/5

Sortie-Generation Model (SGM) Programmer's Manual, specifies the details of the computer programs, file structures, job control language, and operating environment of the SGM GRA

N82-26225# Logistics Management Inst Washington, D C
THE SORTIE-GENERATION MODEL SYSTEM. VOLUME 5 MAINTENANCE SUBSYSTEM
Robert S Greenberg Sep 1981 513 p 6 Vol
(Contract MDA903-81-C-0166)
(AD-A110815 LMI-ML102-Vol-5) Avail NTIS HC A22/MF A01 CSCL 15/5

The Sortie-Generation Model System provides the capability for relating aircraft spares and maintenance manpower levels to the maximal Sortie-generation capability of tactical air forces over time The maintenance subsystem estimates the maintenance manpower and performance input parameters for the queuing model that is embedded in the Sortie-Generation Model (SGM) System This subsystem estimates the failure rate, service rate, and number of servers for each work center in a maintenance organization Author (GRA)

N82-26226# Logistics Management Inst Washington, D C
THE SORTIE-GENERATION MODEL SYSTEM VOLUME 6 SPARES SUBSYSTEM
John B Abell and F Michael Slay Sep 1981 180 p refs 6 Vol
(Contract MDA903-81-C-0166)
(AD-A110900 LMI-ML102-Vol-6) Avail NTIS HC A09/MF A01 CSCL 15/5

The Sortie-Generation Model System provides the capability for relating aircraft spares and maintenance manpower levels to the maximal sortie-generation capability of tactical air forces over time This volume describes the process of constructing a spares data base for input to the Sortie-Generation Model Author (GRA)

N82-26234*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
LASER ANEMOMETER MEASUREMENTS IN AN ANNULAR

CASCADE OF CORE TURBINE VANES AND COMPARISON WITH THEORY
Louis J Goldman and Richard G Seashultz Jun 1982 47 p refs
(NASA-TP-2018 E-876 NAS 1 60 2018) Avail NTIS HC A03/MF A01 CSCL 01A

Laser measurements were made in an annular cascade of stator vanes operating at an exit critical velocity ratio of 0 78 Velocity and flow angles in the blade to blade plane were obtained at every 10 percent of axial chord within the passage and at 1/2 axial chord downstream of the vanes for radial positions near the hub, mean and tip Results are presented in both plot and tabulated form and are compared with calculations from an inviscid quasi three dimensional computer program The experimental measurements generally agreed well with these theoretical calculations, an indication of the usefulness of this analytic approach Author

N82-26235*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
STATIC INTERNAL PERFORMANCE CHARACTERISTICS OF TWO THRUST REVERSER CONCEPTS FOR AXISYMMETRIC NOZZLES
Laurence D Leavitt and Richard J Re Jun 1982 24 p refs
(NASA-TP-2025, NAS 1 60 2025) Avail NTIS HC A02/MF A01 CSCL 01A

The static performance of two axisymmetric nozzle thrust reverser concepts was investigated A rotating vane thrust reverser represented a concept in which reversing is accomplished upstream of the nozzle throat and a three door reverser concept provided reversing downstream of the nozzle throat Nozzle pressure ratio was varied from 2 0 to approximately 6 0 The results of this investigation indicate that both the rotating vane and three door reverser concepts were effective static thrust spoilers with the landing approach nozzle geometry and were capable of providing at least a 50 percent reversal of static thrust when fully deployed with the ground roll nozzle geometry Author

N82-26236*# National Aeronautics and Space Administration Langley Research Center Hampton Va
STEADY, OSCILLATORY, AND UNSTEADY SUBSONIC AND SUPERSONIC AERODYNAMICS, PRODUCTION VERSION 1 1 (SOUSSA-P1 1) VOLUME 2 USER/PROGRAMMER MANUAL ADDENDUM 1 ANALYTICAL TREATMENT OF WAKE INFLUENCE
Herbert J Cunningham Robert N Vesmarais and E Carson Yates Jr May 1982 3 p refs Addendum to NASA-CR-159131 See N80-29253
(Contract NAS1-14977)
(NASA-TM-84484 NAS 1 15 84484) Avail NTIS HC A02/MF A01 CSCL 01A

The influence of the trailing wake at each wing panel center is investigated The effect of the wake is calculated by analyzing the wake as being subdivided into trailing wake strips With the improved program there are two optional ways of calculating the wake effect and the choice is controlled by an added parameter KANW that is part of the input data S L

N82-26238*# Analytical Methods, Inc Redmond Wash
FLOWS OVER WINGS WITH LEADING-EDGE VORTEX SEPARATION
B M Rao and B Maskew Apr 1982 44 p refs
(Contract NAS1-16155)
(NASA-CR-165858 NAS 1 26 16585 Rept-8105) Avail NTIS HC A03/MF A01 CSCL 01A

The unsteady cross flow analogy reduces the steady three dimensional separation flow problem into an unsteady two dimensional flow problem in which the section shape changes with time The two dimensional VORSEP code is extended to the case of arbitrary body growth rates in order to generate the initial vortex structures for the three dimensional free vortex sheet (FVS) code Automatic procedures to reduce the wing geometry definition to a set of cross flow plane sections corresponding to the locations of the time step solutions and to generate the effective source distribution on each cross flow section to represent the section normal growth across the following steps are incorporated in the VORSEP code Also the wake shedding model is improved by adopting a redistribution scheme which improves the stability of the free sheet development with time The improved wake shedding model combined with the redistribution scheme alleviated the numerical instabilities associated with the vortex rollup S L

N82-26256# Rockwell International Corp, El Segundo, Calif Aerodynamic Group
SUPERSONIC CRUISE/TRANSONIC MANEUVER WING SECTION DEVELOPMENT STUDY Final Report, Aug. 1977 - Nov. 1979
Ellwood Bonner and Philip Gingrich Wright-Patterson AFB, Ohio AFWAL Jun 1980 77 p refs
(Contract F33615-77-C-3066 AF Proj 2404)
(AD-A110686, AFWAL-TR-80-3047) Avail NTIS HC A05/MF A01 CSCL 01/3

Computational aerodynamic design of advanced fighter wings with well-controlled transonic maneuver flow and high supersonic cruise efficiency is described Author (GRA)

N82-26258# Wright State Univ, Dayton, Ohio School for Medicine
UPDATE OF THE SUMMARY REPORT OF 1977-1978 TASK FORCE ON AIRCREW WORKLOAD Final Report, 1977 - 1979
William J Cox, Fay Gold, and Richard L Sulzer Washington FAA Apr 1981 82 p refs
(AD-A112547 DOT/FAA/RD-81/34, DOT/FAA/ASF-300-81/2) Avail NTIS HC A05/MF A01 CSCL 01/2

The 1978 summary of accident data from 1967 through 1976 has been extended through 1979 Comparing accident rates of aircraft types approved for operation by two crewmembers vs accident rates for those approved for operation by three crewmembers, no indication of a safety problem relating to crew size was found Over this three-year update period, accident rates per million departures were generally superior for the two-crew aircraft, the same result found for the earlier ten-year period This nominal superiority is not considered a necessary result of flight deck configuration since there are other important differences in the operating environments of the various aircraft A separate study has been made of the relationship between crew size and regulatory violations This study which is appended produced no evidence that aircraft with crew size of two are being flown with less compliance than aircraft with a crew size of three Author (GRA)

N82-26259# General Accounting Office Washington, D C Mission Analysis and Systems Acquisition Div
OPPORTUNITIES EXIST TO ACHIEVE GREATER STANDARDIZATION OF AIRCRAFT AND HELICOPTER SEATS
26 Feb 1982 7 p
(AD-A111718, GAO/MASAD-82-22) Avail NTIS HC A02/MF A01 CSCL 01/3

We reviewed the efforts of DOD and the services to standardize flight life-support equipment While formal management structures and informal agreements have resulted in several standardized life-support items, we found a proliferation of tactical aircraft and helicopter seat systems, the most expensive items of life-support equipment We believe that the past methods of acquiring seats have been costly that standardization opportunities have not been adequately defined and that for the most part standardization efforts undertaken have not been adequately organized planned and supported either by DOD or the services Increased management emphasis by the Under Secretary of Defense (Research and Engineering) and the services could increase standardization of aircraft seats and lower acquisition and support costs Implementation of the Deputy Secretary of Defense s April 30, 1981, initiatives, which recognized that increased standardization of subsystems and support systems cannot only reduce life-cycle costs but also increase reliability should result in additional economies Author (GRA)

N82-26260*# National Aeronautics and Space Administration Langley Research Center Hampton Va
MAGNETIC HEADING REFERENCE Patent Application
H Douglas Garner, inventor (to NASA) Filed 9 Apr 1982 19 p
(NASA-Case-LAR-12638-1, US-Patent-Appl-SN-367187) Avail NTIS HC A02/MF A01 CSCL 17G

The invention relates to devices which vectorally sum the output signals from two magnetometers on an aircraft to produce a signal which is indicative of the error in the heading of the aircraft This error in heading signal is used either by the pilot or an automatic control system to correct the heading The device for generating a signal indicative of the difference between the actual heading and the selected heading of a vehicle is described T M

N82-26261*# Systematics General Corp Sterling, Va Communications and Electronics Div
FREQUENCY SHARING BETWEEN PASSIVE SENSORS AND AERONAUTICAL RADIONAVIGATION SYSTEMS EMPLOYING GROUND TRANSPONDERS IN THE BAND 4 2 - 4 4 GHz
Norman F DeGroot Jan 1982 21 p
(Contract JPL-955956)
(NASA-CR-169041, NAS 1 26 169041, JPL-9950-661) Avail NTIS HC A02/MF A01 CSCL 17G
The 4 2 to 4 4 GHz band is reserved for radio altimeters aboard aircraft and for associated transponders on the ground A radar altimeter system which utilizes associated ground transponders is described and the feasibility of co-channel operation of such a system with a typical passive sensor is analyzed S L

N82-26262*# Systems Control, Inc Palo Alto, Calif
REAL-TIME SIMULATION OF AN AIRBORNE RADAR FOR OVERWATER APPROACHES Final Report, Nov 1980 - Nov 1981
J Karmarkar and D Clark Mar 1982 132 p
(Contract NAS2-10479)
(NASA-CR-166293, NAS 1 26 166293) Avail NTIS HC A07/MF A01 CSCL 17G
Software developed to provide a real time simulation of an airborne radar for overwater approaches to oil rig platforms is documented The simulation is used to study advanced concepts for enhancement of airborne radar approaches (ARA) in order to reduce crew workload improve approach tracking precision and reduce weather minimums ARA's are currently used for offshore helicopter operations to and from oil rigs Author

N82-26263*# Colorado State Univ Fort Collins Dept of Mechanical Engineering
STUDY OF THE GLOBAL POSITIONING SYSTEM FOR MARITIME CONCEPTS/APPLICATIONS STUDY OF THE FEASIBILITY OF REPLACING MARITIME SHIPBORNE NAVIGATION SYSTEMS WITH NAVSTAR Final Technical Report, 1 Jun. 1979 - 31 Dec 1981
C Byron Winn and W Huston 31 Dec 1981 23 p refs
(Grant NsG-5352)
(NASA-CR-169031, NAS 1 26 169031) Avail NTIS HC A02/MF A01 CSCL 17G
A geostationary reference satellite (REFSAT) that broadcasts every four seconds updated GPS satellite coordinates was developed This procedure reduces the complexity of the GPS receiver The economic and performance payoffs associated with replacing maritime stripborne navigation systems with NAVSTAR was quantified and the use of NAVSTAR for measurements of ocean currents in the broad ocean areas of the world was evaluated S L

N82-26264# Emerson Electric Co , Calabasas Calif
MODIFICATION OF OE-258/URN TACTICAL AIR NAVIGATION (TACAN) ANTENNA GROUP Final Report, Oct 1980 - Jul 1981
James D Bain Washington FAA Jul 1981 70 p refs
(Contract DTF01-80-C-10148)
(AD-A111680 FAA-RD-81-53) Avail NTIS HC A04/MF AC1 CSCL 09/5
The OE-258/URN TACAN Antenna Group has been modified to provide a remote monitor capability This remote monitor meets the requirements of the IEEE-488 interface specification A test set (controller) has been provided for use with the antenna group Author (GRA)

N82-26265# Naval Postgraduate School Monterey, Calif Dept of Physics and Chemistry
A LABORATORY EVALUATION OF THE SUITABILITY OF A XENON FLASHTUBE SIGNAL AS AN AID-TO-NAVIGATION M S Thesis
Donald Francis Murphy Dec 1981 109 p refs
(AD-A110729) Avail NTIS HC A06/MF A01 CSCL 17/7
Single flick xenon flashtubes have periodically been used by the U S Coast Guard as visual signals on marine aids-to-navigation Their deployment has met with mixed responses The conspicuity of the signal is excellent it stands out among other visual signals, both flashing and steady lights However the flick is apparently too short approximately 100 micro sec for the mariner to fixate on it He therefore is unable to make an accurate judgement concerning the distance to the light This thesis utilized a Howard-Dolman Box to examine the depth perception of subjects under various flashing light conditions Author (GRA)

N82-26266# Arinc Research Corp Annapolis Md
LIFE-CYCLE-COST ANALYSIS OF THE MICROWAVE LANDING SYSTEM GROUND AND AIRBORNE SYSTEMS Final Report, 31 Oct 1980 - 1 Sep 1981
A Schust P Young and K Peter Washington FAA Oct 1981 348 p
(Contract DOT-FA76WA-2547)
(AD-A110909 Rept-1326-01-16-2547 FAA-RD-81-96) Avail NTIS HC A15/MF A01 CSCL 01/4
This report presents the results of a life-cycle-cost analysis of the Microwave Landing System ground and airborne configurations that may be implemented for the National Airspace System The ground configurations evaluated consisted of 3 deg 2 deg and 1 deg beamwidth azimuth subsystems The airborne configurations evaluated were for air carrier aircraft high-performance general aviation aircraft and low-performance general aviation aircraft Author (GRA)

N82-26267# Defense Mapping Agency Washington D C Advanced Technology Div
GLOBAL POSITIONING SYSTEM (GPS) GEODETIC RECEIVERS
Walter J Senus 8 Feb 1982 5 p refs
(AD-A111026) Avail NTIS HC A02/MF A01 CSCL 17/7
The NAVSTAR Global Positioning System (GPS) when fully developed will provide world-wide all weather continuous highly accurate radio navigation support to the full spectrum of military uses In addition it has the potential to revolutionize the navigational capability of the civil sector as well The Defense Mapping Agency in conjunction with other government agencies in sponsoring the development of GPS user equipment which will benefit greatly the Mapping Charting and Geodesy (MC&G) Community Among these developments are GPS receivers for geodetic survey applications GPS geodetic receivers are being built around several operating modes each of which has its advantages The GPS program as well as the various techniques being pursued are briefly reviewed Data collected to date is reported which indicated excellent performance both in the point positioning mode and in the distance difference mode of operation Further the anticipated improvement in measurement accuracy will be provided with a corresponding reduction in time required to occupy a measurement site and therefore offers operational cost reductions Author (GRA)

N82-26268# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D C
A COMPARISON OF POLE POSITIONS DERIVED FROM GPS SATELLITE AND NAVY NAVIGATION SATELLITE OBSERVATIONS
William H Wooden, II 6 Jan 1982 18 p refs Presented at the 3rd Intern Geodetic Symp on Satellite Doppler Positioning
(AD-A110765) Avail NTIS HC A02/MF A01 CSCL 17/7
The observation of the motion of the Earth s spin axis with respect to the crust has been done continuously since the latter part of 1899 by the International Service With the advent of new technologies new determinations of polar motion have been possible Doppler tracking of the Navy Navigation Satellites has provided estimates of the polar motion on a permanent basis since 1969 Currently these estimates are done at the Defense Mapping Agency and are distributed to several agencies including the Bureau International de l Heure (BIH) which has the responsibility of centralizing polar motion data The NAVSTAR Global Positioning System (GPS) is a new navigation satellite system which will eventually replace the existing Navy Navigation Satellite System As a byproduct of the orbit estimation process for the GPS satellites, values for the position of the pole are determined In this paper the two different methods for computing the pole s position from satellite observations are described The most recent results from each method are compared to each other and to the standard BIH values Author (GRA)

N82-26269# Defense Mapping Agency Hydrographic and Topographic Center, Washington D C Advanced Technology Div

AN UNBIASED ANALYSIS OF THE DOPPLER COORDINATE SYSTEMS

Muneendra Kumar Feb 1982 25 p refs

(AD-A110510) Avail NTIS HC A02/MF A01 CSCL 08/5

The Doppler system has undergone at least five major revisions, or improvements in its definition since original inception Some of the so-called minor modifications of the past have not been well documented and corresponding rigorous updating of the software in many instances is also lacking The actual impact and contribution of each such modification and the absence of proper updating towards inner consistency are not negligible in the present sub-meter era The questions whether (1) the Broadcast Ephemeris (BE) based coordinates are either automatically calculated in the WGS 72 datum or derived with respect to the reference ellipsoid for the WGS 72 datum (2) the BE system except for a small bias, is close to the NSWC 9Z-2 system (3) the BE based coordinates are in the NWL 9D system or strictly speaking' in the modified NWL 10D system, (4) the Doppler coordinate system as NWL 9D prior to June 1977 and is NSWC 9Z-2 now and (5) the coordinate system NWL 9D (and/or NSWC 9Z-2) is geocentric or has a significant Z-axis bias, are still floating around The net result is misunderstanding and misinterpretation for many users The present paper tries to highlight some of the related problems and to answer them as well as possible GRA

N82-26270# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D C

DATA PROCESSING AT THE GLOBAL POSITIONING SYSTEM MASTER CONTROL STATION

Fran Varnum and James Chaffee 4 Jan 1982 25 p Presented at the 3rd Intern Geodetic Symp on Satellite Doppler Positioning

(AD-A110553) Avail NTIS HC A02/MF A01 CSCL 17/7

At the GPS Master Control Station range and delta range measurement from remote unmanned monitor stations are processed to generate satellite navigation messages daily Data are edited smoothed and processed in a Kalman filter to generate estimates of ephemerides and all system clock solar pressure, polar wander and tropospheric states This processing and some examples of typical performance measures are described Author (GRA)

N82-26271# Lincoln Lab Mass Inst of Tech Lexington

A MODEL FOR SENSOR-INTERCEPTOR TRADE-OFF ANALYSIS

C B Chang 18 Jan 1982 81 p refs

(Contract F19628-80-C-0002)

(AD-A112046 TR-599 ESD-TR-365) Avail NTIS HC A05/MF A01 CSCL 17/7

In this report we present an analytical model useful for sensor and interceptor trade-off analysis Major factors used in this model include sensor measurement accuracy data rate interceptor time delay in responding to a command and interceptor control error in executing a command Guidance options considered include command guidance and homing guidance whereby the homing sensor accuracy may either be a constant or vary with powers of target range Author (GRA)

N82-26272# Lincoln Lab Mass Inst of Tech Lexington

APPLICATION OF ADAPTIVE ESTIMATION TO TARGET TRACKING

Chaw-Bing Chang and John A Tabacaynski 13 Jan 1982 63 p refs

(Contract F19628-80-C-0002)

(AD-A112036 TR-598 ESD-TR-81-361) Avail NTIS HC A04/MF A01 CSCL 17/7

In this report we present a survey of problems and solutions in the area of target tracking The discussion includes design trade-offs performance evaluation and current issues Author (GRA)

N82-26273# Federal Aviation Administration Atlantic City, N J

COMPARISON BETWEEN THE SURVEILLANCE PERFORMANCES OF THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM MODE OF THE MODE S AND THE AUTOMATED RADAR TERMINAL SYSTEM Interim Report, Jun - Sep 1980

William Swanseen Jan 1982 24 p

(FAA Proj 034-241-510)

(AD-A111733 FAA-CT-81-29 FAA-RD-81-32) Avail NTIS HC A02/MF A01 CSCL 17/7

A test and evaluation was conducted at the Federal Aviation Administration Technical Center to compare the surveillance performance and the range and azimuth accuracy of the Air Traffic Control Radar Beacon System (ATCRBS) mode of the Mode S (formerly the Discrete Address Beacon System (DABS)) to that achieved with the existing Automated Radar Terminal System (ARTS) III Targets of opportunity and ATCRBS-equipped Technical Center test aircraft were used in this evaluation The 5-foot ATCRBS antenna at the Technical Center Mode S terminal sensor was used to collect data at both the Mode S and the ARTS III sensors Data reduction and analysis tools developed by the Technical Center were used to determine sensor performance characteristics and to highlight areas for further analysis It was concluded that the ATCRBS mode of the Mode S sensor provided improved blip scan ratio Mode A code and altitude reliability performance when compared to the ARTS III The Mode S sensor also provided better range and azimuth accuracy than the ARTS III Author (GRA)

N82-26274# Atmospheric Sciences Lab, White Sands Missile Range N Mex

THE EFFECT OF IONOSPHERIC VARIABILITY ON THE ACCURACY OF HIGH FREQUENCY POSITION LOCATION Final Report

Melvin G Heaps Aug 1981 46 p refs

(DA Proj 1L1-61102-B-53A)

(AD-A107425 ERADCOM/ASL-TR-0095) Avail NTIS HC A03/MF A01 CSCL 17/7

The attainable accuracies in high frequency (HF) radio wave position location over ranges of several hundred kilometers are beset with errors of tens of kilometers due to constraints in three major areas ionospheric variability and irregularity system size limitations for easily fieldable systems and sufficient data acquisition processing and interpretation Of principal concern here is the area of ionospheric variability and irregularity The temporal and spatial coherence of ionospheric structure has been considered with respect to its effect on the accuracy of HF position location The findings show that medium and small-scale ionospheric structures most likely to affect HF position location accuracies have a spatial coherence on the order of 50 km and a temporal coherence on the order of 5 minutes On this basis it is recommended that a multiple ionosonde net be used instead of a single ionosonde such that an ionospheric sounding point is no more than 50 km from a potential radio wave reflection point and that soundings be taken on the order of every 5 minutes or less Author (GRA)

N82-26275# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca Ariz

STANDARD ENGINEERING INSTALLATION PACKAGE AIR TRAFFIC RADIO CHANNEL CONTROL EQUIPMENT CHANGE 1

30 Oct 1981 41 p

(AD-A107150 USACEEIA-SEIP-036-1) Avail NTIS HC A03/MF A01 CSCL 17/7

This report contains changes to the Standard Engineering Installation Package (SEIP) which provides information for the engineering and installation of ATRCC (Air Traffic Radio Channel Control) facilities worldwide Information provided consists of site survey data siting criteria installation specifications and instructions certification format Information provided must be adapted to the specific ATRCC facility/location by the project engineer GRA

N82-26276# Defense Mapping Agency Hydrographic and Topographic Center Washington D C

THE WORLDWIDE NAVIGATIONAL WARNING SERVICE

J E Ayers and John P Lyall 1981 14 p

(AD-A107372) Avail NTIS HC A02/MF A01 CSCL 17/2

In the early 1970s both the International Hydrographic Organization (IHO), an intergovernmental agency dedicated to the improvement of nautical charting and the Intergovernmental Maritime Consultative Organization (IMCO), a U S agency dedicated to safety of life at sea became concerned over the lack of a coordinated worldwide radio service to keep deep sea mariners aware of hazards to navigation Through their joint efforts the Worldwide Navigational Warning Service (WWNWS) was established becoming fully operational on 1 April 1980 The WWNWS covers all international shipping routes through a system of 16 NAVAREA Broadcasts all of which transmit warnings in English (the primary language of the NAVAREA II broadcast is in French) and some of which transmit warnings also in an additional language This paper describes the development of the initial WWNWS the mechanism for service improvement and advances which have been made to date and improvements foreseen for the future Specific examples from the broadcast experience of the Coordinator for NAVAREA IV and XII and the Northwest Atlantic and Northeast Pacific NAVAREAs, respectively are given Author (GRA)

N82-26277* National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards Calif
ANNULAR WING Patent
Harold J Walker inventor (to NASA) Issued 29 Dec 1981 12 p Filed 30 May 1979 Supersedes N79-24959 (17 - 16, p 2070) Continuation of abandoned US Patent Appl SN-880725 filed 24 Feb 1978
(NASA-Case-FRC-11007-2 US-Patent-4,307,856 US-Patent-Appl-SN-043911 US-Patent-Class-244 12 2 US-Patent-Class-244-23C US-Patent-Class-244-34A, US-Patent-Class-244-93) Avail US Patent and Trademark Office CSCL 01C

An annular wing particularly suited for use in supporting in flight an aircraft characterized by the absence of directional stabilizing surfaces is described The wing comprises a rigid annular body of a substantially uniformly symmetrical configuration characterized by an annular positive lifting surface and cord line coincident with the segment of a line radiating along the surface of an inverted truncated cone A decalage is established for the leading and trailing semicircular portions of the body relative to instantaneous line of flight and a dihedral for the laterally opposed semicircular portions of the body, relative to the line of flight The direction of flight and climb angle or glide slope angle are established by selectively positioning the center of gravity of the wing ahead of the aerodynamic center along the radius coincident with an axis for a selected line of flight
Official Gazette of the U S Patent and Trademark Office

N82-26278*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
HINGED STRAKE AIRCRAFT CONTROL SYSTEM Patent Application
Dhanvada M Rao, inventor (to NASA) (Vigyan Research Associates, Inc) Filed 11 Jan 1982 13 p Sponsored by NASA
(NASA-Case-LAR-12860-1 US-Patent-Appl-SN-338387) Avail NTIS HC A02/MF A01 CSCL 01C

Strakes hinged along the fuselage to avoid violent control degradation in the post-stall flight regime are described Hinged strakes are deflected from the conventional position coplanar with wings to an anhedral setting to increase controllability at high angles of attack by decreasing projected plan area and altering vortex flow characteristics As a result, effective lift on wings can be maintained at higher angles of attack than is possible with conventional strakes The hinged strakes are retracted flush against the fuselage in high speed cruise flight to avoid drag effects In an alternate mode of operation, strakes can be asymmetrically deployed to create a rolling that enhances roll control and a side force that counters aircraft nose-slice and directional divergence NASA

N82-26279*# Stanford Univ Calif Dept of Aeronautics and Astronautis
USE OF OPTIMIZATION TO PREDICT THE EFFECT OF SELECTED PARAMETERS ON COMMUTER AIRCRAFT PERFORMANCE Final Report
Valana L Wells and Richard S Shevell Jun 1982 61 p refs
(Grant NAG1-202)
(NASA-CR-169027, NAS 1 26 169027 SUDAAR-534) Avail NTIS HC A04/MF A01 CSCL 01C

An optimizing computer program determined the turboprop aircraft with lowest direct operating cost for various sets of cruise speed and field length constraints External variables included wing area wing aspect ratio and engine sea level static horsepower tail sizes, climb speed and cruise altitude were varied within the function evaluation program Direct operating cost was minimized for a 150 n mi typical mission Generally, DOC increased with increasing speed and decreasing field length but not by a large amount Ride roughness however increased considerably as speed became higher and field length became shorter TM

N82-26280# Hughes Helicopters, Culver City, Calif
ADVANCED CONCEPTS FOR COMPOSITE STRUCTURE JOINTS AND ATTACHMENT FITTINGS VOLUME 2 DESIGN GUIDE Final Report, Jul 1977 - Feb 1981
J V Alexander and R H Messinger Nov 1981 274 p refs 2 Vol
(Contract DAAJ02-77-C-0076, DA Proj 1L2-62209-SH-76)
(AD-A111106 HH-80-402-Vol-2 USAAVRADCOM-TR-81-D-21B) Avail NTIS HC A12/MF A01 CSCL 01/3

The purpose of this program was to develop the technology of applying fiber-reinforced composite materials to helicopter joints and attachment fittings that permit disassembly of major components A generic design methodology approach was used to make the data developed applicable to ongoing and future helicopter programs A detail design, analysis and testing program was carried out on the three joint and fitting concepts selected wrapped tensions fittings, gear box attachment fittings, and seat attachment fittings The scope of the study included analytical design tools including finite element computer analysis fabrication techniques with special emphasis on weight and cost effectiveness considerations structural integrity testing, including static, dynamic, failsafe/safe-life, and ballistic tolerance considerations and nondestructive inspection (NDI) techniques This volume contains the analytical and experimental results of the laminated angle bracket study and the Design Guide which covers each type of joint or fitting tested Author (GRA)

N82-26281# General Accounting Office Washington, D C Mission Analysis and Systems Acquisition Div
NAVY'S F/A-18 EXPECTED TO BE AN EFFECTIVE PERFORMER BUT PROBLEMS STILL FACE THE PROGRAM Report to Congress
26 Feb 1982 39 p refs
(AD-A111877 GAO/MASAD-82-20) Avail NTIS HC A03/MF A01 CSCL 01/3

The F/A-18 naval strike fighter is a multi-mission carrier-suitable aircraft This twin-engine aircraft will be used by the Navy and the Marine Corps for fighter and light attack missions such as strike escort fleet air defense, interdiction and close air support The Navy is concentrating on initial training, logistics and support activities as the F/A-18 development program nears completion All 9 pilot production aircraft have been delivered to the Navy as well as the first 4 of 25 limited production aircraft Five aircraft were sent to the initial F/A-18 squadron which will begin training F/A-18 pilots and mechanics beginning in July 1982 The first class will be mostly Marine Corps personnel in preparation for the December 1982 initial operation capability, when the first Marine Corps F/A-18 squadron receives its full complement of aircraft Author (GRA)

N82-26282# Boeing Vertol Co Philadelphia Pa
ADVANCED INTERNAL CARGO SYSTEM CONCEPT DEMONSTRATION AND EVALUATION Final Report, Jan 1980 - Sep 1981
C Ednie Jan 1982 65 p refs
(Contract DAAK51-80-C-0006 DA Proj 1L1-62209-AH-76)
(AD-A111990 D210-11848-1 USAAVRADCOM-TR-81-D-37) Avail NTIS HC A04/MF A01 CSCL 15/5

This report describes the design and development activity resulting in an add-on cargo handling system for the CH-47 helicopter Design activity was initiated as a result of cargo handling problems encountered in the European Theater The Applied Technology Laboratory at Fort Eustis Virginia designed and fabricated a mock-up of an internal cargo handling system that demonstrated a practical approach for an add-on system for the CH-47 An evaluation of this mockup together with the results of an investigative field trip to the European Theater led to the requirements definition for the cargo handling system The cargo handling system can be installed in a CH-47 helicopter with no modifications to the primary structure The system can handle 463L pallets warehouse pallets and special munitions The system includes forward and aft barriers to minimize tiedown requirements ramp extensions to allow easy fork-lift loading and a fuselage levelling system Functional tests of the system resulted in minor modifications to the original hardware The modified hardware has been successfully installed and demonstrated in a CH-47C and a CH-47D model helicopter Author (GRA)

N82-26283# Boeing Military Airplane Development Seattle, Wash Advanced Airplane Branch

DESIGN GUIDE FOR AIRCRAFT HYDRAULIC SYSTEMS AND COMPONENTS FOR USE WITH CHLOROTRIFLUOR-ETHYLENE NONFLAMMABLE HYDRAULIC FLUIDS Final Report, May 1976 - May 1980

E T Raymond Wright-Patterson AFB Ohio AFWAL Mar 1982 71 p refs

(Contract F33615-76-C-2064 AF Proj 3145)

(AD-A112097 AFWAL-TR-80-2111) Avail NTIS HC A04/MF A01 CSCL 13/7

This design guide documents the major physical properties of chlorotrifluoroethylene (CTFE) polymer-based nonflammable hydraulic fluids and the special considerations which must be observed in the design of aircraft hydraulic systems and components in order to obtain performance comparable to that obtained with petroleum-based hydraulic fluid per MIL-H-5606 Author (GRA)

N82-26284# General Accounting Office Washington D C Mission Analysis and Systems Acquisition Div

MISSION EFFECTIVENESS OF THE AV-8B HARRIER 2 COULD BE IMPROVED IF ACTIONS ARE TAKEN NOW Report to the Congress

26 Feb 1982 28 p

(AD-A111878 GAO/MASAD-82-19) Avail NTIS HC A03/MF A01 CSCL 01/3

The AV-8B Harrier II is a light attack aircraft with vertical and short-takeoff and landing capability being developed by the Navy to provide close air support for Marine Corps amphibian forces The AV-8B is designed to be a substantially improved version of the AV-8A currently used by the Marine Corps Potential maintenance personnel shortages, shipboard space constraints limited repair capability and inadequate ground-support equipment could adversely affect the ability of the AV-8B to perform its mission Author (GRA)

N82-26286# Army Aviation Engineering Flight Activity, Edwards AFB, Calif Directorate for Development and Qualification

AIRWORTHINESS AND FLIGHT CHARACTERISTICS TEST OF AN OH-58C CONFIGURED TO A LIGHT COMBAT HELICOPTER (LCH) Final Report

Arthur R Marshall, Jr, Ralph Woratschek and Robert N Ward Oct 1981 98 p refs

(AD-A112581 USAAEFA-81-07) Avail NTIS HC A05/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a limited airworthiness and flight characteristics test of the OH-58C Light Combat Helicopter (LCH) from 22 July through 9 September 1981 The OH-58C LCH configuration increases the gross weight of the helicopter to 3425 pounds and includes one 7-tube 2 75-inch rocket pod and one 7 62mm minigun mounted externally Performance and handling qualities were evaluated A total of 20 flights were conducted for a total of 26 0 flight hours As a result of the increased maximum gross weight of the OH-58C LCH the hover ceiling was reduced Level flight performance was degraded by the LCH configuration No significant handling qualities differences were noted when comparing test results for the OH-58C LCH to the test results of the standard OH-58C GRA

N82-26287# Army Aviation Engineering Flight Activity Edwards AFB Calif Directorate of Development and Qualification

LIMITED ARTIFICIAL AND NATURAL ICING TESTS PRODUCTION UH-60A HELICOPTER (RE-EVALUATION) Final Report, 22 Dec 1980 - 24 Feb 1981

Marvin L Hanks, Vernon L Diekmann and John O Benson Aug 1981 102 p refs

(AD-A112582 USAAEFA-80-14) Avail NTIS HC A06/MF A01 CSCL 01/3

A limited re-evaluation of the production UH-60A Black Hawk anti-ice and deice systems was conducted to verify correction of deficiencies and shortcomings which were revealed during 1979-1980 icing tests Testing consisted of 22 3 productive flight hours The previous droop stop deficiency (failure of the droop stops to return to the shutdown position with ice accumulation on the rotor head) was corrected by the installation of a different droop stop with anti-ice protection The previous anti-flapping restrainer deficiency (failure of the anti-flapping restrainers to return to the shutdown position with ice accumulated on the rotor head) was downgraded to a shortcoming after correction of the droop stop deficiency The three most important previously identified shortcomings (1) the large increase in power required with ice accumulation on the rotor system (2) the large power available losses with activation of the engine and engine inlet anti-ice systems and (3) the poor location of the deice system circuit breakers, were again documented, although some improvement in power available losses was observed due to installation of the modulating engine inlet anti-ice valves Five other previously identified icing related shortcomings were still present and four were corrected Three additional icing related shortcomings were identified during these tests (l) ice impact damage to the upper strobe light assembly (2) ice impact damage to the nose avionics compartment door, and (3) the poor reliability of the windshield anti-ice control units The UH-60 Black Hawk helicopter configured with the anti-ice deice and heated government competitive test droop stop systems demonstrated safe operation in icing intensities through moderate GRA

N82-26288*# National Aeronautics and Space Administration Langley Research Center Hampton, Va

FLIGHT-TEST VERIFICATION OF A PICTORIAL DISPLAY FOR GENERAL AVIATION INSTRUMENT APPROACH

James J Adams Jun 1982 29 p refs

(NASA-TM-83305 L-15111 NAS 1 15 83305) Avail NTIS HC A03/MF A01 CSCL 01D

Results of flight tests of the pictorial follow me box display results of the simulator study The most important item of agreement was the frequency of the vertical and lateral models of motion of the pilot-aircraft-display system which was 0 4 rad/sec in each study Successful short, curved, descending approaches, such as are often suggested for use with microwave landing systems, can be executed with the follow me box display Variations of the value of distance from the aircraft to the box were also examined using values of 736 m 368 m and 184 m The results show that successful approaches can be made with all of these values A sharper final turn and greater precision of position control are obtained with the shorter distance Deletion of distance measuring equipment from the system was also studies It was shown that successful approaches can be made with no distance measures included in the system, but the values of distance from the aircraft to the box that can be used are restricted A R H

N82-26289*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

A FLOATING-POINT/MULTIPLE-PRECISION PROCESSOR FOR AIRBORNE APPLICATIONS

Robert Yee Feb 1982 11 p refs

(NASA-TM-84252 A-8832, NAS 1 15 84252) Avail NTIS HC A02/MF A01 CSCL 01D

A compact input output (I/O) numerical processor capable of performing floating-point, multiple precision and other arithmetic functions at execution times which are at least 100 times faster than comparable software emulation is described The I/O device is a microcomputer system containing a 16 bit microprocessor a numerical coprocessor with eight 80 bit registers running at a 5 MHz clock rate 18K random access memory (RAM) and 16K electrically programmable read only memory (EPROM) The processor acts as an intelligent slave to the host computer and can be programmed in high order languages such as FORTRAN and PL/M-86 S L

N82-26290# Bunker-Ramo Corp Wright-Patterson AFB Ohio Electronic Systems Div

TANKER AVIONICS/AIRCREW COMPLEMENT EVALUATION (TAACE) PHASE 1 SIMULATION EVALUATION VOLUME 1 RESULTS Final Report, Jun 1979 - Jun 1980

Ralph P Madero Gregory J Barbato, and Richard W Moss Wright-Patterson AFB Ohio AFWAL Nov 1981 60 p refs 2 Vol

(Contract F33615-78-C-3614, AF Proj 2391)

(AD-A110956 AFWAL-TR-81-3127-Vol-1) Avail NTIS HC A04/MF A01 CSCL 01/3

This report documents a cockpit simulation study conducted to validate the pilot useability of a 3-man (pilot, copilot boom operator) KC-135 crew system concept Earlier analysis and mockup evaluation studies had established preliminary design criteria and control display arrangements The effort reported herein draws upon this earlier work and through full mission simulation, validates display formats cockpit hardware arrangements and crew procedures In addition a KC-135 Crew System Criteria document was written deriving from mission statements and control display research design criteria for operating the tanker with a reduced crew GRA

N82-26291# Bunker-Ramo Corp Wright-Patterson AFB, Ohio Electronic Systems Div

TANKER AVIONICS/AIRCREW COMPLEMENT EVALUATION (TAACE) PHASE 1 SIMULATION EVALUATION. VOLUME 2. CREW SYSTEM DESIGN Final Report, Jun. 1979 - Jun. 1980

Ralph P Madero, Gregory J Barbato and Richard W Moss Wright-Patterson AFB, Ohio AFWAL Nov 1981 126 p 2 Vol

(Contract F33615-78-C-3614, AF Proj 2391)

(AD-A110954 AFWAL-TR-81-3127-Vol-2) Avail NTIS HC A07/MF A01 CSCL 01/3

This report documents the second phase of a two-phase effort called the Tanker Avionics/Aircrew Complement Evaluation (TAACE) Program The results obtained from a full mission simulation of an updated avionics configuration for the KC-135 tanker are reported herein These results concern the development of the crew station avionics criteria to be met for a 3-man crew complement (pilot copilot boom operator) completing all KC-135 mission requirements without compromise to either mission performance or aircraft operational safety This volume is divided into three sections Section I - Introduction Section II providing sketches of the crew system design layout, and Section III - providing operational systems descriptions of the Navigation Management System and the Horizontal Situation Display are extensive and therefore are presented separately in Appendixes A and B GRA

N82-26292# Martin Marietta Aerospace, Orlando Fla

HELICOPTER NIGHT VISION SYSTEM SIMULATION EVALUATION Final Report

Dec 1981 138 p refs

(Contract N62269-80-C-0346)

(AD-A110505 OR-16551) Avail NTIS HC A07/MF A01 CSCL 01/3

Simulation experiments demonstrated the ability of the pilot and copilot to fly a night mission at low altitudes ranging from 50 to 150 feet AGL in a CH-53D simulation with the night visionics equipment package described previously Phases I and II HNVS simulation studies indicated that enroute flight profiles over the simulator's rolling terrain can be accomplished at airspeeds ranging from 60 to 80 knots with clearance altitudes averaging 100 feet This study was conducted with a revised terrain model with improved altitude feedback cues that produced higher clearance altitudes and somewhat lower airspeeds than the prior simulations The actual speeds and altitudes will be verified in the planned HNVS flight tests The simulation confirmed the minimum system requirement of a gimballed FLIR with a navigation system and with ancillary hardware such as a symbol generator Although this experiment required no data be generated on dead reckoning versus navigation system requirements both pilot performance and opinion data reiterated the reduced crew station workload with Doppler command steering information Incorporation of the navigation capability of the Control Display Unit also was instrumental in further reducing the navigation workload GRA

N82-26293* National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio

THRUST REVERSER FOR A LONG DUCT FAN ENGINE Patent

Everett A Johnston (GE, Cincinnati) and Edward W Ryan inventors (to NASA) (GE Cincinnati) Issued 14 Jul 1981 9 p Filed 30 Mar 1979

(NASA-Case-LEW-13199-1 US-Patent-4,278 220 US-Patent-Appl-SN-025301 US-Patent-Class-244-110B US-Patent-Class-60-226A) Avail US Patent and Trademark Office CSCL 21E

A bypass duct outer cowl includes a fixed cascade disposed between axially spaced fixed cowl portions and a translatable cowl sleeve and blocker doors movably disposed on the respective radially outer and inner sides of the cascade Actuation and linkage structure located entirely within the outer cowl provides for selectively moving the cowl sleeve rearwardly and rotating the blocker doors to a position across the bypass duct to cause the fan airflow to pass through the cascade in a thrust reversing manner Official Gazette of the U S Patent and Trademark Office

N82-26294*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio

REAL TIME PRESSURE SIGNAL SYSTEM FOR A ROTARY ENGINE Patent Application

William J Rice inventor (to NASA) Filed 19 Feb 1982 21 p (NASA-Case-LEW-13622-1 US-Patent-Appl-SN-350473) Avail NTIS HC A02/MF A01 CSCL 21E

Apparatus for developing a signal which is a composite of the pressures at four different points in the chamber of a rotary type engine is disclosed The composite signal can be read by an IMEP meter or displayed on an oscilloscope The physical arrangement of a Wankel engine and the correlation embodying the invention is shown The profile of the inner surface of a Wankel engine housing and the profile of a three lobed rotor together with the positions of the transducers are also shown The timing diagrams depicting the active regions of the transducers and timing signals used in the correlator circuitry are illustrated S L

N82-26295*# Pennsylvania State Univ University Park

INVESTIGATION OF SPRAY CHARACTERISTICS FOR FLASHING INJECTION OF FUELS CONTAINING DISSOLVED AIR AND SUPERHEATED FUELS Final Report, 1 Aug 1980 - 31 Aug 1981

A S P Solomon, L D Chen and G M Faeth Washington NASA Jun 1982 90 p refs

(Grant NsG-3306)

(NASA-CR-3563 NAS 1 26 3563) Avail NTIS HC A05/MF A01 CSCL 21E

The flow atomization and spreading of flashing injector flowing liquids containing dissolved gases (jet/air) as well as superheated liquids (Freon II) were considered The use of a two stage expansion process separated by an expansion chamber ws found to be beneficial for flashing injection particularly for dissolved gas systems Both locally homogeneous and separated flow models provided good predictions of injector flow properties Conventional correlations for drop sizes from pressure atomized and airblast injectors were successfully modified using the separated flow model to prescribe injector exit conditions to correlate drop size measurements Additional experimental results are provided for spray angle and combustion properties of sprays from flashing injectors Author

N82-26296# Helsinki Univ of Technology Otaniemi (Finland) Lab of Aerodynamics

TRANSIENT SIMULATION OF GAS TURBINES INCLUDING THE EFFECTS OF HEAT CAPACITY OF THE SOLID PARTS Ph D Thesis

Jaakko Larjola 1982 144 p refs

(ISBN-951-752-496-X Rept-82-A1) Avail NTIS HC A07/MF A01

The simulation of low frequency transients (such as acceleration deceleration) of different open cycle gas turbine types is studied The effects of heat transfer between process gas and solid structure is emphasized Correcting equations for these effects are developed and the transient properties of each component are then evolved from the static ones with these equations The heat transfer effects alter significally e g the surge margin of the compressor Simulation model includes intercooler and recuperator The programming language is CSMP S L

N82-26297*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio

DEVELOPMENT POTENTIAL OF INTERMITTENT COMBUSTION (I C) AIRCRAFT ENGINES FOR COMMUTER TRANSPORT APPLICATIONS

Edward A Willis 1982 31 p refs Presented at the Commuter Airlines and Operations Meeting Savannah 23-24 May 1982 (NASA-TM-82869 E-1221 NAS 1 15 82869) Avail NTIS HC A03/MF A01 CSCL 21E

An update on general aviation (g/a) and commuter aircraft propulsion research effort is reviewed The following topics are discussed on several advanced intermittent combustion engines emphasizing lightweight diesels and rotary stratified charge engines The current state-of-the-art is evaluated for lightweight aircraft suitable versions of each engine This information is used to project the engine characteristics that can be expected on near-term and long-term time horizons The key enabling technology requirements are identified for each engine on the long-term time horizon E A K

N82-26298*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
PROPULSION OPPORTUNITIES FOR FUTURE COMMUTER AIRCRAFT
William C Strack 1982 27 p refs Presented at 18th Joint Propulsion Conf Cleveland 21-23 Jun 1982 sponsored by AIAA SAE and ASME
(NASA-TM-82915 E-1304 NAS 1 15 82915) Avail NTIS HC A03/MF A01 CSCL 21E
Circa 1990 propulsion improvement concepts are discussed for 1000 to 5000 SHP conventional turboprop powerplants including engines gearboxes, and propellers Cycle selection power plant configurations and advanced technology elements are defined and evaluated using average stage length DOC for commuter aircraft as the primary merit criterion B W

N82-26299*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
COMPARISON OF EXPERIMENTAL AND ANALYTICAL PERFORMANCE FOR CONTOURED ENDWALL STATORS
Robert J Boyle and Jeffrey E Haas (Army Aviation Research and Development Command Cleveland) 1982 15 p refs Presented at Eighteenth Joint Propulsion Conf Cleveland 21-23 Jun 1982 sponsored by AIAA SAE and ASME
(NASA-TM-82877 NAS 1 15 82877 AVRADCOM-TR-82-C-12) Avail NTIS HC A02/MF A01 CSCL 21E
Comparisons between predicted and experimental stator losses showed that the analysis was able to predict the change in stator loss when contoured endwalls with highly three dimensional passage geometry were used The level of loss was predicted to within 75 percent of that measured The predicted loss was due only to profile loss and boundary layer growth on the endwalls The 25 percent difference was approximately 0 015 at design pressure ratio The analysis was shown to predict the trend in stator flow angle even for small stator geometries Author

N82-26300*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
NASA RESEARCH IN SUPERSONIC PROPULSION A DECADE OF PROGRESS
L H Fishbach L E Stitt, J R Stone, and J B Whitlow, Jr 1982 40 p refs Presented at 18th Joint Propulsion Conf Cleveland 21-23 Jun 1982 sponsored by AIAA, SAE and ASME
(NASA-TM-82862 NAS 1 15 82862) Avail NTIS HC A03/MF A01 CSCL 21E
A second generation economically viable, and environmentally acceptable supersonic aircraft is reviewed Engine selection testbed experiments and noise reduction research are described Author

N82-26301# Naval Postgraduate School Monterey, Calif Dept of Aeronautics
EFFECT ON FUEL EFFICIENCY OF PARAMETER VARIATIONS IN THE COST FUNCTION FOR MULTIVARIABLE CONTROL OF A TURBOFAN ENGINE M S Thesis
Barry Lawrence Dougherty Sep 1981 106 p refs
(AD-A110614) Avail NTIS HC A06/MF A01 CSCL 21/5
In modern turbofan engines, variable geometry has been incorporated to improve some off-design performance Most control designs ignore this variable geometry and use fuel metering as the primary control input This thesis investigates the use of variable geometry to control the engine and, thereby, reduce fuel consumption due to transients Additionally steady-state trim conditions are altered to reduce the static fuel consumption The non-linear transient simulation program is used to analyze the steady-state operating condition and develop small perturbation control limitations Linear models, both large and reduced order, are used in analyzing the effect of controllers on system response A computer program was generated to reduce a large order linear model to a usable size for control system development This analysis shows the reduced-order regime dependent controllers to be viable and to favorably enhance the quest for reducing specific fuel consumption in existing engines Author (GRA)

N82-26302# Naval Postgraduate School, Monterey, Calif Dept of Mechanical Engineering
PERFORMANCE OF MULTIPLE, ANGLED NOZZLES WITH SHORT MIXING STACK EDUCTOR SYSTEMS M S Thesis
Charles Carver Davis Sep 1981 435 p refs
(AD-A110817) Avail NTIS HC A19/MF A01 CSCL 21/5
Cold flow tests were conducted on a four-nozzle gas eductor system to evaluate the feasibility of reducing mixing stack lengths by the application of angled primary flow nozzles Three short mixing stacks with length to diameter ratios of 1 75, 1 5 and 1 25 were tested using a set of straight nozzles and a series of angled nozzles having tilt angles of 10 15, 20 and 22 5 degrees The nozzles were constructed with an area of primary flow to area of mixing stack ratio of 2 5 Pumping coefficients, mixing stack pressure distributions, flow changes, exit velocity profiles, and back pressures were used to evaluate the various mixing stack length and angled nozzle combinations GRA

N82-26303# Naval Postgraduate School, Monterey, Calif Dept of Aeronautics
COMBUSTION BEHAVIOR OF SOLID FUEL RAMJETS. VOLUME 2. EFFECTS OF FUEL PROPERTIES AND FUEL-AIR MIXING ON COMBUSTION EFFICIENCY Final Report
Aug 1981 54 p refs
(AD-A110796, NPS67-81-011) Avail NTIS HC A04/MF A01 CSCL 21/5
Fundamental SFRJ fuel properties were determined using a DTA and a gas chromatograph for both high and low heating rates The performance of these fuels was then measured under various operating conditions and test geometries Fuel properties were found to have some effect on the obtainable combustion efficiency but much larger effects could be induced by the flow conditions (induced mixing near the fuel surface, bypass air, etc) Author (GRA)

N82-26304# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
AN EXPERIMENTAL STUDY OF RECTANGULAR AND CIRCULAR THRUST AUGMENTING EJECTORS M S Thesis
Gregory Unnever Dec 1981 74 p refs
(AD-A111110, AFIT/GAE/AA/81D-31) Avail NTIS HC A04/MF A01 CSCL 20/4
A short rectangular ejector and two circular ejectors were tested to determine the effects of primary nozzle configuration and geometry on thrust augmentation The primary nozzle configurations consisted primarily of slot nozzles which injected fluid parallel to the diffuser walls and achieved Coanda type flow at the throat Results of the rectangular ejector tests indicate that thin plates installed in the mixing chamber or the diffuser, increase mixing but decrease thrust augmentation A continuous slot nozzle, modified to create four discrete jets at the inlet, improved mixing and thrust augmentation compared to the original design Thrust augmentation ratio increased from 1 4 to 1 58 The circular ejector primary nozzles consisted of a continuous slot torus' nozzle and individual slot nozzles which could be symmetrically placed around the inlet periphery A nozzle configuration using 16 slot nozzles on the periphery of the inlet face gave the best performance A thrust augmentation ratio of 2 0 was achieved GRA

N82-26305# Army Materials and Mechanics Research Center, Watertown, Mass
MECHANICAL WEAR ASSESSMENT OF HELICOPTER ENGINES BY FERROGRAPHY Final Report
Charles P Merhib, Samuel J Acquaviva, and Robert W Ladner Nov 1981 24 p ref
(AD-A110772, AMMRC-TR-81-55) Avail NTIS HC A02/MF A01 CSCL 21/5
Two Ferrography analyzers an analytical or laboratory Ferrograph and an On-Line (quasi-real-time) Ferrograph, were evaluated The analytical Ferrograph was found to be an effective supplement to the spectrometric oil analysis program (SOAP) since the Ferrograph analyzes particles in the range of 1 to over 100 microns while SOAP analyzes particles below 5 microns in size Comments are also offered on a third analyzer the Direct Reading (DR) Ferrograph To evaluate the analytical Ferrograph, oil samples from helicopters at Fort Devens, Massachusetts, were analyzed One transmission was found with excessive wear particles which was later verified by SOAP The On-Line Ferrograph was tested in 410 hours of operation using a T53-L-13B helicopter engine in a test call at the Corpus Christi Army Depot After determining baseline data for the engine, defective bearings

were substituted to enhance particle wear penetration The particles subsequently generated were successfully detected by both the On-Line Ferrograph and SOAP GRA

N82-26306# General Motors Corp, Indianapolis, Ind
AERODYNAMICALLY INDUCED VIBRATION Interim Report, 1 Jun. 1980 - 31 Jul 1981
Robert L Jay and James L Bettner Sep 1981 128 p
(Contract F49620-80-C-0078, AF Proj 2307)
(AD-A110493, DDA-EDR-10840) Avail NTIS HC A07/MF A01 CSCL 21/5

An experimental investigation, performed in a large scale low-speed, single-stage compressor, was conducted to provide the radial and chordwise distribution of basic unsteady pressure data on the stator Radial and circumferential distributions of streamwise and transverse velocity fluctuations were determined at stations upstream, inside and immediately downstream of the stator Analysis of the results indicated a correlation of the normalized transverse fluctuation velocity component with stator incidence angle The fluctuations were very large in the endwall regions and were attributed to poor flow conditions generated in the hub and tip endwall regions of the rotor GRA

N82-26307# Massachusetts Inst of Tech, Cambridge Gas Turbine Lab
HEAT TRANSFER IN TURBINES Final Report, 1 Jan. 1976 - 31 Dec. 1980
Jean F Louis Wright-Patterson AFB, Ohio AFWAL Oct 1981 118 p refs
(Contract F33615-76-C-2018, AF Proj 3056)
(AD-A111584 AFWAL-TR-81-2099) Avail NTIS HC A06/MF A01 CSCL 21/5

This report summarizes the studies in heat transfer and film cooling effectiveness performed under Contract F33615-76-C-2018 The purpose of these experimental and theoretical studies is to develop an indepth understanding of heat transfer and film cooling in gas turbines A common experimental procedure is described for heat transfer measurements under isothermal wall conditions using fast response heat transfer gauges in tests conducted in a shock tunnel and a blowdown facility The tests were conducted at flow and thermodynamic conditions modeling the operating conditions of advanced gas turbines The configuration under study were single slot single line of holes double row of holes on a flat and curved plates and double lines on an airfoil located in a cascade The experimental technique was validated by long duration high temperature tests of an air cooled flat plate Also described is an analytical study of the thermal and fluid mechanical evolution of a cooling film injected from a single line of inclined holes Author (GRA)

N82-26308# Naval Postgraduate School, Monterey Calif Dept of Aeronautics
BLADE TIP GAP EFFECTS IN TURBOMACHINES A REVIEW Final Report, 1 Oct - 30 Sep 1980
Roy E Peacock Nov 1981 103 p refs
(AD-A111892 NPS67-81-016) Avail NTIS HC A06/MF A01 CSCL 21/5

A review is presented of experiments examining the effects of blade tip gaps encountered in turbomachines and the methods by which the synthesised data are currently used in turbomachinery design and performance analysis Data gained since the 1930 s is subdivided for convenience into diffusing, or compressor-type flows and accelerating, or turbine-type flows There is a further sub-division into cascade and rotating machinery data The overall trend university is that an increasing tip gap whose effect can reach over most or all of the blade height brings reduced overall performance of a turbomachine Turbine data are in general more regular than the body of compressor data possibly due in part to the enhanced effect of usually undefined boundary layers in diffusing flow There is some evidence among the compressor and compressor cascade data that an optimum gap exists when the opposing effects of secondary flows, and tip leakage with rotor/wall relative movement tend to balance Comment is made upon the prediction and design models published in the literature Author (GRA)

N82-26309# Pratt and Whitney Aircraft Group West Palm Beach Fla
LIFE AND UTILIZATION CRITERIA IDENTIFICATION IN DESIGN (LUCID), VOLUME 1 Final Report, Aug 1978 - May 1981
J G Osmer and C C Dietrick Wright-Patterson AFB Ohio AFWAL Oct 1981 175 p 2 Vol
(Contract F33615-78-C-2032 AF Proj 3066)
(AD-A111939 PWA-FR-14961-Vol-1
AFWAL-TR-81-2101-Vol-1) Avail NTIS HC A08/MF A01 CSCL 21/5

A methodology for quantifying relative life/performance trades during the conceptual design phase of gas turbine engine development is presented As part of this methodology a computer aided design system employing regression techniques was developed and demonstrated Major elements of this system are performing satisfactorily, however certain component subroutines are exhibiting unacceptable error levels Further effort is required in this innovative application of standard regression techniques GRA

N82-26310# Pratt and Whitney Aircraft Group West Palm Beach, Fla
LIFE AND UTILIZATION CRITERIA IDENTIFICATION IN DESIGN (LUCID), VOLUME 2 Final Report, Aug 1978 - Mar 1981
J G Osmer and C C Dietrick Wright-Patterson AFB Ohio AFWAL Oct 1981 117 p refs 2 Vol
(Contract F33615-78-C-2032, AF Proj 3066)
(AD-A111940 AFWAL-TR-81-2101-Vol-2) Avail NTIS HC A06/MF A01 CSCL 21/5

Procedures for predicting gas turbine engine usage are presented Peacetime missions were defined for an advanced tactical strike aircraft and were employed by the usage models to generate a composite engine duty cycle The engine duty cycle was analyzed and compared to engine usage projections for other advanced tactical aircraft The analysis demonstrated significant variations in engine usage due to weapon delivery tactics associated with advanced air to surface missiles as well as variations in peacetime mission frequencies and aircraft performance GRA

N82-26311# Boeing Military Airplane Development Seattle Wash
CURRENT STATUS OF INLET FLOW PREDICTION METHODS
Gerald C Paynter 14 May 1981 36 p refs
(AD-A111784) Avail NTIS HC A03/MF A01 CSCL 21/5

The increasing availability of large computers advances in numerical fluid mechanics and the rapidly escalating cost of wind tunnel testing are responsible for a trend toward the use of parametric analysis rather than parametric testing to support the design of inlet systems With an emphasis on the transonic and supersonic speed regimes current approaches to inlet flow analysis are discussed in the context of the inlet design process Results from typical procedures now under development for supersonic inlet flows are presented along with a discussion of the advantages and disadvantages of each for design The requirements for experimental validation of a procedure and analysis problem areas are reviewed Recent developments which may lead to an improved inlet flow analysis capability are discussed Author (GRA)

N82-26312# Monsanto Research Corp Dayton Ohio
TURBINE ENGINE LUBRICANT RECLAMATION Interim Report, 1 Sep 1979 - 1 Feb 1981
George L Beemsterboer and Richard J Bruns Wright-Patterson AFB Ohio AFWAL Dec 1981 132 p refs refs HC A06/MF A01
(Contract F33615-79-C-2052 AF Proj 3048)
(AD-A112098 MRC-DA-1057 AFWAL-TR-81-2053) Avail NTIS CSCL 11/8

A distillation and adsorption treatment for reclaiming used MIL-L-7808 turbine oils was investigated A viable additive package was tested on different MIL-L-7808 type virgin base stocks Fifteen used oils were analyzed by acid number, high performance liquid chromatography and gas chromatography A distillation process utilizing caustic (sodium hydroxide) pretreatment was developed on 500-ml and 13-litre scales Adsorption treatment of distilled oils with calcium hydroxide followed by attapulgus clay was examined Preparations for large-scale (25 and 250 gal) reclamations are currently under way to elucidate the validity of caustic distillation and absorbent treatment parameters Author (GRA)

N82-26313# Rensselaer Polytechnic Inst Troy N Y School of Engineering and Applied Science

AN ANALYTICAL STUDY OF TURBULENCE RESPONSES, INCLUDING HORIZONTAL TAIL LOADS, OF A CONTROL CONFIGURED JET TRANSPORT WITH RELAXED STATIC STABILITY M S Thesis
Boyd Perry,III 17 Feb 1975 122 p refs
Avail NTIS HC A06/MF A01
The turbulence responses of control configured vehicles (CCV) with relaxed static stability (RSS) are discussed Three similar vehicle configurations employing two types of static stability augmentation systems (SSAS) at two flight conditions (two Mach numbers at constant altitude are considered The configurations include a baseline (statically stable) configuration and two representative CCV (statically unstable) configurations, featuring one with baseline geometry and one with a significantly reduced horizontal tail Stability flying qualities and maneuverability requirements are imposed on the airplane-SSAS systems and denote representative requirements imposed on a CCV with RSS Using these requirements as a common base the rigid airframe and tail load turbulence responses are examined in terms of configuration changes for a given SSAS and in terms of SSAS changes for a given configuration Turbulence response calculations for each SSAS indicate that even though the tail load responses for the unstable configuration with the small tail are less than those for the stable configuration the tail loads per unit tail volume are larger B W

N82-26314*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
FLIGHT EXPERIMENTS USING THE FRONT-SIDE CONTROL TECHNIQUE DURING PILOTED APPROACH AND LANDING IN A POWERED LIFT STOL AIRCRAFT
W S Hindson (National Research Council of Canada) G H Hardy and R C Innis Apr 1982 87 p refs
(NASA-TM-81337 A-8777 NAS 1 15 81337 FRL-TR-LTR-FR-81) Avail NTIS HC A05/MF A01 CSCL 01C
The essential features of using pitch attitude for glidepath control in conjunction with longitudinal thrust modulation for speed control are described using a simple linearized model for a powered-lift STOL aircraft operating on the backside of the drag curve and at a fixed setting of propulsive lift It is shown that an automatic speed-hold system incorporating heave-damping augmentation can allow use of the front-side control technique with satisfactory handling qualities and the results of previous flight investigations are reviewed Manual control considerations, as they might be involved following failure of the automatic system are emphasized The influence of alternative cockpit controller configurations and flight-director display features were assessed for their effect on the control task which consisted of a straight-in steep approach flown at constant speed in simulated instrument conditions Author

N82-26315*# Massachusetts Inst of Tech Cambridge Lab for Information and Decision Systems
LATERAL CONTROL SYSTEM DESIGN FOR VTOL LANDING ON A DD963 IN HIGH SEA STATES M S Thesis
Marc Bodson May 1982 221 p refs
(Grant NGL-22-009-124)
(NASA-CR-169074 NAS 1 26 169074 LIDS-TH-1209) Avail NTIS HC A10/MF A01 CSCL 01C
The problem of designing lateral control systems for the safe landing of VTOL aircraft on small ships is addressed A ship model is derived The issues of estimation and prediction of ship motions are discussed using optimal linear linear estimation techniques The roll motion is the most important of the lateral motions and it is found that it can be predicted for up to 10 seconds in perfect conditions The automatic landing of the VTOL aircraft is considered and a lateral controller defined as a ship motion tracker is designed using optimal control techniqes The tradeoffs between the tracking errors and the control authority are obtained The important couplings between the lateral motions and controls are demonstrated, and it is shown that the adverse couplings between the sway and the roll motion at the landing pad are significant constraints in the tracking of the lateral ship motions The robustness of the control system including the optimal estimator is studied using the singular values analysis Through a robustification procedure a robust control system is obtained and the usefulness of the singular values to define stability margins that take into account general types of unstructured modelling errors is demonstrated The minimal destabilizing perturbations indicated by the singular values analysis are interpreted and related to the multivariable Nyquist diagrams Author

N82-26316# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
INVESTIGATION OF AN IMPROVED STRUCTURAL MODEL FOR DAMAGED T-38 HORIZONTAL STABILIZER FLUTTER ANALYSIS USING NASTRAN M S Thesis
Lex Clayton Dodge Dec 1981 62 p refs
(AD-A111095 AFIT/GAE/AA/81D/6) Avail NTIS HC A04/MF A01 CSCL 01/1
This thesis investigates tuning a finite element model and applying the procedures to the T-38 horizontal stabilizer for use on NASTRAN The T-38 stabilizer model is to be used in a subsequent flutter analysis Static and dynamic analysis has shown the model to have inadequate bending and torsional stiffness The model was tuned in the frequency domain with free-free boundary conditions The tuned frequencies and mode shapes show good correlation to the measured values The finite element model was shown to not contain variables that significantly influence the torsion modes frequencies more than the bending frequencies Eigenvalue analysis of the tuned model with aircraft installed boundary conditions produced good results for all but the first torsion frequency This frequency was tuned by increasing the model s control system stiffness This tuned model produces good frequencies and mode shapes Additional investigation is needed to compare the dynamic model corrections to the static model corrections found by Jack Sawdy AF IT/GAE/AA/81D-27 Author (GRA)

N82-26317# Air Force Inst of Tech Wright-Patterson AFB Ohio School of Engineering
MINIMUM TIME TURNS CONSTRAINED TO THE VERTICAL PLANE M S Thesis
Christopher S Finnerty Dec 1981 77 p refs
(AD-A111096 AFIT/GAE/AA/81D-7) Avail NTIS HC A05/MF A01 CSCL 01/2
The objective of this study is to find the throttle controls and trajectories which yield the minimum turning times for a high performance aircraft with thrust reversal capability The aircraft remains in the vertical plane allowing only pull-up and split-s maneuvers A second-order parameter optimization method coupled with the suboptimal control approach is used to solve the minimum time-to-turn problem The results of the study found that trajectories restricted to the vertical plane gave different results, and in at least one case better results than those not so constrained The results also indicate that depending on the maneuver performed thrust reversal is beneficial in reducing the minimum time-to-turn regardless of whether the aircraft s initial velocity is above or below corner speed Finally the results demonstrate that thrust reversal can be utilized for minimum time turns with resulting increases in specific energy GRA

N82-26318# Air Force Inst of Tech Wright-Patterson AFB, Ohio School of Engineering
USE OF ENTIRE EIGENSTRUCTURE ASSIGNMENT WITH HIGH-GAIN ERROR-ACTUATED FLIGHT CONTROL SYSTEMS M S Thesis
Darrell Brett Ridgely Dec 1981 155 p refs
(AD-A111098, AFIT/GAE/AA/81D-24) Avail NTIS HC A08/MF A01 CSCL 01/3
The theory of high-gain error-actuated feedback control, developed by Porter and Bradshaw was applied to the design of various longitudinal decoupling flight control systems for an advanced aircraft The controllers developed in this study utilized output feedback with proportional plus integral control to produce desirable closed-loop response with minimal interaction between outputs This report describes how entire eigenstructure assignment can be used to determine appropriate measurement equations by assigning their corresponding transmission zeros A singular value decomposition was used to choose the eigenvectors from their permissible subspaces The results show that these modes appear in the output response even for very high gain Therefore selection of good eigenvalues/eigenvectors was shown to be crucial to the successful application of this theory This report also examined the effect of varying the other design parameters on the closed-loop system response GRA

N82-26319# Lear Inc Grand Rapids Mich Instrument Div
INTEGRATED FLIGHT TRAJECTORY CONTROL Final Report, Aug 1979 - May 1981

Gregory L Comegys and Garrett R Hanson Wright-Patterson AFB Ohio AFWAL Aug 1981 151 p refs
(Contract F33615-79-C-3624 AF Proj 2403)
(AD-A110998 ID-01R-0481 AFWAL-TR-81-3077) Avail NTIS HC A08/MF A01 CSCL 01/3

IPTC programs demonstrated by simulation the ability to compute four dimensional reference trajectories and provide guidance commands to the pitch and role autopilot axes for vertical and lateral aircraft control and to the autothrottle for thrust and accurate time of arrival control The ability of the trajectory generator to respond to pilot induced flight plan deviations and data linked mission changes was also demonstrated Conventional cathode ray tubes (CRTs) were utilized for flight plan graphics and alphanumeric display The IFTC Development Program was concerned with adding certain functions to increase the tactical flight management capabilities of the concept IFTC was integrated with the Firefly II advanced air to ground weapon delivery algorithms to provide ingress and egress flight path generation and control The LSI developed Mission Data Transfer System (MDIS) was added to the simulation to demonstrate the aid to mission planning and the rapid data initialization of the simulated airborne system Author

N82-26320# Bunker-Ramo Corp Westlake Village Calif Electronic Systems Div
SIMULATION REPORT ADVANCED DISPLAY FOR COMPLEX FLIGHT TRAJECTORIES Final Report, Jun - Oct 1980
Peter B Lovering Debra A Warner Deborah K Park, Matthew Miller and Stuart B Burdess (AFWAL) Wright-Patterson AFB Ohio AFWAL Jun 1981 72 p refs
(Contract F33615-78-C-3614 AF Proj 2403)
(AD-A111259 AFWAL-TR-81-3057) Avail NTIS HC A04/MF A01 CSCL 01/2

Several cockpit display problems were revealed during flight tests of complex approach trajectories in support of the Microwave Landing System (MLS) Program Among these problems were pilot orientation with respect to the approach profile and the runway verifying proper performance along the prescribed path and cross-checking or monitoring profile computations This document contains a brief background statement regarding the display and describes the simulator experiment results and recommendations for display improvement In all eight rated Air Force Pilots of varying backgrounds flew approximately 264 curved multi-segmented glideslope approaches in a variety of simulated wind conditions Data collection included objective performance with respect to the desired flight path and pilot opinion on each of the new display features Generally, pilots were favorably impressed with the display concept and recommended further development GRA

N82-26321# Applied Science Associates Inc Valencia Pa
MAINTENANCE TRAINING SIMULATOR DESIGN AND ACQUISITION HANDBOOK OF ISB PROCEDURES FOR DESIGN AND DOCUMENTATION Interim Report, Mar 1979 - Mar 1980
Rohn J Hritz Hobart J Harris Jennifer A Smith and George R Purifoy Jr Brooks AFB, Tex AFHRL Feb 1982 215 p
(Contract F33615-78-C-0019 AF Proj 2361)
(AD-A111430 AFHRL-TP-81-51) Avail NTIS HC A10/MF A01 CSCL 05/9

This technical paper presents a method for deriving training requirements selecting an approach for meeting the training objectives identified and making training equipment fidelity and instructional feature design decisions where training hardware is needed The procedures supplement existing materials (AFP 50-58 and the 3306th Test and Evaluation Squadron Procedural Handbook Edwards AFB) by clarifying existing training technology and providing new procedures to assist the ISD analyst in designing and documenting training equipment The handbook expands upon currently used procedures in three major decision areas These are (a) determining which training requirements require hardware or training equipment of some type (b) selecting the degree of fidelity with which to represent components and parts on the training equipment and (c) choosing instructional features to be incorporated in the training equipment All procedures use decision flow charts to increase objectivity The method results in documentation that is to be used as a basis for completing the ISD-Derived Training Equipment Design The design is then communicated to the Simulator System Program Office (SimSPO) for use in preparing procurement specifications to contractors Author (GRA)

N82-26322# Calspan Field Services Inc Arnold Air Force Station, Tenn
PERFORMANCE OF THE AEDC MARK 1 AEROSPACE ENVIRONMENTAL CHAMBER WITHOUT OIL DIFFUSION PUMPING Final Report
W B Stephenson and R E Alt Feb 1982 26 p refs
(AD-A111406 AEDC-TR-81-32) Avail NTIS HC A03/MF A01 CSCL 14/2

The 40- by 80-ft MK-I Aerospace Environmental Chamber was pumped down to a pressure of 2 x 10 to the minus 6th power torr in order to verify an operational mode that could maintain test conditions without the use of oil diffusion pumping Mechanical pumps rough pumped into the micron (1 to 100 x 10 to the minus 3rd power torr) range and the cryogenic arrays reduced the pressure to 2 x 10 to the minus 6th power torr and maintained it for 24 hours The pumpdown without the use of diffusion pumping is often dictated by test requirements for exceptional cleanliness After pumpdown, inbleeding of CO2 H2, and N2 affected chamber pressure as a function of gas species and inflow rate The time for the liquid nitrogen and gaseous helium-cooled cryosurfaces to cool down and warm up was determined as an aid to test planning Because several modifications to the cryopumping geometry had been made since the chamber was initially placed into service it was considered important to verify the MK-I performance It is concluded that the mechanical roughing/cryogenic pumping method of operation is satisfactory for simulation of conditions where the outgassing is relatively small or consists of gases with low vapor pressure at liquid nitrogen temperature (i e CO2 or H2O) GRA

N82-26323# Air Force Inst of Tech Wright-Patterson AFB, Ohio School of Systems and Logistics
OPTIMAL PLACEMENT MODEL FOR THE B-52G WEAPONS SYSTEM TRAINER M S Thesis
Franklin E Hoke Jr Sep 1981 79 p refs
(AD-A110977 AFIT/LSSR-83-81) Avail NTIS HC A05/MF A01 CSCL 15/5

As a result of the Force Modernization Study the Strategic Air Command will have its first new generation simulator the Weapons System Trainer (WST) available in the beginning of 1982 Because of the highly intensive requirements of B-52 training it had been determined that each B-52 unit would be equipped with a total WST system While there is agreement with the strategic implications of individual base location for the WST, the necessity of that decision should be questioned. The original research question directed at G model bases was Can an economically optimum location scheme be determined for the minimum number of WST s necessary to meet training requirements? Consequently the central objective of this research was the development of a mathematical model which would assure the optimum placement of the WST based on the defined resources constraints and economic criteria The research and generated solutions lend credence to the model as a management tool in that it permits an objective analysis of alternatives in terms of cost location schemes and number of simulators It is concluded that the model should provide useful information in future simulator location studies Author (GRA)

N82-26324# Federal Aviation Administration Washington D C Office of Aviation Policy and Plans
FINAL REGULATORY EVALUATION METROPOLITAN WASHINGTON AIRPORTS POLICY Final Report
Lawrence A Pearsall and Douglas A Samuelson Oct 1981 187 p refs
(AD-A110583 FAA-APO-81-12) Avail NTIS HC A09/MF A01 CSCL 01/2

This final regulatory evaluation examines the potential impacts of rules to be applied to aircraft operations at Washington National Airport These rules are part of the overall policy toward the development of Washington National Airport and Dulles International Airport The alternative economic impacts on airlines passengers, communities and the FAA of imposing passenger ceilings, operations quotas landing fees, perimeter rules, curfews and noise restrictions under various scenarios are assessed in this evaluation, and the final rule is specifically addressed in the final Chapter The quantifiable impacts of this rule are estimated at a $27 million net cost to society, but this net cost is believed to be outweighed by benefits which cannot be measured Author (GRA)

N82-26325# Naval Training Equipment Center, Orlando Fla Visual Technology Research Simulator

VISUAL TECHNOLOGY RESEARCH SIMULATOR. VISUAL AND MOTION SYSTEM DYNAMICS Interim Report, 1978 - 1981
G Blair Browder and Steve K Butrimas Apr 1981 75 p refs
(AD-A111801 NAVTRAEQUIPC-IH-326) Avail NTIS HC A04/MF A01 CSCL 05/9

Simulator system time lags and transport delays can be critical factors in achieving a successful modern trainer This document presents the results of detailed measurements made on the Navy s Visual Technology Research Simulator (VTRS/CTOL) These measurements determined end-to-end dynamic lags, with aircraft control stick as the input stimulus and visual/motion hardware response as the output Major subsystems of the VTRS/CTOL include a T-2C aircraft cockpit, pneumatic G-seat, six degree of freedom motion base, wide angle dome display with a servo-controlled projection system driven with either CIG or closed circuit model board TV Dynamic performance data shows phasing between the motion and visual systems for CIG and model board simulation This study concludes that the VTRS/CTOL simulator throughout lags are less than 150 milliseconds which is generally accepted as satisfactory for simulation Author (GRA)

N82-26326# Federal Aviation Administration, Washington, D C Office of Aviation Policy and Plans
AIRFIELD AND AIRSPACE CAPACITY/DELAY POLICY ANALYSIS
Harvey Safeer John Rodgers, Lawrence A Pearsall, Stefan Hoffer Mark Pfeifer and David DeCarme Dec 1981 59 p refs
(AD-A110777 FAA-APO-81-14) Avail NTIS HC A04/MF A01 CSCL 01/5

A general discussion of the concepts of capacity and delay at airfields and in enroute airspace precedes an estimation of present and future capacity and delay Options to increase capacity and mitigate delay are then reviewed The discussion is pointed towards United States air carrier airports and the users of those airports The most detailed analysis concerns the top 39 air carrier airports and is based on data collection from three major air carriers Potential congestion problems sufficient to impair the efficiency of national transportation are found to be possible at 19 major airports by 1991 Remedies to such congestion are described for 12 airports but presently known resources are expected to be insufficient to satisfy the potential demand at 7 airports GRA

N82-26350*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville Ala
THE MARSHALL SPACE FLIGHT CENTER KC-135 ZERO GRAVITY TEST PROGRAM FOR FY 1981
R E Shurney ed Mar 1982 69 p refs
(NASA-TM-82476 NAS 1 15 82476) Avail NTIS HC A04/MF A01 CSCL 11G

Seven separate investigations during 23 5 hours of testing aboard the KC-135 zero gravity aircraft were conducted All experiment objectives were met or exceeded Author

N82-26384* National Aeronautics and Space Administration Langley Research Center, Hampton, Va
FUSELAGE STRUCTURE USING ADVANCED TECHNOLOGY FIBER REINFORCED COMPOSITES Patent
Robert K Robinson (Boeing Commercial Airplane Co, Seattle) and Harry M Tomlinson, inventors (to NASA) (Boeing Commercial Airplane Co, Seattle) Issued 12 Jan 1982 9 p Filed 16 Feb 1978 Supersedes N78-18045 (16 - 09, p 1111) Sponsored by NASA
(NASA-Case-LAR-11688-1, US-Patent-4,310,132 US-Patent-Appl-SN-878540 US-Patent-Class-244-119, US-Patent-Class-244-123, US-Patent-Class-244-132) Avail US Patent and Trademark Office CSCL 11D

A fuselage structure is described in which the skin is comprised of layers of a matrix fiber reinforced composite, with the stringers reinforced with the same composite material The high strength to weight ratio of the composite, particularly at elevated temperatures, and its high modulus of elasticity, makes it desirable for use in airplane structures

Official Gazette of the U S Patent and Trademark Office

N82-26400# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio Fuels Branch
KOVATS INDICES AS A TOOL IN CHARACTERIZING HYDROCARBON FUELS IN TEMPERATURE PROGRAMMED GLASS CAPILLARY GAS CHROMATOGRAPHY. PART 1 QUALITATIVE IDENTIFICATION Final Report, Dec. 1979 - Sep 1980
Paul C Hayes, Jr and Edward W Pitzer Nov 1981 85 p refs
(AF Proj 3048)
(AD-A111389, AFWAL-TR-81-2102) Avail NTIS HC A05/MF A01 CSCL 21/4

Kovats Indices are used as a tool to identify the major components of several aircraft jet fuels of the JP-4 type Glass capillary gas chromatography in the temperature programmed mode was the technique of choice The first phase of the effort involved optimization of the capillary system for the maximum resolution between a selected pair of normal hydrocarbons in an acceptable analysis time Peak resolution was investigated as a function of carrier capillary pressure, temperature programming rate, and initial column temperature Eleven qualitatively known and quantitatively accurate calibration solutions were prepared to include over 200 different hydrocarbons Kovats Indices were generated for these solutions in a statistically reliable fashion on two capillary columns of different polarities Thus, each hydrocarbon standard had its own unique set of two Kovats Indices Several petroleum, as well as shale derived JP-4 samples were subsequently chromatographed on the same two capillary columns Peaks were given tentative identification by matching of Kovats Indices Author (GRA)

N82-26439*# United Technologies Corp, East Hartford Conn Commercial Products Div
HOT ISOSTATICALLY PRESSED MANUFACTURE OF HIGH STRENGTH MERL 76 DISK AND SEAL SHAPES Final Report
R D Eng and D J Evans May 1982 139 p refs
(Contract NAS3-20072)
(NASA-CR-165549 NAS 1 26 165549, PWA/5574-123) Avail NTIS HC A07/MF A01 CSCL 11F

The feasibility of using MERL 76, an advanced high strength direct hot isostatic pressed powder metallurgy superalloy, as a full scale component in a high technology long life, commercial turbine engine were demonstrated The component was a JT9D first stage turbine disk The JT9D disk rim temperature capability was increased by at least 22 C and the weight of JT9D high pressure turbine rotating components was reduced by at least 35 pounds by replacement of forged Superwaspaloy components with hot isostatic pressed (HIP) MERL 76 components The process control plan and acceptance criteria for manufacture of MERL 76 HIP consolidated components were generated Disk components were manufactured for spin/burst rig test, experimental engine tests, and design data generation, which established lower design properties including tensile, stress-rupture, 0 2% creep and notched (Kt = 2 5) low cycle fatigue properties, Sonntag, fatigue crack propagation, and low cycle fatigue crack threshold data Direct HIP MERL 76, when compared to conventionally forged Superwaspaloy, is demonstrated to be superior in mechanical properties increased rim temperature capability, reduced component weight, and reduced material cost by at least 30% based on 1980 costs J D

N82-26446# Dayton Univ, Ohio Research Inst
RESEARCH AND DEVELOPMENT ON WEAR METAL ANALYSIS Final Report, 16 Mar 1976 - 20 Jul. 1981
Wendell E Rhine, Costandy S Saba, Robert E Kauffman, John R Brown, and Patricia S Fair Wright-Patterson AFB, Ohio AFWAL Jan 1982 253 p refs
(Contract F33615-76-C-5312, AF Proj 2303)
(AD-A112100 AFWAL-TR-81-4184) Avail NTIS HC A12/MF A01 CSCL 07/4

Since the reliability of wear metal determinations depends on the integrity of the primary standards used to calibrate the instruments standards were synthesized and evaluated for use in the Oil Analysis Program (OAP) The standards currently used by the Air Force in addition to Cannon metal caprates metal beta-diketonates, and NBS standards were evaluated for their long term stability Two state-of-the-art plasma emission instruments were evaluated for their potential applications to the AF OAP The goal of this effort was to improve the particle detection capability of oil analysis instruments The sample introduction systems used by these instruments could not efficiently transport particles to the plasma sources However, the dc plasma instrument could analyze particles better than currently used instruments Research was also conducted to identify and characterize wear debris found in typical used turbine engine lubricating oils Methods were developed to determine the concentration of organometallic metallic and metal oxide species in oils for Mg, Cu and Fe An investigation was conducted to determine and recommend optimized atomic absorption procedures for analysis of wear metals in aircraft lubricating oils Optimization procedures and recommended AA methods are included A method was developed to determine the 'actual' concentration of wear metals in authentic used aircraft engine oils It is quantitative for Al, Cr, Cu, Fe, Mg, Mo, Ni, Pb, Sn and Ti metallic particles GRA

N82-26465*# Rockwell International Corp, Downey Calif

DEVELOP, DEMONSTRATE, AND VERIFY LARGE AREA COMPOSITE STRUCTURAL BONDING WITH POLYIMIDE ADHESIVES Final Report

Bashir D Bhombal Donald H Wykes Keith C Hong and Arnold A Stenersen May 1982 152 p refs

(Contract NAS1-15843)

(NASA-CR-165839 NAS 1 26 165839) Avail NTIS HC A08/MF A01 CSCL 11A

The technology required to produce graphite-polyimide structural components with operational capability at 598 K (600 F) is considered A series of polyimide adhesives was screened for mechanical and physical properties and processibility in fabricating large midplane bonded panels and honeycomb sandwich panels in an effort to fabricate a structural test component of the space shuttle aft body flap From 41 formulations, LaRC-13 FM34B-18, and a modified LaRC-13 adhesive were selected for further evaluation The LaRC-13 adhesive was rated as the best of the three adhesives in terms of availability, cost processibility properties and ability to produce void fee large area (12 x 12') midplane bonds Surface treatments and primers for the adhesives were evaluated and processes were developed for the fabrication of honeycomb sandwich panels of very good quality which was evidenced by rupture in the honeycomb core rather than in the facesheet bands on flatwise tensile strength testing The fabrication of the adhesively bonded honeycomb sandwich cover panels ribs, and leading edge covers of Celion graphite/LARC-160 polyimide laminates is described ARH

N82-26483*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

EXPERIMENTS ON FUEL HEATING FOR COMMERCIAL AIRCRAFT

R Friedman and F J Stockemer (Lockheed-California Co, Burbank, Calif) 1982 15 p refs Presented at 18th Joint Propulsion Conf, Cleveland, 21-23 Jun 1982, Sponsored by AIAA, SAE and ASME

(NASA-TM-82878 E-1254, NAS 1 15 82878) Avail NTIS HC A02/MF A01 CSCL 21D

An experimental jet fuel with a -33 C freezing point was chilled in a wing tank simulator with superimposed fuel heating to improve low temperature flowability Heating consisted of circulating a portion of the fuel to an external heat exchanger and returning the heated fuel to the tank Flowability was determined by the mass percent of unpumpable fuel (holdup) left in the simulator upon withdrawal of fuel at the conclusion of testing The study demonstrated that fuel heating is feasible and improves flowability as compared to that of baseline, unheated tests Delayed heating with initiation when the fuel reaches a prescribed low temperature limit, showed promise of being more efficient than continuous heating Regardless of the mode or rate of heating complete flowability (zero holdup) could not be restored by fuel heating The severe, extreme-day environment imposed by the test caused a very small amount of subfreezing fuel to be retained near the tank surfaces even at high rates of heating Correlations of flowability established for unheated fuel tests also could be applied to the heated test results if based on boundary-layer temperature or a solid index (subfreezing point) characteristic of the fuel Author

N82-26484# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio Fuels Branch

JET FUEL FROM SHALE OIL THE 1981 TECHNOLOGY REVIEW

Herbert R Lander, Jr Dec 1981 257 p refs Proceedings of Symp, Miamisburg, Ohio, 17-18 Nov 1981

(AF Proj 3048)

(AD-A111217, AFWAL-TR-81-2135) Avail NTIS HC A12/MF A01 CSCL 21/4

The Jet Fuel From Shale Oil - 1981 Technology Review culminated three years of Air Force Shale Oil related programs Final economic optimized results of three processing studies evaluating the yield, cost and quality of JP-4 and JP-8 jet fuel produced from whole crude shale oil are discussed Reported also are technologies associated with a newly developed nitrogen tolerant catalyst and conclusions of combustion studies performed on shale derived JP-4 jet fuel samples and Nuclear Magnetic Resonance (NMR) analyses of the composition of shale derived jet fuel samples Author (GRA)

N82-26485# Center for Naval Analyses, Alexandria, Va Naval Studies Group

MOBILITY FUELS FOR THE NAVY

Thomas ONeill Jan 1982 21 p refs

(Contract N00014-76-C-0001)

(AD-A112511, CNA-PP-336) Avail NTIS HC A02/MF A01 CSCL 21/4

As fuel declines, both specifications and engine designs will have to be modified to accommodate this change In addition, specifications have to reflect the fact that fuel chemistry itself is undergoing change, so that new problems have begun to arise Recently, batches of DFM and JP-5 that passed inspection have been associated with fuel filter clogging and excessive smoking The mechanisms of these effects are not clearly understood As synfuels are introduced, the variety of chemicals in fuels will be greatly expanded, and this will cause a new range of problems Besides modifying the specifications of current fuels to address the issues of price and availability, other ways might come from changing the types of fuel burned The Navy could attempt to switch to fuels in civilian use Number 2 diesel oil is similar to the ship fuel DFM while Jet A-1 is not unlike the aircraft fuel JP-5 Another approach could involve the use of just one type of fuel for both ships and airplanes This would reduce storage and handling costs perhaps enough to offset the modest differential of 5 cents per gallon between JP-5 and DFM that existed in October 1981 GRA

N82-26487# Southwest Research Inst, San Antonio, Tex Army Fuels and Lubricants Research Lab

DEVELOPMENT OF ARMY HIGH-ENERGY FUEL DIESEL/TURBINE-POWERED SURFACE EQUIPMENT, PHASE 2 Interim Report, Oct 1979 - Sep. 1981

William W Wimer and D M Yost Dec 1981 134 p refs

(Contracts DAAK70-80-C-0001, DAAK70-82-C-0001, DA Proj, 1L7-62733-AH-20)

(AD-A111942, AFLRL-147) Avail NTIS HC A07/MF A01 CSCL 21/4

The Army is interested in those fuels that have a high-energy content per unit volume and therefore result in increased payload capabilities and/or extended operational range of the vehicle A series of screening processes are being used to identify those fuels and/or fuel components that could result in an increase of 10 percent in the range of the vehicle without an increase in the fuel tank size, i e, fuels with a high-energy content percent volume The chemical and physical properties of various candidate fuels and fuel components are described The fuel components included both liquids and solids (at room temperature) The blending of the various components and the characterization of the resulting fuels are outlined Solubility studies were done on some of the solid components to assist in obtaining the resulting fuel in the more desirable liquid state Those solid components, such as anthracene, that were insoluble in the tests conducted but judged to have good high-energy potential were studied as slurries Catalyzed 'carbon black' was investigated Settling studies with carbonaceous fuels included the effect of temperature upon the stability the stability of FRF-carbon slurries, and the refinement of the previously reported Freezing Tube Technique' for measuring stability Impact dispersion tests were conducted to study the fire-safety characteristics of energy-augmented fuels The screening of candidate fuels with the Petter engine is described in detail Other engine studies with the CLR engine are also included Author (GRA)

N82-26490# Department of Energy Washington D C Office of Transportation Programs

SYMPOSIUM ON COMMERCIAL AVIATION ENERGY CONSERVATION STRATEGIES, PAPERS AND PRESENTATIONS

Apr 1981 354 p refs Symp held in Washington, D C, 2-3 Apr 1981 Sponsored in part by FAA

(AD-A107106) Avail NTIS HC A16/MF A01 CSCL 21/4

The Symposium provided a forum in which representatives from DOE FAA National Aeronautics and Space Administration (NASA) and the aviation industry exchanged information and ideas regarding current and future efforts to conserve fuel and to promote energy conservation within the commercial aviation sector General topics discussed included Federal and industry energy conservation programs such as flight operations, air traffic control, engineering and maintenance, and corporate management strategies The Symposium, was highlighted by a panel discussion entitled 'Energy Conservation Where Do We Go From Here?' This report contains the papers and presentations from the Symposium GRA

N82-26546# Lincoln Lab, Mass Inst of Tech, Lexington
A COMPARATIVE STUDY OF NARROWBAND VOCODER ALGORITHMS IN AIR FORCE OPERATIONAL ENVIRONMENTS USING THE DIAGNOSTIC RHYME TEST
E Singer 6 Jan 1982 26 p refs
(Contract F19628-80-C-0002)
(AD-A112053, TR-590, ESD-TR-81-334) Avail NTIS HC A03/MF A01 CSCL 17/2

This report presents a summary of work performed at Lincoln Laboratory aimed at improving the intelligibility of 2 4 kbps vocoders to be used in USAF operational environments The distortions present in some of these environments, particularly the F-15 fighter aircraft can place a severe burden on the speech modelling capabilities of contemporary vocoders To study these effects and the benefits of various algorithmic improvements the Diagnostic Rhyme Test was used as a means of providing an objective measure of relative system performance A wide range of areas was explored through the use of real time computer simulations, including the effects of modified analysis and synthesis techniques, design parameter choices, interoperability, and environmental factors The purpose of this report is to assemble and document the extensive body of DRT data which has been collected and thereby provide a means for the selection of design parameters likely to lead to improved vocoder performance Author (GRA)

N82-26554# Ohio State Univ Columbus ElectroScience Lab
ELEVATION PLANE ANALYSIS OF ON-AIRCRAFT ANTENNAS
Chong L Yu and Walter Dennis Burnside Jan 1982 93 p refs
(Contract N62269-71-C-0296)
(AD-A112373 ESL-3188-2) Avail NTIS HC A05/MF A01 CSCL 09/5

The radiation patterns, in the elevation plane, of airborne antennas mounted on the aircraft fuselage have been analyzed by modern diffraction theory including wedge diffraction theory and creeping wave theory It is found that the fuselage shape has a dominant effect on the elevation patterns In order to analyze a general convex shape, a new approach, 'section matching method', has been developed in which the fuselage profile is described by a set of points This new method is applied to some general geometrical shapes which approximate aircraft fuselage The composite elliptical cylinder is the most general model considered The validity of this method has been verified by modal one more rigorous GTD solutions Author (GRA)

N82-26612# Air Force Wright Aeronautical Labs Wright-Patterson AFB, Ohio Aerodynamics and Airframe Branch
THE NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR INCOMPRESSIBLE TURBULENT FLOW OVER AIRFOILS Final Technical Report, Oct 1979 - Feb 1981
Harwood A Hegna Oct 1981 154 p refs
(AF Proj 2307)
(AD-A111279 AFWAL-TR-81-3053) Avail NTIS HC A08/MF A01 CSCL 20/4

Numerical solutions are obtained for two-dimensional incompressible turbulent viscous flow over airfoils of arbitrary geometry An algebraic eddy viscosity turbulence model based on Prandtl's mixing length theory is modified for separated adverse pressure gradient flows Finite difference methods for solving the inviscid stream function equation and the incompressible laminar Navier-Stokes equations are used A finite difference method for solving the Reynolds averaged incompressible turbulent two-dimensional Navier-Stokes equations is employed The inviscid stream function equation and the Navier-Stokes equations are transformed using a curvilinear transformation A body-fitted coordinate system with a constant coordinate line defining the airfoil section surface is transformed to a rectangular coordinate system in the transformed or computational plane An elliptic partial differential Poisson equation for each coordinate is used to generate the coordinate system in the physical plane for arbitrary airfoils The two-dimensional time dependent Reynolds averaged incompressible Navier-Stokes equations in the primitive variables of velocity and pressure and a Poisson pressure equation are numerically solved Turbulence is modelled with an adverse pressure gradient eddy viscosity technique An implicit finite difference method is used to solve the set of transformed partial differential equations The system of linearized simultaneous difference equations, at each time step, is solved using successive-over-relaxation iteration GRA

N82-26619# Naval Surface Weapons Center, White Oak, Md
COMPARISON OF NUMERICAL RESULTS AND MEASURED DATA FOR SMOOTH AND INDENTED NOSETIPS
Tsuying Hsieh 14 May 1981 12 p refs
(AD-A111794) Avail NTIS HC A02/MF A01 CSCL 20/4

Numerical calculations, using an unsteady implicit numerical algorithm which solves either the inviscid or the thin-layer Navier-Stokes equations, were performed for smooth and severely indented nosetips at hypersonic speed and zero angle of attack The computed results of inviscid and laminar flowfield are compared to wind tunnel measured data for surface pressure, shock location, heat transfer and density distribution in the shock layer Good agreements between the calculated and measured flowfield are obtained for smooth nosetip without flow separation Difficulties in the simulation of severely indented nosetips with large separation bubble or sharp corner are discussed Author (GRA)

N82-26660# Defense Mapping Agency Washington, D C Advanced Technology Div
THE HYDROGRAPHIC AIRBORNE LASER SOUNDER (HALS)
Stephen M Webb 3 Feb 1982 12 p refs
(AD-A111027) Avail NTIS HC A02/MF A01 CSCL 08/10

To provide an increase in hydrographic survey resources the Hydrographic Airborne Laser Sounder is being developed by the Naval Ocean Research and Development Activity (NORDA) under the sponsorship of the Defense Mapping Agency (DMA) The HALS system incorporates a pulsed, scanning blue-green laser and will be flown in a helicopter from a survey ship operated by the U S Naval Oceanographic Office (NAVOCEANO) Through the use of statistics in post-flight processing the HALS data will meet survey accuracy standards more than adequate for safe navigation NORDA will perform a technical evaluation of HALS and then turn the system over to NAVOCEANO for operation in late 1983 Author (GRA)

N82-26701*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
BIRD IMPACT ANALYSIS PACKAGE FOR TURBINE ENGINE FAN BLADES
Murray S Hirschbein 1982 20 p refs Presented at 23rd Struct Dyn and Mater Conf, New Orleans, 10-12 Previously announced in IAA as A82-30162 May 1982, Sponsored by AIAA, ASME, ASCE and AHS
(NASA-TM-82831, NAS 1 15 82831) Avail NTIS HC A02/MF A01 CSCL 20K

N82-26703*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
COMPARISON OF ANALYTICAL AND WIND-TUNNEL RESULTS FOR FLUTTER AND GUST RESPONSE OF A TRANSPORT WING WITH ACTIVE CONTROLS
Irving Abel, Boyd Perry, III, and Jerry R Newsom Jun 1982 47 p refs
(NASA-TP-2010, L-15099 NAS 1 60 2010) Avail NTIS HC A03/MF A01 CSCL 01C

Two flutter suppression control laws wre designed and tested on a low speed aeroelastic model of a DC-10 derivative wing Both control laws demontrated increases in flutter speed in excess of 25 percent above the passive wing flutter speed In addition, one of the control laws was effective in reducing loads due to turbulence generated in the wind tunnel The effect of variations in gain and phase on the closed-loop performance was measured and is compared with predictions In general, both flutter and gust response predictions agree reasonably well with experimental data B W

N82-26720# Naval Postgraduate School, Monterey, Calif Dept of Aeronautical Engineering

DESIGN OF A DATA ACQUISITION AND REDUCTION SYSTEM FOR FATIGUE TESTING M S Thesis

Jerry Wayne Dalton Sep 1981 64 p refs

(AD-A110612) Avail NTIS HC A04/MF A01 CSCL 14/2

A data acquisition and reduction system has been created for aircraft materials fatigue testing The system uses an HP-9835 Desktop Calculator an HP-2240A Measurement and Control Processor and a Materials Testing System loading machine Three different computer programs on the HP-9835 are used to analyze material properties, simulate inflight fatigue loading and compute fatigue damage at a stress concentration The flight loads are selected from Mil Spec 8866 and applied in a random order The fatigue damage at a stress concentration is calculated from the applied local stresses using Miner's Law Author (GRA)

N82-26822# Washington Univ Technology Associates, Inc St Louis Mo

YAWING OF WIND TURBINES WITH BLADE CYCLIC-PITCH VARIATION Final Report, 15 Sep 1979 - 15 Dec 1980

K H Hohenemser, Andrew H P Swift, and David A Peters Aug 1981 242 p refs Prepared for Midwest Research Inst Golden, Colo

(Contracts DE-AC02-77CH-00178, EG-77-C-01-4042)

(DE81-029639 SERI/TR-8085-3-T2) Avail NTIS HC A11/MF A01

The control system horizontal axis wind turbine is discussed It incorporates two features the application of blade cyclic pitch variation adopted from rotorcraft technology and the use of yaw angle control, not only for wind direction following, but also for rotor speed or torque control Cyclic pitch variation in a two-bladed rotor relieves the blades of all the gyroscopic and odd harmonic aerodynamic root moments It makes rapid yaw rates of a two-bladed rotor possible without causing vibratory hub moments and without causing appreciable angular excursions of the blade tip path plane Due to the allowable rapid yaw rates of wind turbines with blade cyclic pitch variation, the two conventional separate control systems - yaw control for wind direction following and blade feathering control for regulating rotor speed and torque - can be replaced by a system with only a single control variable, the rotor yaw angle DOE

N82-26828# Sandia Labs Albuquerque, N Mex

USER'S MANUAL FOR THE VERTICAL AXIS WING TURBINE CODE VDART2

J H Strickland T Smith, and K Sun Sep 1981 70 p refs

(Contract DE-AC04-76DP-00789)

(DE82-000796 SAND-81-7039) Avail NTIS HC A04/MF A01

This user s manual provides details on the Darrieus wind turbine aerodynamic performance/loads prediction computer code, VDART2 The code is the latest generation of vortex-based models and includes the effects of dynamic stall, pitching circulation, and added mass DOE

N82-26873# Air Force Engineering and Services Center, Tyndall AFB, Fla Engineering and Services Lab

THE BIOLOGICAL DEGRADATION OF SPILLED JET FUELS A LITERATURE REVIEW Final Report, Jun - Aug 1981

Robert E Carlson Oct 1981 41 p refs

(AF Proj 1900)

(AD-A110758, AFESC/ESL-TR-81-50) Avail NTIS HC A03/MF A01 CSCL 06/6

Biodegradation of many of the components of Air Force fuels does occur, although most studies have been done under laboratory conditions, and the extrapolation of the findings to natural rates of biodegradation is premature Many factors affect biodegradation rates, including the nature and concentration of the specific hydrocarbon compound, the species of bacteria present and their quantity, and environmental factors such as nutrient availability, temperature, and oxygen concentrations Initial concerns should be first, the determination of the importance of biodegradation relative to other loss factors such as volatilization and sediment sorption, and second the determination of the ultimate fate of recalcitrant compounds and their metabolites Author (GRA)

N82-26897# Applied Physics Lab, Johns Hopkins Univ Laurel, Md

INFLUENCE OF METEOROLOGICAL PROCESSES ON THE VERTICALITY OF ELECTRIC FIELDS Final Report, 1 Oct. 1978 - 30 Sep. 1981

Maynard L Hill 15 Jan 1982 16 p refs

(Contract N00024-78-C-5384 DA Proj 1L1-61102-BH-57)

(AD-A111549 APL/ATO-P/MLH82-06, ARO-14830 1-GS) Avail NTIS HC A02/MF A01 CSCL 04/1

A maneuverable atmospheric probe (MAP) was instrumented with atmospheric electric field sensors and operated at White Sands Missile Range to investigate meteorological affects on the verticality of electric fields Verticality to within + or - 2 deg was found to be the norm for fair weather conditions that included a high degree of convective instability Near a large mountain peak, it was observed that the field contours are favorable for deriving information that is useful for preventing collisions of aircraft with mountainous and other terrain protuberances Author (GRA)

N82-26921*# Arizona State Univ, Tempe

WIND TUNNEL MEASUREMENTS OF THREE-DIMENSIONAL WAKES OF BUILDINGS Final Report

Earl Logan Jr and Shu Ho Lin Washington NASA Jun 1982 95 p refs

(Contract NAS8-32357)

(NASA-CR-3565, M-379, NAS 1 26 3565) Avail NTIS HC A05/MF A01 CSCL 04B

Measurements relevant to the effect of buildings on the low level atmospheric boundary layer are presented A wind tunnel experiment was undertaken to determine the nature of the flow downstream from a gap between two transversely aligned, equal sized models of rectangular cross section These building models were immersed in an equilibrium turbulent boundary layer which was developed on a smooth floor in a zero longitudinal pressure gradient Measurements with an inclined (45 degree) hot-wire were made at key positions downstream of models arranged with a large, small, and no gap between them Hot-wire theory is presented which enables computation of the three mean velocity components, U, V and W, as well as Reynolds stresses These measurements permit understanding of the character of the wake downstream of laterally spaced buildings Surface streamline patterns obtained by the oil film method were used to delineate the separation region to the rear of the buildings for a variety of spacings S L.

N82-26939# Air Weather Service Scott AFB, Ill Aerospace Sciences Branch

FORECASTING AIRCRAFT CONDENSATION TRAILS

Sep 1981 25 p refs

(AD-A111876, AD-E850130, AWS/TR-81/001) Avail NTIS HC A02/MF A01 CSCL 04/2

Aircraft condensation trails (contrails) are caused by aircraft aerodynamics or engine exhaust in the proper atmospheric conditions Engine-exhaust trails are the most common and are discussed in this report Jet aircraft contrail-formation graphs facilitate yes-or-no forecasts for any season with forecasts of pressure, temperature and relative humidity Contrail probability curves give condensation trail probabilities with forecast pressure and temperature Engine power setting does not affect contrail formation, but does affect intensity The contrail-formation graph for propeller aircraft is similar to the jet graph GRA

N82-27009*# Massachusetts Inst of Tech Cambridge Lab for Information and Decision Systems

CONTROL OPTIMIZATION, STABILIZATION AND COMPUTER ALGORITHMS FOR AIRCRAFT APPLICATIONS Status Report, 15 Apr. 1981 - 15 May 1982

Michael Athans ed and Alan S Willsky ed 15 May 1982 40 p refs

(Grant NGL-22-009-124)

(NASA-CR-169015, NAS 1 26 169015 LIDS-SR-1210 SR-28) Avail NTIS HC A03/MF A01 CSCL 09B

The analysis and design of complex multivariable reliable control systems are considered High performance and fault tolerant aircraft systems are the objectives A preliminary feasibility study of the design of a lateral control system for a VTOL aircraft that is to land on a DD963 class destroyer under high sea state conditions is provided Progress in the following areas is summarized (1) VTOL control system design studies, (2) robust multivariable control system synthesis, (3) adaptive control systems (4) failure detection algorithms, and (5) fault tolerant optimal control theory Author

N82-27088*# Kansas Univ Center for Research, Inc Lawrence Flight Research Lab
A RESEARCH PROGRAM TO REDUCE INTERIOR NOISE IN GENERAL AVIATION AIRPLANES INFLUENCE OF DEPRESSURIZATION AND DAMPING MATERIAL ON THE NOISE REDUCTION CHARACTERISTICS OF FLAT AND CURVED STIFFENED PANELS Progress Report
Ramasamy Navaneethan Barry Streeter, Steven Koontz and Jan Roskam Oct 1981 310 p refs
(Contract NCC1-6)
(NASA-CR-169035 NAS 1 26 169035 KU-FRL-417-17) Avail NTIS HC A14/MF A01 CSCL 20A

Some 20 x 20 aluminum panels were studied in a frequency range from 20 Hz to 5000 Hz The noise sources used were a swept sine wave generator and a random noise generator The effect of noise source was found to be negligible Increasing the pressure differential across the panel gave better noise reduction below the fundamental resonance frequency due to an increase in stiffness The largest increase occurred in the first 1 psi pressure differential The curved stiffened panel exhibited similar behavior, but with a lower increase of low frequency noise reduction Depressurization on these panels resulted in decreased noise reduction at higher frequencies The effect of damping tapes on the overall noise reduction values of the test specimens was small away from the resonance frequency In the mass-law region a slight and proportional improvement in noise reduction was observed by adding damping material Adding sound absorbtion material to a panel with damping material beneficially increased noise reduction at high frequencies A R H

N82-27089*# Bolt Beranek and Newman, Inc Cambridge, Mass
ON THE DESIGN AND TEST OF A LOW NOISE PROPELLER Final Report
George P Succi Nov 1981 52 p refs
(Contract NAS1-16521)
(NASA-CR-165938, NAS 1 26 165938, Rept-4764) Avail NTIS HC A04/MF A01 CSCL 20A

An extensive review of noise and performance of general aviation propellers was performed Research was done in three areas The acoustic and aerodynamic theory of general aviation propellers, wind tunnel tests of three one-quarter scale models of general aviation propellers and flight test of two low noise propellers The design and testing of the second propeller is reviewed The general aerodynamic considerations needed to design a new propeller are described The design point analysis of low noise propellers is reviewed The predicted and measured noise levels are compared Author

N82-27090*# Georgia Inst of Tech, Atlanta School of Aerospace Engineering
ACOUSTIC PROPERTIES OF TURBOFAN INLETS Final Technical Report, 1 Sep 1974 - 31 Oct 1981
Ben T Zinn, Robert K Sigman, and Scott J Horowitz 31 Oct 1981 6 p refs
(Grant NsG-3036)
(NASA-CR-169016, NAS 1 26 169016) Avail NTIS HC A02/MF A01 CSCL 20A

The acoustic field within a duct containing a nonuniform steady flow was predicted This analysis used the finite element method to calculate the velocity potential within the duct S L

N82-27191*# *National Aeronautics and Space Administration* Lewis Research Center Cleveland Ohio
BIBLIOGRAPHY OF LEWIS RESEARCH CENTER TECHNICAL PUBLICATIONS ANNOUNCED IN 1981
May 1982 295 p
(NASA-TM-82838, E-1205, NAS 1 15 82838) Avail NTIS HC A13/MF A01 CSCL 05B

Technical reporting that resulted from the scientific and engineering work performed and managed by the Lewis Research Center in 1981 are indexed and abstracted All the publications were announced in the 1981 issues of STAR (Scientific and Technical Aerospace Reports) and/or IAA (International Aerospace Abstracts) Included are research reports journal articles conference presentations, patent applica.ions, and theses A total of 384 technical publications is listed Author

N82-27216# Air Force Academy, Colo Dept of Aeronautics
AIR FORCE ACADEMY AERONAUTICS DIGEST: SPRING/SUMMER 1981 Final Report
A M Higgins, ed, F M Jonas, ed, E J Jumper, ed, J M Kempf, ed, and B Gregory, ed Dec 1981 110 p refs
(AD-A112421, USAFA-TR-81-11) Avail NTIS HC A06/MF A01 CSCL 20/4

This Digest covers unclassified research in aeronautics performed at the United States Air Force Academy during the six months ending 15 July 1981 This report includes technical papers in the specific areas of aerodynamics, propulsion, experimental instrumentation, engineering education and aeronautical history Topics include The Mass Flux Surface Boundary Condition for Linarized Potential Flow A Numerical Investigation of the Effects of Fin Planform Parameters on the Subsonic Cruise Performance of a Supersonic Arrow Wing Configuration, An Improved Method for Calculation of Static Thrust for the USAFA J-85/13 Turbojet Engine, Pressure Measurement Using a High-Speed Data Acquisition and On-Line Calibration System, Cadet Performance during Summer Academics-Repeat versus non-repeat students, Reflections of an English Literature Major on Our Technological Society, and The Evolution and Future of Aeropropulsion Systems GRA

N82-27217# Logistics Management Inst, Washington, D C
DEPOT SUPPORT OF GAS TURBINE ENGINES Final Report
T J OMalley and David V Glass Oct 1981 39 p
(Contract MDA903-81-C-0166)
(AD-A107141 LMI-ML103) Avail NTIS HC A03/MF A01 CSCL 15/5

This report assesses the DoD's capacity and capability to support the depot maintenance requirements of gas turbine engines over the next 5-10 years Special attention is given to newer nonaeronautical applications (tanks, marine propulsion, and cruise missile) Gas turbine engines used in fixed and rotary wing aircraft will continue to dominate the engine workload, the gas turbines used in cruise missiles, tanks, and ships will comprise less than 10 percent of the total engine workload by 1990 Additional depot maintenance capacity to support gas turbine engines is not required The depots have adequate capacity today, and since the gas turbine workload is projected to increase by only 6 percent between FY 82 and FY 87, capacity should remain adequate through the 1980s The Military Departments have the required capabilities to support the new nonaeronautical gas turbine engines entering the DoD inventory They have repaired similar engines, both in size and technology, for several years Author (GRA)

N82-27218# Office of Naval Research, London (England)
A TECHNICAL ASSESSMENT OF AERONAUTICAL ENGINEERING IN ISRAEL
Joseph A Strada 1 Jul 1981 8 p refs
(AD-A106980, ONRL-R-5-81) Avail NTIS HC A02/MF A01 CSCL 01/3

A variety of Israeli academic and industrial institutions are discussed with an eye toward assessing research and development activities in aeronautical engineering disciplines Each institution is described in brief and some of its current research projects are listed Research in aerodynamics, guidance and control, propulsion and combustion is discussed and industrial product lines are described where appropriate Some conclusions are drawn in an effort to assess the country's overall capabilities in aeronautical engineering Author (GRA)

N82-27219# General Accounting Office, Washington, D C Mission Analysis and Systems Acquisition Div
OPPORTUNITIES TO REDUCE THE COST OF SOME B-52 MODIFICATIONS Report to Secretary of Defense
9 Apr 1982 7 p
(AD-A113563, GAO/MASAD-82-30) Avail NTIS HC A02/MF A01 CSCL 05/1

As part of our ongoing review of the overall modernization of the strategic bomber force, we have paid particular attention to the Air Force s plans for modifying the B-52 force We found that certain costly items may not be needed in view of the missions of the various models of the B-52 force and their expected life in the force More specifically, the offensive avionics system (OAS) modification could be scaled back on 67 B-52Gs by deleting unneeded components for a potential savings of $21 6 million, using certain components acquired for B-52Ds on other B-52 aircraft could further reduce OAS funding needs by $33 3 million, and a $35 million modification to comply with SALT II may not be needed on B-52Hs that have been modified to carry cruise missiles GRA

N82-27220# RAND Corp, Santa Monica, Calif
PREPLANNED PRODUCT IMPROVEMENT AND OTHER MODIFICATION STRATEGIES: LESSONS FROM PAST AIRCRAFT MODIFICATION PROGRAMS Interim Report
Frederick Biery and Mark Lorell Dec 1981 78 p refs
(Contract F49620-82-C-0018)
(AD-A113599, RAND/N-1794-AF) Avail NTIS HC A05/MF A01 CSCL 15/5

Pre-Planned Product Improvement (P3I) is a weapon system acquisition strategy formulated in the late 1970s in a response to the high development costs of new systems, lengthening acquisition intervals, increasing age of current inventories, constrained budgets, and various technology trends It is founded on the assumption that quality enhancement modification of existing inventory systems is a cheaper and quicker way to modernize than the development of entirely new systems The P3I strategy is aimed at facilitating this process, its central element is the design of new systems from their origins to accommodate future quality upgrades Discussion of the merits and disadvantages of P3I, however, remains abstract and theoretical This Note reviews the circumstances that led to the formulation of P3I, clarifies the implications of the concept and offers an initial assessment of the policy as applied to aircraft systems based on a careful and extensive examination of past major aircraft modification efforts The authors conclude that long-range pre-planning during the design stage is impractical This note also provides lessons drawn from past experience on the conduct of modification programs in general Author (GRA)

N82-27221# Clemson Univ, S C Dept of Mathematical Sciences
SPECIFICATION AND ESTIMATION OF DYNAMIC COST FUNCTIONS FOR AIRFRAME PRODUCTION AIRFRAMES
Thomas R Gulledge, Jr Dec 1981 185 p refs
(Contracts N00014-75-C-0451 F33615-81-K-5116, NR Proj 365-049)
(AD-A113147, N135) Avail NTIS HC A09/MF A01 CSCL 14/1

The cost behavior of the airframe industry is unique Cost minimization models are specified that have potential for modeling this unique production situation These models are firmly grounded in economic theory, and they stress the importance of learning and production rate as determinants of program costs As an empirical application, one of the models is applied to the F102 airframe program Author (GRA)

N82-27225# Naval Ship Research and Development Center, Bethesda, Md
PROCEEDINGS OF THE 12TH NAVY SYMPOSIUM ON AEROBALLISTICS, VOLUME 1
May 1981 451 p refs Symp held at Bethesda, Md, 12-14 May 1981 2 Vol
(AD-A111763) Avail NTIS HC A20/MF A01 CSCL 20/4

Partial Contents Missile Aerodynamics Aerodynamics of Tactical Weapons to Mach No 8 and Angle of Attack 180 Deg, An Inviscid Computational Method for Tactical Missile Configurations, Triservice Data Base Extension of PROGRAM MISSILE, Theoretical and Experimental Supersonic Lateral-Directional Stability Characteristics, Aerodynamics of a Rolling Airframe Missile, Approximate Method for Predicting Supersonic Normal Force Coefficient of Very-low-aspect-ratio Lifting Surfaces Supersonic Aerodynamics of a Class of Cone-Derived Waveriders, Determination of Aerodynamic Characteristics of Ballistic Projectiles at Transonic Speeds, Store Separation, Study of Flow Fields and Store Forces in Close Proximity to a Triple Ejection Rack at Transonic Speeds, Computer Program for Simulating the Six-Degree-of-Freedom Motion of Missile Debris Fragments An Influence Function Method for Predicting Aerodynamic Characteristics during Weapon Separation, Submissile Aerodynamics during Dispensing, Gun Launch Dynamics of the Navy 5-Inch Guided Projectile, Dynamics of Subsonic Tracer Projectiles, Thrust Augmentation for Tomahawk Cruise Missile, and Drag Characteristics and Suitability of Three-Foot Long Parachute Decelerators GRA

N82-27233*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
CHARACTERISTICS OF FUTURE AIRCRAFT IMPACTING AIRCRAFT AND AIRPORT COMPATIBILITY
D William Conner May 1982 26 p refs
(NASA-TM-84476, NAS 1 15 84476) Avail NTIS HC A03/MF A01 CSCL 01C

Results are reported of an opinion survey of selected individuals at the decision-making level within the five major manufacturers of transport aircraft in the United States and Europe Opinions were obtained concerning both possible and probable existence of over 50 compatibility-related characteristics of transport aircraft in use in the years 1990, 2000, and 2010 The maximum size of aircraft is expected to increase, at a roughly uniform rate, to the year 2010 by 85 percent in passengers, 55 percent in airfreighter payload, and 35 percent in gross weight weight Companion to the expected growth in payloads and gross weight was the identification of probable increases in aircraft geometrical dimensions and component capability, and use of fully double-decked passenger compartments Wing span will increase considerably more than normally expected to provide wings of higher aspect ratio New aircraft features coming into probable use include large turboprops, synthetic jet-A fuel, winglets, wake-vortex-reducing devices and laminar flow control New operational concepts considered probable include steep approaches, high-speed turnoffs, and taxiway towing for the aircraft, plus passenger bypass of the terminal building, expedited handling of belly cargo and an intermodal cargo container for the payloads B W

N82-27235*# National Aeronautics and Space Administration, Washington, D C
AERODYNAMIC INVESTIGATIONS TO DETERMINE POSSIBLE ICE FLIGHT PATHS
W Burgsmueller, H Frenz, P May, and G Anders Mar 1982 77 p Transl into ENGLISH of Vereinigte Flugtechnische Werke--Fokker GMBH Rept-Ef-586, 18 Jan 1977 84 p Transl by Kanner (Leo) Associates, Redwood City, Calif
(Contract NASw-3541)
(NASA-TM-76648, NAS 1 15 76648) Avail NTIS HC A05/MF A01 CSCL 01C

After flights with the VFW 614 under severe icing conditions, damage to the engine was found In wind tunnel tests a determination of the origin of this ice was made, it is supposed that the damage was caused by this ice On the modified flight test model of the VFW 614 on a 1 15 scale, measurements were conducted in the VFW-Fokker wind tunnel with exposed particles which represented the free ice The results of this testing are presented Author

N82-27236# Boeing Commercial Airplane Co, Seattle, Wash Systems Technology Div
AIRCRAFT ALERTING SYSTEMS STANDARDIZATION STUDY. VOLUME 1: CANDIDATE SYSTEM VALIDATION AND TIME-CRITICAL DISPLAY EVALUATION Final Report, Feb. - Nov. 1980
G P Boucek, D A Po-Chedley, B L Berson, D C Hanson, M F Leffler, and R W White Jan 1981 116 p refs
(Contract DOT-FA79WA-4268)
(AD-A107225 FAA/RD-81/38/1) Avail NTIS HC A06/MF A01 CSCL 01/2

This report is one of a series of documented studies directed to the improvement and standardization of aircraft alerting systems The purpose of the study was to develop and validate, through simulation, functional design criteria that can be used in designing effective aircraft alerting systems The major objectives of this phase study were to resolve system component questions, validate the two candidate system concepts by comparison to a representative baseline system, for both the pilot and flight engineer stations, evaluate presentation media and display formats for time-critical warnings, develop guidelines for the design of alerting systems The system component questions were resolved in a series of experiments and the results were integrated into two system concepts for validation In the validation tests, line-qualified pilots exercised the three alerting systems in a full-mission, fixed-base simulator In all areas of measurement pilot performance was as good or better with the two candidate system designs than with the conventional, baseline system The results indicate that a flight engineer station should contain the visual display components offered by the candidate system concepts Voice was the recommended medium of presentation when rapid response is required The time-critical display tests showed that fastest pilot response performance was obtained when graphic guidance alerts were placed in the

pilot's primary field of view The functional design criteria that were developed are contained in 'Aircraft Alerting System Design Guidelines,' Report Number DOT/FAA/RD-81/38/11
Author (GRA)

N82-27237# Federal Aviation Administration, Atlantic City, N J
PROCEEDINGS OF THE 1ST ANNUAL WORKSHOP ON AVIATION RELATED ELECTRICITY HAZARDS ASSOCIATED WITH ATMOSPHERIC PHENOMENA AND AIRCRAFT GENERATED INPUTS
Joseph J Traybar and Nickolus O Rasch Oct 1981 38 p
Workshop held at Atlantic City, 26-27 Feb 1980
(FAA Proj 182-340-100)
(AD-A107326, FAA-CT-81-205) Avail NTIS
HC A03/MF A01 CSCL 01/3

This workshop was to bring together the various elements of the agency to engage in discussions to identify aviation related electricity hazards associated with both atmospheric phenomena and aircraft generated inputs, and determine a prioritize specific FAA problem area and/or requirements that need to be addressed This information is vital in the development of the agency's posture and requirements in this important technology area
Author (GRA)

N82-27238# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate
CURRENT ADM RESTRAINT SYSTEM STATUS, TRADE-OFF CONSTRAINTS AND LONG RANGE OBJECTIVES FOR THE MAXIMUM PERFORMANCE EJECTION SYSTEM (MPES)
Marcus Schwartz Feb 1982 31 p
(AD-A112645 NADC-82021-60) Avail NTIS
HC A03/MF A01 CSCL 01/2

This report documents the restraint sub-system design options which were investigated for possible incorporation on the Navy Maximum Performance Ejection System (MPES) This study focused mainly on three ongoing development items for the advanced development model (ADM), but also considered some longer range objectives which address future requirements and anticipated technology developments which are necessary for a more comprehensive restraint package Author (GRA)

N82-27239# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate
AN OXYGEN ENRICHED AIR SYSTEM FOR THE AV-8A HARRIER Final Report
Richard L Routzahn Oct 1981 185 p refs
(AD-A112334 NADC-81198-60) Avail NTIS
HC A09/MF A01 CSCL 06/11

Due to the high support costs, increase in aircraft down time and hazards associated with the utilization of liquid oxygen, development has been progressing with On-Board Oxygen Generation Systems (OBOGS) which have the capability of providing an aviator's breathing gas of sufficient quality and quantity An Oxygen Enriched Air System (OEAS), employing the molecular sieve concept, has been subjected to environmental test and evaluation by the Naval Air Development Center The OEAS contains a molecular sieve oxygen concentrator, breathing regulator and performance monitor The test and evaluation program was conducted to verify that design criteria have been met and to establish system performance in the environments anticipated on the AV-8A Harrier and other tactical aircraft The system has successfully demonstrated the ability, under certain conditions, to provide a breathing gas composed of 95 percent oxygen and 5 percent argon It will also provide adequate amounts of breathing gas and sufficient oxygen concentrations for a one or two man open loop breathing schedule Concentrator anomalies have occurred during the program with control electronics and lubricants within the unit Redesign of the breathing regulator is necessary to insure compatibility with lox systems and in providing a greater gas quantity during ground idle conditions Redesign of the performance monitor is necessary to withstand environmental conditions anticipated in service use Prior to future aircraft incorporation, design studies must pay consideration not only to bleed air pressure availabilities, but also to temperatures which may degrade system performance
Author (GRA)

N82-27241# Naval Postgraduate School, Monterey, Calif Dept of Aeronautics
PROPOSED RESEARCH TASKS FOR THE REDUCTION OF HUMAN ERROR IN NAVAL AVIATION MISHAPS Final Report, 1 Jul 1980 - Sep 1981
Donald M Layton Oct 1981 24 p
(AD-A112339, NPS67-81-018) Avail NTIS
HC A02/MF A01 CSCL 01/2

Seven possible areas of research are proposed that could lead to the reduction and/or mitigation of the human error involvement in Navy aircraft mishaps These include tasks for the Naval Aerospace Medical Research Laboratory, other Navy and contracted activities The following research actions have been recommended Review of existing mishap reports, Cockpit review/analysis of existing Aircraft, Review and revision of standard anthrometrical data, Critical Incident Technique, Design/T&E cooperation procedures, Basic research into error causes, and Broad research functions GRA

N82-27242# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate
DEVELOPMENT OF A BACKPACK SURVIVAL KIT FOR EJECTION SEATS
Thomas J Zenobi and Gary F Whitman 8 Feb 1982 15 p
(W0584001)
(AD-A113653, NADC-82024-60) Avail NTIS
HC A02/MF A01 CSCL 06/7

The Navy is designing a Backpack Survival Kit (BSK) for ejection seats Expected advantages of the BSK as compared to seat lid kits are less weight and more crewmember mobility during emergency egress from aircraft cockpits With development of more sophisticated ejection propulsion systems, volume for survival kit stowage under the seat lid may not be available, the BSK offers an alternative stowage location Design considerations include integration into the ejection seat system, attachment to the crewmember's restraint harness, stowage of survival gear, liferaft deployment, and crewmember mobility Author (GRA)

N82-27244# National Transportation Safety Board, Washington, D C Bureau of Technology
CABIN SAFETY IN LARGE TRANSPORT AIRCRAFT
9 Sep 1981 57 p refs
(PB82-129297 NTSB-AAS-81-2) Avail NTIS
HC A04/MF A01 CSCL 01B

A study by the National Transportation Safety Board showed that in 58 4 percent of the 77 survivable/partially survivable passenger carrying transport aircraft accidents/incidents occurring since 1970, there were failures of cabin furnishings These failures killed injured, entrapped or otherwise incapacitated aircraft occupants preventing successful emergency escape in many cases Failures of cabin furnishings also created obstacles to egress by blocking aisles and exits Regulations dealing with occupant protection in crashes were last updated 30 years ago They do not adequately reflect actual crash experience nor do they provide adequate protection to occupants in survivable crashes, especially the more severe crashes, where it is most needed Recent accident experience supports the need to upgrade the current minimum design standards Moreover, the technology exists for upgrading existing design and testing methods for cabin furnishings to meet the upgraded regulations GRA

N82-27245# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS, INVOLVING CORPORATE/ EXECUTIVE AIRCRAFT, U.S. GENERAL AVIATION, 1979
16 Oct 1981 67 p
(PB82-138967, NTSB-AMM-81-8) Avail NTIS
HC A04/MF A01 CSCL 01B

Reports of U S general aviation corporate/executive aircraft accidents are given Included are 77 accident briefs, 14 of which involve fatal accidents The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident Additional statistical information is tabulated by type of accident, phase of operation, injuries and causal/factors(s) GRA

N82-27246# National Transportation Safety Board Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING MISSING AND MISSING LATER RECOVERED AIRCRAFT, U.S GENERAL AVIATION, 1979
16 Oct 1981 72 p
(PB82-138959, NTSB-AMM-81-7) Avail NTIS
HC A04/MF A01 CSCL 01B

Reports of U S general aviation missing and missing later recovered accidents are presented Included are 68 accident briefs, 21 of which cover missing aircraft not recovered and 47 missing later recovered The brief format presents the facts, conditions circumstances, and probable cause(s) for each accident Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s) GRA

N82-27247# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING ALCOHOL AS A CAUSE/FACTOR, U.S. GENERAL AVIATION, 1979
16 Oct 1981 40 p
(PB82-138942, NTSB-AMM-81-6) Avail NTIS HC A03/MF A01 CSCL 01B

Reports on all U S general aviation accidents involving alcohol impairment as a cause/factor are given Included are 34 accident briefs, 30 of which involve fatal accidents The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate injuries and causal factor(s) GRA

N82-27248# National Transportation Safety Board, Washington D C Bureau of Technology
BRIEFS OF FATAL ACCIDENTS INVOLVING WEATHER AS A CAUSE/FACTOR, U.S. GENERAL AVIATION, 1979
16 Oct 1981 271 p
(PB82-138934, NTSB-AMM-81-5) Avail NTIS HC A12/MF A01 CSCL 01B

Report of all fatal U S general aviation accidents involving weather as a cause/factor for the year 1979 are presented Included are 276 fatal accidents in the brief format This format presents the facts, conditions, circumstances, and probable cause(s) for each accident Additional statistical information is tabulated on all accidents involving weather as a cause/factor by type of accident, phase of operation, injury index, aircraft damage, pilots certificate, injuries and cause/factor(s) GRA

N82-27249# National Transportation Safety Board Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING ROTORCRAFT, U.S. GENERAL AVIATION, 1979
16 Oct 1981 166 p
(PB82-138926, NTSB-AMM-81-4) Avail NTIS HC A08/MF A01 CSCL 01B

General aviation rotorcraft accidents are reported Included are 289 accident briefs, 39 of which involve fatal accidents The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, kind of flying, pilot certificates, injuries, and causes and related factors GRA

N82-27250# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING TURBINE POWERED AIRCRAFT, US GENERAL AVIATION, 1979
16 Oct 1981 110 p refs
(PB82-138918, NTSB-AMM-81-3) Avail NTIS HC A06/MF A01 CSCL 01B

General aviation turbine powered aircraft accidents are reported Included are 171 accident briefs, 36 of which involve fatal accidents The brief format presents the facts, conditions, circumstances, and probable cause(s) fo each accident Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and cause/factor(s) GRA

N82-27251# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING MIDAIR COLLISIONS: U S. GENERAL AVIATION, 1979
16 Oct 1981 54 p
(PB82-138900, NTSB-AMM-81-2) Avail NTIS HC A04/MF A01 CSCL 01B

General aviation accidents involving midair collisions are reported Included are 25 accident files, 14 of which involve fatal accidents The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident Additional statistical information is tabulated by kind of flying, phase of operation, injury index, altitude of occurrence, airport proximity, aircraft damage, pilot certificate, injuries and causal factors(s) GRA

N82-27252# National Transportation Safety Board, Washington, D C Bureau of Technology
LISTING OF AIRCRAFT ACCIDENTS/INCIDENTS BY MAKE AND MODEL, U.S. CIVIL AVIATION, 1979
16 Oct 1981 188 p
(PB82-138892, NTSB-AMM-81-1) Avail NTIS HC A09/MF A01 CSCL 01B

Civil aviation accidents/incidents, sorted by aircraft make and model are reported Included are the file number, aircraft registration number, date and location of the accident, aircraft make and model and injury index for all 4,182 accidents/incidents occurring in this period GRA

N82-27253# National Transportation Safety Board, Washington, D C
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA: U.S. AIR CARRIER OPERATIONS, 1979
16 Nov 1981 87 p
(PB82-134339, NTSB-ARC-81-1) Avail NTIS HC A05/MF A01 CSCL 01B

This record of aviation accidents in all operations of the U S air carriers for calendar year 1979 includes an analysis by class of carrier and type of service in which the 1979 performances are compared with 5 year base-period averages A 10 year review, 1970 through 1979, of the certificated route carriers shows accident rates by aircraft make and model, types of accidents, phases of operation, causes or related factors, and a comparison of total which summarize the accidents, fatalities and accident rates, causal tables, and briefs of accidents are included GRA

N82-27254# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF FATAL ACCIDENTS INVOLVING FIXED-WING MULTI-ENGINE AIRCRAFT, U.S GENERAL AVIATION, 1979
16 Oct 1981 148 p
(PB82-139007, NTSB-AMM-81-12) Avail NTIS HC A07/MF A01 CSCL 01B

The publication contains reports of fixed-wing multiengine general aviation aircraft accidents that occurred in 1979 Included are 15 turbojet, 51 turboprop and 444 reciprocating engine aircraft accidents However, briefs of only the fatal accidents in the three categories are presented The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident Additional statistical informatin is tabulated by injuries and cause(s) and related factor(s) GRA

N82-27255# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING COMPUTER AIR CARRIERS AND ON-DEMAND AIR TAXI OPERATIONS, U.S. GENERAL AVIATION, 1979
16 Oct 1981 168 p
(PB82-138991 NTSB-AMM-81-11) Avail NTIS HC A08/MF A01 CSCL 01B

Reports of commuter air carrier and on-demand air taxi accidents are presented Included are 50 commuter air carrier and 173 on-demand air taxi accident briefs The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident Additional statistical information is tabulated by type of operation, injuries, aircraft weight, and cause(s) and related factor(s) GRA

N82-27256# National Transportation Safety Board, Washington D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING AERIAL APPLICATION OPERATIONS, U.S. GENERAL AVIATION, 1979
16 Oct 1981 260 p
(PB82-138983, NTSB-AMM-81-10) Avail NTIS HC A12/MF A01 CSCL 01B

Reports of U S general aviation aerial application accidents occurring in 1979 are given Included are 395 accident briefs, 27 of which involve fatal accidents The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident Additonal statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries, kind of operation and causes/factors GRA

N82-27257# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING AMATEUR/HOME BUILT AIRCRAFT, U S. GENERAL AVIATION, 1979
16 Oct 1981 76 p
(PB82-138975 NTSB-AMM-81-9) Avail NTIS HC A05/MF A01 CSCL 01B

Reports of U S general aviation accidents involving amateur/home built aircraft are presented Included are 130 accident briefs, 36 of which involve fatal accidents The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factor(s) GRA

N82-27258# National Transportation Safety Board, Washington, D C Bureau of Technology
BRIEFS OF ACCIDENTS INVOLVING GLIDERS, U S. GENERAL AVIATION, 1979
16 Oct 1981 44 p refs
(PB82-139015 NTSB-AMM-81-13) Avail NTIS HC A03/MF A01 CSCL 01B

Reports of all U S general aviation accidents, occurring in 1979, involving gliders are presented Included are 54 accident Briefs, 2 of which involve fatal accidents The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot age, injuries and causal factor(s) GRA

N82-27259*# Ohio Univ, Athens Avionics Engineering Center
A LORAN-C PROTOTYPE NAVIGATION RECEIVER FOR GENERAL AVIATION
Robert W Lilley and Daryl L McCall Aug 1981 25 p refs Presented at the 4th Digital Avionics Systems Conf, St Louis, Nov 1981
(NASA-CR-169118 NAS 1 26 169118 TM-80) Avail NTIS HC A02/MF A01 CSCL 17G

Prototype equipment was developed for flight evaluation which provides enroute navigation in both latitude-longitude and rho-theta coordinates The nonprecision approach capabilities of this equipment was evaluated The antenna/preamplifier coupler, the RF processor, tracking loop hardware, tracking loop software, and the video output are discussed Laboratory and flight test results are evaluated A R H

N82-27260# Auburn Univ, Ala Dept of Electrical Engineering
MARINE AIR TRAFFIC CONTROL AND LANDING SYSTEM (MATCALS) INVESTIGATION
E R Graf, Charles L Phillips, and Scott A Starks Apr 1981 184 p refs Sponsored in part by Georgia Inst of Technology, Atlanta
(Contract N00039-80-C-0032)
(AD-A107384) Avail NTIS HC A09/MF A01 CSCL 17/7

The report is organized into three main sections, namely Part Two, Part Three and Part Four Part Two contains the results of an investigation into replacing the alpha-beta filter in the MATCALS digital controller with an observer, in order to reduce the effects of radar noise Part Three presents a centroid algorithm based up return amplitude-versus-angle signature Part Four presents an investigation of adaptive filtering algorithms for the MATCALS system GRA

N82-27261# Ohio Univ, Athens Dept of Electrical Engineering
EFFECTS OF HIGH VOLTAGE TRANSMISSION LINES ON NON-DIRECTIONAL BEACON PERFORMANCE Final Report, Jun 1980 - Oct 1981
Ismail Ibrahim and Raymond Luebbers Washington FAA Oct 1981 184 p refs
(Contract DTFA01-80-C-10072)
(AD-A112311, QUEE-FAA-1-2, FAA-RD-81-82) Avail NTIS HC A09/MF A01 CSCL 17/7

The potential for high-voltage transmission lines to interfere with the operation of non-directional beacons through the mechanisms of coronagenerated radio noise or passive reradiation of the desired signal has been assessed by use of computer prediction models The generated noise levels were calculated for both AC and DC lines using methods found in the appropriate literature which have previously been compared with measured data The reradiated signal levels were computed using a moment-method wire model computer program This approach was validated by measurements made and reported herein For all situations considered, it was concluded that locating an NDB near a high-voltage transmission line should not impair the function of the NDB due to either corona noise or passive reradiation from the line GRA

N82-27262# Center for Naval Analyses Alexandria, Va Operations Evaluation Group
A RESULT IN THE THEORY OF SPIRAL SEARCH
Walter R Nunn Mar 1980 16 p refs
(Contract N00014-76-C-0001)
(AD-A112481, CNA-PP-274) Avail NTIS HC A02/MF A01 CSCL 17/7

This note presents a result in the theory of spiral search which does not seem to be available in the literature in spite of its straightforward derivation and obvious applicability in certain types of 'real life' search problems The result gives the probability of detection as a function of time for a class of prior distributions of search-object, i e target, position centered at the origin of the x,y plane We restrict attention to a spiral-type search in which the searcher covers the AOU(area of uncertainty) in concentric rings, moving out from the center In the common case that the prior density is circular normal, the time to detection is seen to be approximately exponentially distributed This is a somewhat counter-intuitive result in that the detection rate is constant, since it would appear that detection rate must decrease with time as the searcher moves from high probability areas to low probability areas GRA

N82-27263# Federal Aviation Administration, Atlantic City, N J
MICROWAVE LANDING SYSTEM FLARE SUBSYSTEM TEST Data Report, period ending Apr. 1979
Carl B Jezierski Oct 1981 43 p refs
(FAA Proj 075-725-420)
(AD-A107327, FAA-CT-81-61) Avail NTIS HC A03/MF A01 CSCL 17/7

Microwave Landing System (MLS) Flare subsystem performance data were collected on a specially instrumented Federal Aviation Administration (FAA) Technical Center aircraft The airborne data were compared with a theodolite tracking system reference and error plots generated Due to extensive lightning damage only two flight tests were performed Flare subsystem accuracy could not be determined because of insufficient data Author (GRA)

N82-27264# Federal Aviation Administration, Atlantic City, N J
HIGH-SPEED ROTARY PRINTING DEVICE FOR AIR TRAFFIC CONTROL APPLICATIONS: A PRELIMINARY EVALUATION Final Report, Aug. 1980 - Apr. 1981
Gerard Spanier Oct 1981 16 p
(AD-A107325, FAA-CT-81-59, FAA/RD-81/73) Avail NTIS HC A02/MF A01 CSCL 09/2

This report describes a unique, high-speed rotary printing device evaluated by the Federal Aviation Administration (FAA) Technical Center to determine potential applicability in air traffic control (ATC) work stations The report discusses general performance of the unit, basic ATC operational problems being addressed by the study, concepts of application, and future activities for more comprehensive evaluations in simulated and real work station environments Author (GRA)

N82-27265# Federal Aviation Administration, Atlantic City, N J
SURVEILLANCE SIMULATION TESTING OF TERMINAL AND EN ROUTE MODE S SENSORS Interim Report, Apr. - Aug. 1980
Robert B Frack Jan 1982 66 p
(FAA Proj 034-241-510)
(AD-A112250, DOT/FAA/CT-81/16) Avail NTIS HC A04/MF A01 CSCL 17/7

A test and evaluation (T&E) was conducted to determine the surveillance characteristics of the Mode S (formerly the Discrete Address Beacon System (DABS) en route and terminal sensors operating with effective receive beam widths of 2 4 deg and 3 4 deg The tests were conducted at the FAA Technical Center for terminal and enroute Mode S configurations having maximum ranges of 60 and 200 nautical miles (nmi), respectively Surveillance loading was simulated using an aircraft reply and interference environment simulator (ARIES) to provide Mode S, Air Traffic Control Radar Beacon System (ATCRBS), or a mixture of the two types of aircraft Surveillance characteristics were measured by determining the percent detection, blip scan ratio, Mode 3/A and C reliability, Mode S identifier (ID) reliability, and the number of replies per report or interrogations per scan for both types of aircraft It was concluded that increasing the effective receive beam width had negligible impact on the surveillance characteristics of either sensor operating with simulated Mode S targets Increasing the effective receive beam width improved the percent detection and Mode C reliability for both sensors operating with simulated ATCRBS targets GRA

N82-27266# Federal Aviation Administration, Atlantic City, N J
MODE S SYSTEM ACCURACY Final Report, Jun. - Oct. 1980
Clifford Chapman and Joseph J Brady Feb 1982 69 p refs
(FAA Proj 034-241-510)
(AD-A112249, FAA-CT-81-67, FAA-RD-81-90) Avail NTIS HC A04/MF A01 CSCL 17/7

A series of flight tests were performed using three Mode S (formerly the Discrete Address Beacon System (DABS)) sensors for the purpose of determining the capability of each sensor in reporting the true position of an aircraft For both the Mode S and the Air Traffic Control Radar Beacon System (ATCRBS) mode of operation, slant range, and azimuthal position data, as reported by each sensor, were compared to positional data collected concurrently by a precision range instrumentation system at the Federal Aviation Administration (FAA) Technical Center GRA

N82-27267# Federal Aviation Administration, Atlantic City, N J
DESIGN AND IMPLEMENTATION OF EFFICIENT ALGORITHMS FOR AUTOMATIC DETERMINATION OF CORRECTED SLANT RANGE Final Report
D W Stout and R G Mulholland Feb 1982 22 p refs
(FAA Proj 975-200-10A)
(AD-A112248, FAA-CT-81-30) Avail NTIS HC A02/MF A01 CSCL 17/7

This report introduces a systematic approach to the design of algorithms for evaluating the corrected slant range in a radar surveillance system Applications include air traffic control (ATC) operations requiring real-time continuous comptutation for a multitude of targets without overtaxing available computational resources From the point of view of accuracy, utilization of memory, and computational speed, the design technique is capable of providing an algorithm that is superior to the corrected slant range technique presently employed in the National Airspace System (NAS) Author (GRA)

N82-27268# Federal Aviation Administration, Atlantic City, N J Technical Center
TERMINAL AIR TRAFFIC CONTROL WITH SURVEILLANCE DATA FROM THE MODE S SYSTEM: RESULTS OF SYSTEM DEMONSTRATIONS TO FIELD CONTROLLERS Final System Demonstration Report, period ending May 1981
Verne Tallio and Haim Gabrieli Feb 1982 76 p refs
(Contract DTFA01-81-C-10001)
(AD-A112632, MTR-81T7, DOT/FAA/CT-82/11) Avail NTIS HC A05/MF A01 CSCL 17/7

This report describes the results of a series of system demonstrations of a modified version of the ARTS III system (ADS2) which was developed to operate with target reports provided by the Mode S system The demonstrations were conducted at the FAA Technical Center with field controllers from the Philadelphia ARTS III facility The report contains a compilation of the controllers' opinions and comments on the operational characteristics of the new system This demonstration cannot be considered a comprehensive test and evaluation effort, however, with regard to those system capabilities which were demonstrated, the controllers found no major technical or operational obstacles which would impact the system implementation in an operational environment Author (GRA)

N82-27269# RAND Corp, Santa Monica, Calif
AUTOPILOT: A DISTRIBUTED PLANNER FOR AIR FLEET CONTROL Interim Report
Perry W Thorndyke, David McArthur, and Stephanie Cammarata Jul 1981 34 p refs
(Contract MDA903-78-C-0029, ARPA Order 3460)
(AD-A107139, RAND/N-731-ARPA) Avail NTIS HC A03/MF A01 CSCL 17/7

Distributed planning requires both architectures for structuring multiple planners and techniques for planning, communication, and cooperation We describe a family of systems for distributed control of multiple aircraft, in which each aircraft plans it own flight path and avoids collisions with other aircraft AUTOPILOT, the kernel planner used by each aircraft, comprises several processing experts that share a common world model These experts sense the world, plan and evaluate flight paths, communicate with other aircraft, and control plan execution We discuss four architectures for the distribution of airspace management and planning responsibility among the several aircraft occupying the airspace at any point in time The architecture differ in the extent of cooperation and communication among aircraft Author (GRA)

N82-27270# RAND Corp, Santa Monica, Calif
SCENARIOS FOR EVOLUTION OF AIR TRAFFIC CONTROL
Robert Wesson, Kenneth Solomon, Randall Steeb, Perry W Thorndyke, and Keith Wescourt Nov 1981 82 p refs
(Contract MDA903-81-C-0211)
(AD-A112566, RAND/R-2698-FAA) Avail NTIS HC A05/MF A01 CSCL 17/7

To accommodate the predicted demand for air traffic service in the year 2000, computer technology must augment human control skills Preliminary laboratory studies have demonstrated that computer programs can track aircraft, predict their future paths, generate conflict-free clearances, and monitor them for compliance-all automatically This technology could automate most routine ATC tasks and could change the human role in ATC to that of a system manager How to make the transition to such a system from the present one and exactly what the future specialist's role would be are the issues addressed by this report We present three scenarios that delineate a spectrum of transition plans a Baseline scenario in which the human controller's role is emphasized, and AERA (Automated En Route ATC) scenario in which computers assume the primary control responsibility and perform most ATC functions autonomously, and a Shared Control scenario in which automated, individually invokable modules assist a human specialist who retains the primary responsibility for control GRA

N82-27271# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div
GYRO SYSTEMS (SELECTED PAGES)
D S Pelpor 19 Mar 1982 87 p Transl into ENGLISH of the mono "Giroskopicheskiye Sistemy" Moscow, 1971 p 5-12, 97-105, 281-293, 431-436, 475-485
(AD-A113748, FTD-ID(RS)T-1768-81) Avail NTIS HC A05/MF A01 CSCL 17/7

Operating principles are discussed for (1) differentiating and integrating gyroscopes, (2) gyrostabilizers, (3) course gyros and gyroscopic sensors of the direction of the true vertical, and (4) inertial systems Schematics are provided of each of these means for control of aircraft, rockets, and spacecraft as well as of their onboard instruments A diagram of the layout of gyroscopes on the platform of a three dimensional space gyrostabilizer is included A R H

N82-27272# Ohio State Univ, Columbus Dept of Geodetic Science and Surveying
GRAVITY INDUCED POSITION ERRORS IN AIRBORNE INERTIAL NAVIGATION
Klaus-Peter Schwarz Dec 1981 60 p refs
(Contract F19628-79-C-0075, AF Proj 7600)
(AD-A113823, Rept-326, AFGL-TR-82-0030, SR-11) Avail NTIS HC A04/MF A01 CSCL 17/7

The report investigates the feasibility of improving airborne inertial navigation by use of gravity field approximations which are more accurate than the normal model presently applied The effect of the anomalous gravity field on positioning is investigated by using a simplified dynamical error model and by deriving analytical expressions for the steady state error via the state space approach In this approach, changes in the anomalous gravity field are cast into the form of first-order differential equations which are related to a position dependent covariance representation of the gravity field by way of the vehicle velocity Different possibilities for a state space model of the anomalous field are discussed The procedure chosen combines the consistency of the Tscherning-Rapp model with the advantages of a formulation in terms of Gauss-Markov processes by making use of the essential parameters of a covariance function proposed by Moritz The expressions for the gravity induced position errors resulting from this approach are easy to compute for a wide variety of cases The assumptions made to derive them are in general justifiable Based on the available gravity field information a number of approximation models are proposed and expressed in terms of equivalent spherical harmonic expansions Results show that the use of presently available global models would reduce the gravity induced position errors from Sigma = 150 m Improved global models expected in the near future as for instance those from the GRAVSAT mission, would bring errors below Sigma = 50 m GRA

N82-27273# Army Missile Command, Redstone Arsenal, Ala Systems Simulation and Development Directorate

QUASILINEARIZATION SOLUTION OF THE PROPORTIONAL NAVIGATION PROBLEM

Dale W Alspaugh (Purdue Univ, West Lafayette, Ind) and Maurice M Hallum, III Jun 1981 24 p refs

(DA Proj 1L1-62302-A-214)

(AD-A113668, AD-E950227, DRSMI/RD-81-15-TR) Avail NTIS HC A02/MF A01 CSCL 17/7

An approximate solution is presented in this report for the trajectory of a constant-speed missile following a planar intercept trajectory based on proportional navigation guidance The technique of quasilinearization is used to generate a sequence of solutions An explicit solution is developed using the first recursive solution The accuracy of this solution is discussed in the context of specific sets of parameters It is shown that this explicit solution provides excellent accuracy over a wide range of intercept trajectories Author (GRA)

N82-27274# Naval Surface Weapons Center, Dahlgren, Va Strategic Systems Dept

DOPPLER TEST RESULTS OF EXPERIMENTAL GPS RECEIVER Final Report

Richard J Anderle Jan 1982 64 p refs

(AD-A113587, NSWC/TR-82-01) Avail NTIS HC A04/MF A01 CSCL 08/5

Three experimental geodetic Global Positioning System Receivers were deployed in the Washington, D C area Analysis of five to six hours of Doppler observations distributed among four satellites yielded relative position coordinates on a 28 km baseline which were repeatable to 30 cm in height, 70 cm in the East directions and to 10 cm in the North directions Results obtained for a receiver equipped with an oscillator having poorer stability degraded to 50 cm to 1 5 meters The results confirm simulations that Doppler observations made with the geodetic receiver under development will yield decimeter accuracy in relative position in one to three hours Since the experimental receivers required about a minute to sequence between satellites, tests could not be performed to test cm precision in relative station positioning which can be obtained by comparing phase observations between satellites with receivers under development GRA

N82-27275# Naval Coastal Systems Center, Panama City, Fla Mine Countermeasures Development Div

A BALANCED ACTIVE ANTENNA AND IMPULSE NOISE BLANKET SYSTEM FOR THE REYDIST T RADIO NAVIGATION RECEIVER

Bobby R Ludlum Feb 1982 32 p

(AD-A114074, AD-F200023, NCSC-TM-340-82) Avail NTIS HC A03/MF A01 CSCL 17/7

Erratic operation of Raydist T radio navigation equipment aboard mine countermeasures helicopters has been traced to fuselage-tow cable interactions with the Raydist receiving antenna and to negative-corona generated impulse noise The development of a balanced active antenna and an impulse noise blanker which have proved successful in reducing these detrimental effects are described The final system is described in detail and the results of laboratory tests are presented Author (GRA)

N82-27276# Georgia Inst of Tech, Atlanta Engineering Experiment Station

MARINE AIR TRAFFIC CONTROL AND LANDING SYSTEM (METCALS) INVESTIGATION Final Report

Robert N Trebits, Eric S Stoberg, Raymond B Efurd, Benjamin Perry, and Mark A Corbin Feb 1982 172 p refs

(Contract N00039-80-C-0082)

(AD-A113047 GIT/EES-A-2550-FTR) Avail NTIS HC A08/MF A01 CSCL 17/7

A television tracker system for the AN/TPN-22 radar was designed, assembled, and delivered A cursor whose position is determined by the radar's tracking solution is superimposed on a TV camera image of the aircraft on its landing approach Alphanumeric data also appear on the display for video tape documentation purposes Author (GRA)

N82-27277# Mitre Corp, McLean, Va METREK Div

THE FLIGHT SERVICE AUTOMATION SYSTEM (FSAS) SYSTEM BENCHMARK. VOLUME 1: SUMMARY, INTRODUCTION AND CONCEPTS

R G Nystrom, S Koslow, and C R Spooner Aug 1981 80 p 4 Vol

(Contract DTFA01-81-C-10001)

(PB82-143538, MTR-81W131-Vol-1) Avail NTIS HC A05/MF A01 CSCL 01B

A system benchmarking technology was developed to meet the requirements of an interactive, dedicated application This methodology is applicable to procurements in which the hardware/operating system configurations are off the shelf and the applications software was not implemented in its eventual form In this methodology, a model of the application is interfaced with the operating system and is executed, while being driven by a specified load, and performance of the proposed configuration is measured The requirements of the FSAS application of this system benchmark methodology was documented and is published in the present form to record and the concepts and techniques of the methodology are made available GRA

N82-27278# Mitre Corp, McLean, Va METREK Div

THE FLIGHT SERVICE AUTOMATION SYSTEM (FSAS) SYSTEM BENCHMARK VOLUME 2: THE MODEL OF THE APPLICATION

C R Spooner Aug 1981 344 p 4 Vol

(Contract DTFA01-81-C-10001)

(PB82-143546 MTR-81W131-Vol-2) Avail NTIS HC A15/MF A01 CSCL 01B

Application of a system benchmarking technology is illustrated The model of the application is described and requirements and guidelines for mapping the model to the proposed configurations, and for selection of options in the model are provided GRA

N82-27279# Mitre Corp, McLean, Va METREK Div

THE FLIGHT SERVICE AUTOMATION SYSTEM (FSAS) SYSTEM BENCHMARK VOLUME 3: THE VENDOR INTERFACE PACKAGE

C R Spooner Aug 1981 175 p 4 Vol

(Contract DTFA01-81-C-10001)

(PB82-143553, MTR-81W131-Vol-3) Avail NTIS HC A08/MF A01 CSCL 01B

The Vendor Interface Package (VIP) for th FSAS system is presented It provides a standard interface for the model with the proposed system The VIP requirements and implementation guidelines are given GRA

N82-27280*# Operations Research, Inc, Silver Spring, Md

BENEFIT COST ANALYSIS OF THE AIRCRAFT ENERGY EFFICIENCY PROGRAM Final Report

James Bauchspies, Frank Hopkins, and Lawrence Kaplan Nov 1980 242 p refs Revised

(Contract NASw-2961)

(NASA-CR-169116, NAS 1 26 169116) Avail NTIS HC A11/MF A01 CSCL 01C

Analyses were reviewed in light of rapid and dramatic changes in fuel cost and availability, as well as significant changes in the economic and political climate relating to these factors N W

N82-27281# Boeing Commercial Airplane Co, Seattle, Wash Noise Technology Dept

AIRCRAFT NOISE REDUCTION

Richard E Russell and J M Streckenbach 1981 15 p Presented at the Intern Symp on Transportation Noise, Pretoria, 21-23 Oct 1981

Avail NTIS HC A02/MF A01

A brief introduction of the Boeing commercial airliner family is followed by a discussion of the significant noise reduction accomplishments for turbine-powered aircraft from the 1950's

to the 1980's, with projections of further benefits until the year 2000 Definition of the trades to be made between noise reduction and fuel economy, as well as technical problems yet unsolved, lead to a recognition that the greatest advances in aircraft noise reduction are past, and that significant research will be required in the future to lower noise floors that are presently inhibiting further progress Emphasis is given to precautions that must be taken in the selection of meaningful fleet noise data to avoid costly and irreversible errors in airport and community planning
T M

N82-27282# United Technologies Corp, Stratford, Conn Sikorsky Aircraft Div
XH-59A ABC TECHNOLOGY DEMONSTRATOR ALTITUDE EXPANSION AND OPERATIONAL TESTS Final Report, Aug. 1980 - Jun 1981
A J Ruddell Dec 1981 79 p refs
(Contract DAAK51-80-C-0021, DA Proj 1L1-62209-AH-76)
(AD-A111114, SER-69072, USAAVRADCOM-TR-81-D-35)
Avail NTIS HC A05/MF A01 CSCL 01/3

This report presents the results of two flight test programs conducted with the XH-59A Advancing Blade Concept demonstra-configuration, consisted of altitude and center-of-gravity envelope expansion testing Test results verified the concept of ope expansion testing Test results verified the concept of developing lift primarily on the advancing rotor blades to dramatically improve lift and speed potential The XH-59A achieved a maximum speed of 263 knots true airspeed and demonstrated a service ceiling of 25,500 feet The entire flight envelope was demonstrated without classical retreating blade stall Rotor loads and stresses and rotor tip clearance followed predicted trends and were controllable Limited center-of-gravity envelope expansion was accomplished The second program consisted of operational tests conducted primarily in the nap-of-the-earth and contour flight environments, using both the auxiliary and helicopter propulsion modes The compact ABC design and smaller rotor diameter enhanced operation in confined areas Operational test results showed the ABC to be a viable alternative concept for future tactical aircraft GRA

N82-27283# Army Logistics Evaluation Agency, Cumberland, Pa
AVIATION MATERIEL COMBAT READY IN-COUNTRY (AMCRIC)
Herman M Orrell, III Jun 1981 58 p refs
(AD-A107451) Avail NTIS HC A04/MF A01 CSCL 15/5

A previous study, titled Aviation Materiel Combat Ready In-Country (AMCRIC), was provided as a basis to develop a concept to preposition Army aircraft in US Army Europe This study recognized that aircraft are not authorized as war reserve, and that no aircraft are currently included in POMCUS in Europe To adequately reinforce NATO, some method had to be devised to allow Army aircraft to be immediately available to a deploying combat force The project considered (a) Methods available to accomplish prepositioning of Army helicopters and ancillary systems, (b) South Vietnam Army aviation experience in combat, (c) State-of-the-art storage methods by US Government, foreign governments, and commercial contractors and (d) Major command interfaces within the US Army that will be required to establish a workable concept The project results were that US Army has the capability to store helicopters for short periods using on-hand resources, and The Vice Chief of Staff, Army, approved a prepositioning concept developed which will store helicopters in USAREUR on a test bed basis using AH-1S helicopters GRA

N82-27284# Air Force Geophysics Lab, Hanscom AFB, Mass
RESPONSE OF CLOUD MICROPHYSICAL INSTRUMENTS TO AIRCRAFT ICING CONDITIONS Interim Scientific Report
Morton Glass and Donald D Grantham 6 Jul 1981 56 p refs
(AF Proj 6670)
(AD-A112317, AFGL-TR-81-0192, AFGL-ERP-747) Avail NTIS HC A04/MF A01 CSCL 01/4

A series of passes on 6 December 1979 through multilayered-supercooled stratiform and stratocumulus clouds by the Air Force Geophysics Laboratory's instrumented C-130E cloud physics research aircraft is used to evaluate a Rosemount Ice Detector The response of the detector to icing conditions is compared with measurements from a J-W liquid water content meter and the Knollenberg Axial Scattering Spectrometer Probe (ASSP) A procedure to adjust for zero drift of the J-W instrument is developed Comparison of liquid water measurements from the J-W and from the ASSP indicate that these data are highly correlated and similar in magnitude A procedure for extracting useful information from the Rosemount Ice detector has been developed The icing conditions in the cloud systems studied are typical of the range of conditions in winter stratiform clouds Liquid water (LWC) values of 0 3 g/cu m and median volume diameters of 15 micrometers were most frequently observed The results of the analysis show that the Rosemount Ice Detector is a sensitive indicator of the fluctuations of liquid water in clouds with LWC not exceeding 0 8 g/cu m -3 Author (GRA)

N82-27285# General Accounting Office, Washington, D C Mission and Analysis and Systems Acquisition Div
REDUCED PERFORMANCE AND INCREASED COST WARRANT REASSESSMENT OF THE MULTIPLE STORES EJECTOR RACK
26 Mar 1982 6 p refs
(AD-A112776, GAO/MASAD-82-26) Avail NTIS HC A02/MF A01 CSCL 19/2

The Air Force plans to award a contract in June 1982 for the continued development of an aircraft bomb carrier known as the Multiple Stores Ejector Rack (MSER) The rack, in development since 1976, was intended for use by certain Navy aircraft as well as several aircraft operated by the Air Force However, we have found that service interest in a common bomb rack has dwindled and both the Air Force and the Navy are pursuing separate bomb rack developments, some MSER development goals may not be achieved, and other alternatives to MSER have not been fully evaluated, in addition, MSER's estimated development costs have tripled and average unit procurement costs could not be 14 times greater than the cost of the racks now in service, and the development period has more than doubled The Air Force has basically reduced it MSER requirements to one aircraft, the F-16, and the Navy has all but pulled out of the program Before authorizing further expenditure of funds for MSER, GAO recommends that the Air Force and Navy Secretaries be required to determine whether a common bomb rack is still needed, whether MSER will meet Air Force and Navy requirements, and whether it is cost effective GRA

N82-27286# Systems Control, Inc, Palo Alto, Calif
DEVELOPMENT OF LOW-ORDER MODEL OF AN X-WING AIRCRAFT BY SYSTEM IDENTIFICATION Final Report
James H Vincent and John W Bunnell Feb 1982 103 p refs
(Contract N00014-79-C-0578)
(AD-A113760) Avail NTIS HC A06/MF A01 CSCL 01/3

The original purpose of this contract was to prepare a flight test plan for the proposed X-wing demonstrator using system identification to extract useful math models from the flight test data Since the original statement of work was submitted, however, the scope of this study changed An X-wing program decision has been reached not to carry the Lockheed X-wing configuration to flight test Therefore, this task was modified to provide a demonstration of the feasibility of using system identification techniques to extract low-order math models from time history data from a detailed X-wing rotor simulation (REXOR) GRA

N82-27287# Transportation Systems Center, Cambridge, Mass
B-747 VORTEX ALLEVIATION FLIGHT TESTS: GROUND-BASED SENSOR MEASUREMENTS Final Report
D C Burnham Jan 1982 188 p refs
(AD-A113621, DOT-TSC-FAA-81-19, DOT/FAA/RD-81/99)
Avail NTIS HC A09/MF A01 CSCL 20/4

In 1979, a series of B-747 flight tests were carried out to study the wake-vortex alleviation produced by deploying spoilers in the landing configuration The alleviation achieved was examined by encounters of probe aircraft and by velocity profile measurements made by a ground-based Laser Doppler Velocimeter For the first time these two types of measurements were analyzed in a way which allowed direct comparison, they showed reasonable agreement The velocimeter measurements can be used to evaluate the vortex-induced rolling moment on any following aircraft at any separation The spoiler alleviation was found to be insufficient to assure safe landings of small aircraft at reduced separation behind the B-747 The persistence of the alleviated vortices appears to be due to the wing-tip vortices which dominate the roll-up of the spoiler-alleviated wake The addition of rapid roll inputs to the spoiler deployment produced much more effective alleviation, but at the expense of an unacceptable ride quality in the generating aircraft Author (GRA)

N82-27288# Aeronautical Research Inst of Sweden Stockholm Structures Dept
COMPARISON OF DIFFERENT FIGHTER AIRCRAFT LOAD SPECTRA
Aake Magnusson 1982 16 p refs
(Contract F-INK-82223-77-001-21-001)
(FFA-TN-1982-02) Avail NTIS HC A02/MF A01

Open hole specimens, made from 3 mm thick aluminum 7075-T6 [3627-48] clad sheet, were subjected to fighter aircraft load spectra The influence on fatigue life of spectrum variations, e g, severe negative maneuver loads, maximum load truncation and cycle omission was studied Six load spectra, including fighter aircraft loading standard for fatigue evaluation (FALSTAFF) and a cycle truncated version of FALSTAFF, containing 9006 cycles per 200 flights, i e, half the original number, were investigated Severe negative maneuver loads as well as maximum load truncation reduce the fatigue life Truncated FALSTAFF produces the same fatigue life as the original sequence Author (ESA)

N82-27289# Advanced Engineering Lab, Salisbury (Australia)
COMPOSITE FLIGHT TEST BOOM FOR NOMAD N22B AIRCRAFT
N C Frost Nov 1981 20 p refs
(AEL-0086-TM, AR-002-598) Avail NTIS HC A02/MF A01

The design, analysis and manufacturing processes are described for an instrumentation nose boom for a flight test program on the Nomad aircraft Author

N82-27290# Naval Ship Research and Development Center, Bethesda, Md Central Instrumentation Dept
CORRECTING FOR TURBULENCE EFFECTS ON AVERAGE VELOCITY MEASUREMENTS MADE USING FIVE HOLE SPHERICAL PITOT TUBE PROBES
Robert D Pierce Feb 1982 32 p refs
(AD-A112573 DTNSRDC/CID-82/1) Avail NTIS HC A03/MF A01 CSCL 14/2

A procedure has been developed for correcting five hole spherical pitot tube mean velocity measurements for errors caused by velocity fluctuations associated with turbulent flow Velocity fluctuations are independently measured with hot film or hot wire anemometers These data are then applied to expressions derived in this report to accomplish the necessary correction This procedure applies to the case where the pitot tube responds to average pressure differentials and is not oriented to null the cross velocity components For the special case of isotropic flow the results derived in this report show that corrections are not required Author (GRA)

N82-27291# Federal Aviation Administration Atlantic City, N J Technical Center
COCKPIT DISPLAY OF TRAFFIC INFORMATION AND THE MEASUREMENT OF PILOT WORKLOAD: AN ANNOTATED BIBLIOGRAPHY Final Report, 1970 - 1982
Jacqueline T Rehmann Feb 1982 62 p
(AD-A113637, DOT/FAA/CT-81/49, DOT/FAA/EM-81/9) Avail NTIS HC A04/MF A01 CSCL 01/3

Approximately 80 references relating to pilot workload were selected and summarized as part of the Cockpit Display of Traffic Information (CDTI) studies currently being conducted by the Federal Aviation Administration Technical Center in Atlantic City New Jersey A comprehensive search of the scientific literature was conducted using several sources, including books, scientific journals, proceedings of technical meetings, and computerized information retrieval Specific topics covered on this annotated bibliography, as they related to CDTI and its concomitant workload considerations, are subjective measures, spare mental capacity primary task measures, and physiological measures Author (GRA)

N82-27292# AOA Apparatebau Gauting G m b H (West Germany)
TORSIONAL STIFFNESS ELEMENT BASED ON COBALT-SAMARIUM MAGNETS Final Report
Rainer Osthermayer Bonn Bundesministerium fuer Forschung und Technologie Dec 1981 70 p refs In GERMAN ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-044 ISSN-0170-1339, Rept-4 1 0032) Avail NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 14,70

The feasibility of a strapdown turn and bank indicator with an electromagnetic torsional stiffness element based on cobalt samarium permanent magnets was investigated Characterization of the suitability of this magnetic material in fulfilling design requirements was stressed Theoretical fundamentals for the tailoring of magnetic heads were reviewed Cobalt samarium disks were magnetized axially in such a way that over a range of 18 deg a linear relationship between magnetic induction and the axial deviation angle exists With these magnets, electromagnetic torsional stiffness elements were built in which the torsion constant is adjustable by the current Alternative torsional stiffness elements with constant magnetization, but specific profiling of the magnets as well as magnets in connection with a specific current were also studied on a model for dynamic applications Results validate the mechanical torsional stiffness element design and confirm the magnetic properties of cobalt samarium Author (ESA)

N82-27293# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
IMPACT OF ADVANCED AVIONICS TECHNOLOGY AND GROUND ATTACK WEAPON SYSTEMS
Feb 1982 147 p refs Meeting held at Agheos-Andreas, Greece, 19-23 Oct 1981
(AGARD-CP-306, ISBN-92-835-0310-4) Avail NTIS HC A07/MF A01

Autonomous operations conducted by day, night, and in adverse weather are associated with a high degree of automation, requiring sensors with high performance and a large data and signal processing capacity The vulnerability of attack aircraft to the ground to air defense and the excessive workload of the pilot in the guidance of air to ground weapons point to the concept of a generation of fire and forget weapons

N82-27294# Aeronautical Systems Div, Wright-Patterson AFB, Ohio Deputy for Avionics Control
IMPACT OF ADVANCED AVIONICS AND MUNITIONS TECHNOLOGY ON GROUND ATTACK WEAPONS SYSTEMS IN NIGHT AND ADVERSE WEATHER CONDITIONS
Louis J Urban *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 4 p (For primary document see N82-27293 18-06)
Avail NTIS HC A07/MF A01

Worldwide environmental conditions that may be encountered by fighter pilots are reviewed as well as the capabilities of potential adversaries Technology efforts and systems developed to improve capability to operate at night and under unfavorable weather conditions discussed include advanced medium range air-to-air missiles, the PAVE TACK system used on the F-4 and F-111 aircraft, and the low altitude navigation and targeting infrared system for night (LANTIRN) which assists the pilot of a single seat aircraft to fly under the weather in night and helps in acquiring targets and readying weapons for launch To complement LANTIRN, high resolution synthetic aperture tactical radar and millimeter wave radars are under development to improve target recognition, resolution, and navigation The precision location strike system, imaging infrared Maverick, combined effects bomblets, GATOR air delivered mines, and wide area antiarmor munitions are other developments summarized A R H

N82-27295# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
AIR-GROUND ATTACK AXES OF RESEARCH FOR AIRBORNE SYSTEMS [ATTAQUE AIR-SOL AXES DE RECHERCHE POUR LES SYSTEMES AEROPORTES]
S Croce-Spinelli *In its* Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 14 p In FRENCH (For primary document see N82-27293 18-06)
Avail NTIS HC A07/MF A01

The integration of weapons systems with other airborne systems and equipment is considered from the point of view of operational aspects Various weapons and their fire control characteristics are classed and the requirements and possibilities offered for meeting them are tabulated Target acquisition, mission constraints, and versatility of mission are examined Strapdown inertial guidance, radio altimeters, radar maps electro-optics, and multiple access transmission networks are discussed Systems for very low altitude flight and threat evaluation are described Transl by A R H

N82-27296# British Aerospace Aircraft Group, Kingston-upon-Thames (England)
SOME POTENTIAL NOVEL APPROACHES TO THE AUTOMATIC AIRBORNE DETECTION AND IDENTIFICATION OF GROUND TARGETS
J S Williams *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 13 p refs

Avail NTIS HC A07/MF A01
Basic sensor processing functions are examined in an effort to establish the type of operation to be conducted optically If optical techniques are to be used in target detection and identification, interfaces must be minimized in order to reduce the size of the device used, improve reliability and inspectability, and conserve signal power during processing Topics covered include receiving optics, optical signal decomposition, image preprocessing display prepreparation, acquisition computation, and range and bearing Coherent transform optics, holographic methods, optical feedback, real-time processing, and optical bistable devices are discussed as processing elements Although optical signal processing has considerable potential in airborne target recognition, considerable research is needed in this capability is to be realized There is a need to support this activity with adequate modelling of the perception capability of the human visual system if information is to properly displayed and then utilized A R H

N82-27297# National Aerospace Lab, Amsterdam (Netherlands)
A PLANNING SYSTEM FOR F-16 AIR-TO-SURFACE MISSIONS
P J M Urlings, W Loeve, and J Batenburg (Royal Netherlands Air Force, Zeist) *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 6 p refs

Avail NTIS HC A07/MF A01
Recently introduced into the Royal Netherlands Air Force, the F-16 aircraft is to be employed in both air-to-air and air-to-surface operations Successful air-to-surface mission accomplishment is highly dependent on the avionics system capabilities as navigation, target acquisition fire control, and weapons delivery To make use of the full avionic potential, the set-up of its systems requires careful planning and preflight preparation Checklists must also be prepared for navigation and in-flight system operation A concept for a mission planning system is presented to provide the F-16 pilot with a tool for performing adequate preparation Specific F-16 avionic demands on mission planning are summarized and two systems related to this planning are described The assembling of F-16 in-flight essentials into a combat mission folder is described A R H

N82-27298# Hughes Aircraft Co, El Segundo Calif Advanced Programs Lab
PAVE MOVER AIDED INTEGRATED STRIKE AVIONICS SYSTEM
A J Mendez, T A DuPuis (AFWAL) and J Boaz *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 6 p refs

Avail NTIS HC A07/MF A01
Methods were developed for specifying targeting sensor performance based on tactics and weapons characteristics alone Targeting sensor specifications (demand curves) developed in this manner indicate that, for quick reaction, short range attack with precision-guided munitions, single sensors do not generate sufficient confidence (supply curves) to satisfy the required timeliness This problem is alleviated by treating all sensors as an integrated set - the ISAS concept New tactics produce sudden encounters which do not always yield a favorable attack geometry, even if the ISAS is able to distinguish the high priority targets in its field of regard This situation is greatly improved by real-time targeting data from a stand off target acquisition/control system such as Pave Mover Maximum benefit from the new tactics and weapon delivery concepts is accrued by pairing the complementary capabilities of ISAS and Pave Mover This combination optimizes the strike effectiveness and survivability of ground attack aircraft which must penetrate to the battlefield and deep interdiction regions A R H

N82-27299# AEG-Telefunken, Ulm (West Germany)
ADAPTIVE MULTIFUNCTION SENSOR CONCEPT FOR AIR-GROUND MISSIONS
R P Mills-Goodlet, D J R Stock, E G Woelfle, and C Hamilton *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 13 p refs

Avail NTIS HC A07/MF A01
The requirements imposed on a radar system it is to be installed in aircraft flying low-level interdiction missions are discussed A typical low low-level air-ground attack scenario is described together with the various radar techniques and modes that must be employed Particular attention is given to the nose radar, its antenna, and its integration with other aircraft sensors to form an adaptive multisensor system The ways in which such a multisensor system can reduce pilot workload are examined A R H

N82-27300# Naval Air Systems Command, Washington, D C
ATTACK AND EN ROUTE AVIONICS FOR IN-WEATHER OPERATIONS
E B Beggs, W F Ball (Naval Weapons Center, China Lake, Calif), and N J Schneider (Naval Weapons Center, China Lake, Calif) *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 11 p

Avail NTIS HC A07/MF A01
An increasingly sophisticated and lethal ground threat environment must be countered in large part by technological advances in the avionics of naval attack aircraft Critical deficiencies exist in the areas of standoff targeting and weapon delivery, defense suppression, equipment reliability, and crew loading To reduce pilot workload, automated procedures and decision aids must be developed Technology must be made available for precise navigation, integration of weapon delivery and flight control systems, automatic target recognition, detection avoidance, automatic flight path routing, and secure communications The ingress and egress phases of naval air missions are discussed as well as the attack phase and defense suppression Author

N82-27301# Electronique Marcel Dassault, St Cloud (France)
WEAPON SYSTEM OF A FUTURE ATTACK AIRCRAFT [SYSTEME D'ARME D'UN AVION D'ATTAQUE FUTUR]
B E Bortomb *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 11 p refs In FRENCH
Avail NTIS HC A07/MF A01
A hypothetical all-weather air-to-surface weapon system is presented which is adaptable to a single seat aircraft whose weight without armor would be on the order of 4 tons It would appear that this system requires a precise predesignation of objectives, so that it can then fulfill its mission with good chances of success by day as well as by night, through diverse fogs and relatively important precipitation conditions which cover 99% of the cases in which it is used Transl by A R H

N82-27302# British Aerospace Public Ltd Co, Preston (England)
ADVANCED TECHNOLOGY AND FIGHTER COCKPIT DESIGN: WHICH DRIVES WHICH?
I E Schofield *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 10 p

Avail NTIS HC A07/MF A01
Problems experienced by the ground attack fighter pilot are reviewed, and the design of an acceptable man machine interface in the cockpit in order to ensure maximum head up operation for low level flying is discussed The present use of automation and CRT displays is reviewed Problems in the employment of increased automation, direct voice input, and synthetic speech, and their integration into the avionics system are considered The use of multifunction displays and controls, keyboards, and the more traditional switchery is discussed J D

N82-27303# Army Armament Research and Development Command, Dover, N J
DIGITAL IMAGE PROCESSING FOR ACQUISITION, TRACKING, HAND OFF AND RANGING
Robert R Marinellie and John V Spangler *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 12 p refs

Avail NTIS HC A07/MF A01
The design, application, and preliminary analysis of flight test results of the AUTO-Q digital image processor for the automatic recognition of targets in reconnaissance images are

discussed The problems of information extraction from and bandwidth reduction in raw sensor data and the way they lead to the evolution of a common preprocessing approach are considered The image processing tasks involved in target acquisition, tracking, and handoff are described The basic concepts and algorithms in AUTO-Q are presented, and the volution of three generations of digital hardware described A description of the electrical and mechanical characteristics of the latest system is presented J D

N82-27304# Marconi Avionics Ltd, Rochester (England) Airborne Display Div

WIDE ANGLE RASTER HEAD UP DISPLAY DESIGN AND APPLICATION TO FUTURE SINGLE SEAT FIGHTERS

David W Hussey *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 8 p refs

Avail NTIS HC A07/MF A01

Unconventional optical design capable of the largest practical field of view, around 20 degrees by 30 degrees for the majority of existing fighter cockpits are described Some auxiliary advantages implicit in the designs are also outlined Head up displays of this type are currently in development for the USAF LANTIRN program to be flown in the F-16 and A-10 They are also compatible with a wide range of other fighter aircraft J D

N82-27305# Army Night Vision Lab, Fort Belvoir, Va

ADVANCED TARGET ACQUISITION AND TRACKING CONCEPTS FOR REAL TIME APPLICATIONS

John Thomas Hall *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 7 p refs

Avail NTIS HC A07/MF A01

The basic functional requirements for the target acquisition mission based on the sensor input, preprocessing, image segmentation, feature extraction, target detection, and target classification operations are presented The impact on designing real time tracking algorithms to follow targets through clutter is considered An advanced tracking concept considering the coupling of the target detection/classification algorithm with the multimode track is discussed The thrust for multisensor systems is considered from the synergistic target acquisition point of view The implementation of smart sensor target acquisition functions is presently limited by hardware capabilities The advancement in the very high speed dedicated integrated circuit technology will make present advanced algorithms realizable in integrated circuit hardware The projected needs for real time target acquisition and tracking are considered for the autonomous vehicle Several approaches are considered for realization of the truly real time target acquisition system in the next decade J D

N82-27306# Rome Air Development Center, Griffiss AFB, N Y

TACTICAL SYSTEMS APPROACH TO INTERDICTION OF 2ND ECHELON MOVING TARGETS USING REAL TIME SENSORS

Martin J Blancalana and Henry J Mancini (GE, Utica, N Y) *In* AGARD Impact of Advan Avionics Technol on Ground Attack Weapon Systems Feb 1982 9 p refs

Avail NTIS HC A07/MF A01

An integrated system architecture for the effective interdiction of second echelon ground forces which are advancing under the cover of intense EW and air defense protection is described The proposed architecture is based on principles derived from control theory and present practice, and includes the use of advanced air to surface and surface to surface quasi-autonomous attack elements operating in a complementary manner with stand off target acquisition and track sensors All of the necessary elements of such an advanced architecture are in fact in various stages of development today Author

N82-27309*# Pratt and Whitney Aircraft Group, East Hartford, Conn

PERFORMANCE DETERIORATION DUE TO ACCEPTANCE TESTING AND FLIGHT LOADS; JT90 JET ENGINE DIAGNOSTIC PROGRAM

W J Olsson 22 Jan 1982 147 p refs
(Contract NAS3-20632)
(NASA-CR-165572, NAS 1 26 165572, PWA-5512-87) Avail NTIS HC A07/MF A01 CSCL 21E

The results of a flight loads test of the JT9D-7 engine are presented The goals of this test program were to measure aerodynamic and inertia loads on the engine during flight, explore the effects of airplane gross weight and typical maneuvers on these flight loads, simultaneously measure the changes in engine running clearances and performance resulting from the maneuvers, make refinements of engine performance deterioration prediction models based on analytical results of the tests, and make recommendations to improve propulsion system performance retention The test program included a typical production airplane acceptance test plus additional flights and maneuvers to encompass the range of flight loads in revenue service The test results indicated that aerodynamic loads, primarily at take-off, were the major cause of rub-indicated that aerodynamic loads, primarily at take-off, were the major cause of rub-induced deterioration in the cold section of the engine Differential thermal expansion between rotating and static parts plus aerodynamic loads combined to cause blade-to-seal rubs in the turbine B W

N82-27310*# General Electric Co, Cincinnati, Ohio Aircraft Engine Business Group

CORE COMPRESSOR EXIT STAGE STUDY, VOLUME 6 Final Report, Oct. 1976 - Dec. 1981

D C Wisler Dec 1981 97 p refs
(Contract NAS3-20070)
(NASA-CR-165554, NAS 1 26 165554, GE-R81AEG288) Avail NTIS HC A05/MF A01 CSCL 21E

Rear stage blading designs that have lower losses in their endwall boundary layer regions were studied A baseline Stage A was designed as a low-speed model of stage 7 of a 10-stage compressor Candidate rotors and stators were designed which have the potential of reducing endwall losses relative to the baseline Rotor B uses a type of meanline in the tip region that unloads the leading edge and loads the trailing edge relative to the baseline rotor A designs Rotor C incorporates a more skewed (hub strong) radial distribution of total pressure and smoother distribution of static pressure on the rotor tip than those of rotor B Candidate stator B embodies twist gradients in the endwall region Stator C embodies airfoil sections near the endwalls that have reduced trailing edge loading relative to stator A The baseline and candidate bladings were tested using four identical stages to produce a true multistage environment Single-stage tests were also conducted The test data were analyzed and performances were compared Several of the candidate configurations showed a performance improvement relative to the baseline A R H

N82-27311*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

QCSEE UNDER-THE-WING ENGINE ACOUSTIC DATA

Harry E Bloomer and Nick E Samanich May 1982 28 p refs
(NASA-TM-82691, E-972 NAS 1 15 82691) Avail NTIS HC A03/MF A01 CSCL 21E

Both an over-the-wing (OTW) and an under-the-wing (UTW) experimental engine are discussed The UTW engine had a variable-geometry fan exhaust nozzle and a variable-pitch fan that provided quick-response reverse thrust capability An automatic digital control enabled optimal engine operation under all steady-state conditions as well as during forward and reverse thrust transient operation The engine was tested at the Engine Noise Test Facility alone and with wind and flap segments to simulate an installation on a short-haul transport aircraft The engine acoustic configuration was varied to give 14 test configurations All of the acoustic test results from the UTW program at Lewis are presented as 1/3-octave-band sound pressure level (SPL) tabulations for all of the test points and some narrow-band spectra and 1/3-octave-band data plots for selected conditions T M

N82-27312# Naval Ship Research and Development Center, Bethesda, Md

PROCEEDINGS OF THE 12TH NAVY SYMPOSIUM ON AEROBALLISTICS, VOLUME 2

14 May 1981 366 p refs Symp held at Bethesda, Md, 12-14 May 1981 2 Vol
(AD-A111783) Avail NTIS HC A16/MF A01 CSCL 20/4

Contents Current Status of Inlet Flow Prediction Methods, Rotational Flow in a Curved-Wall Diffuser Designed by Using the Inverse Method of Solution of Potential Flow Theory, Aerodynamic Characteristics of a Series of Airbreathing Missile Configurations, Parabolized Navier-Stokes Predictions for Three-Dimensional Viscous Supersonic Flows, Results of a

Government and Industry Survey of the Heating Methods Used to Determine Missile Structural Temperatures, Supersonic Combustor Insulation Ablation Analysis and Tests, Computation of Three-Dimensional Viscous Flow over Blunt Lifting Bodies at High Angle of Attack, Computation of Hypersonic Laminar Viscous Flow over a Body with Mass Transfer and/or Spin at Angle of Attack, Three-Dimensional Viscous Shock-Layer Analysis of Laminar or Turbulent Flows in Chemical Equilibrium, Further Development of the Streamline Method for Determination of Three-Dimensional Flow Separation, Comparison of Numerical Results and Measured Data for Smooth and Indented Nosetips, Structural and Electrical Performance Considerations in the Design of Multiband Radomes, and Structural Considerations for the Recovery of Air-to-Air Missiles GRA

N82-27313# General Electric Co, Cincinnati, Ohio Aircraft Engine Business Group
FOREIGN OBJECT IMPACT DESIGN CRITERIA, VOLUME 2 Interim Technical Report, 31 Dec 1977 - 31 Dec. 1978
Albert F Storace Wright-Patterson AFB, Ohio AFAPL Feb 1982 73 p refs
(Contract F33615-77-C-5221, AF Proj 3066)
(AD-A112701, R78AEG180-Vol-2, AFAPL-TR-78-81-Vol-2) Avail NTIS HC A04/MF A01 CSCL 21/5

The program objective is to establish specific design criteria and provide the analytical design tools to assess and improve the foreign object damage tolerance of turbine engine fan and compressor blading This program will aid in the design of more efficient damage-tolerant blading through the replacement of trial and error FOD test and evaluation practices with systematic transient structural analysis methods, test procedures and design criteria A design system structure was completed and initial versions of the preliminary and final design transient structural response computer programs were developed In addition, the interface between the bird loading model and the final design response model was completed Three first stage blades were selected for modeling and testing Tests and analyses to be used to generate local and gross structural damage design data are in progress and planning was completed for structural element impact tests Composite and metallic specimens for local and gross damage testing were designed and most of these specimens have been fabricated A parametric matrix to guide the analyses and validation testing was completed and FOD design criteria goals were formulated for consideration in the program Author (GRA)

N82-27314# General Electric Co, Cincinnati, Ohio Aircraft Engine Business Group
FOREIGN OBJECT IMPACT DESIGN CRITERIA, VOLUME 3 Interim Technical Report, 31 Dec. 1978 - 31 Dec. 1979
Albert F Storace Wright-Patterson AFB, Ohio AFAPL Feb 1982 134 p refs
(Contract F33615-77-C-5221, AF Proj 3006)
(AD-A112447, AFAPL-TR-78-81-Vol-3) Avail NTIS HC A03/MF A01 CSCL 21/5

Specific design criteria were established and the analytical design tools were provided to assess and improve the foreign object damage (FOD) tolerance of turbine engine fan and compressor blading Efficient, damage tolerant blading is designed by replacing trial and error FOD test and evaluation practices with systematic transient structural analysis methods, test procedures, and design criteria A design structure was developed for the purposes of providing a consistent framework in which to constitute the design criteria, guiding the overall technical effort, and formulating a data foundation to define the problem environment The transient-structural-response and interactive-loading models were developed Local and structural impact testing, material property determination, error band analysis, and the formulation of design criteria were addressed The properties for the metallic materials were established, and testing is underway to establish the properties for the composite materials GRA

N82-27315# Virginia Univ, Charlottesville Dept of Mechanical Engineering
THE SCHLADITZ FUEL INJECTOR: AN INITIAL PERFORMANCE EVALUATION WITHOUT BURNING Final Report, 1 Sep. 1977 - 28 Feb. 1979
G B Matthews, J E Scott, K A Harvey, Jr, and J Z Colt, Jr Mar 1982 96 p refs
(Contract N00014-77-C-0564)
(AD-A113612 UVA/525335/MAE78/101R) Avail NTIS HC A05/MF A01 CSCL 21/5

The Schladitz Fuel Injector (SFI) is a network of electrically heated, extremely thin metal whiskers Tests show that very fine fuel droplet sprays are formed leading to substantial improvements in combustion efficiency Evaluation of this performance potential, however, requires thorough investigation of the flow rate/pressure drop/heating rate influence on spray quality and droplet distribution Such tests were performed on two SFI geometries with steady flows of Jet A fuel When these flows were discharged directly to the atmosphere, pressure drop reached a minimum at heating rates of 280 J/cc At this point, spray quality improved noticeably, showing substantial fog or mist production, which became complete mist as the heating rate approached three-fourths the Jet A enthalpy of vaporization Similar tests of SFI flows exhausting through conventional spray nozzles showed appreciable improvement in spray quality, producing 50% or more mist at heating rates about one-third less than those required in the absence of nozzles GRA

N82-27316*# Naval Air Propulsion Test Center, Trenton, N J Propulsion Technology and Project Engineering Dept
ROTOR FRAGMENT PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE NGINE ROTOR FAILURES THAT OCCURRED IN U.S. COMMERCIAL AVIATION DURING 1978 Final Report, 1977 - 1978
R A DeLucia and J T Salvino Sep 1981 30 p
(NASA Order C-41581-B)
(NASA-CR-165388, NAS 1 26 165388, AD-A113767, NAPC-PE-23) Avail NTIS HC A03/MF A01 CSCL 21/5

This report presents statistical information relating to the number of gas turbine engine rotor failures which occurred in commercial aviation service use The predominant failure involved blade fragments, 82 4 percent of which were contained Although fewer rotor rim, disk, and seal failures occurred, 33 3%, 100% and 50% respectively were uncontained Sixty-five percent of the 166 rotor failures occurred during the takeoff and climb stages of flight Author (GRA)

N82-27317# Southwest Research Inst, San Antonio, Tex Army Fuels and Lubricants Research Lab
DEVELOPMENT OF ACCELERATED FUEL-ENGINES QUALIFICATION PROCEDURES METHODOLOGY, VOLUME 1 Interim Report, Oct. 1980 - Sep. 1981
J A Russell, J P Cuellar, Jr, J C Tyler, J Erwin, W K Knutson, R A Alvarez, R L Stenberg (Army Aviation Research and Development Command), F O Zimmer (Army Aviation Research and Development Command), R L Renta (Mueller Associates, Inc), and T J Timbario (Mueller Associates, Inc) Dec 1981 216 p refs 2 Vol
(Contracts DAAK70-81-C-0209, DAAK70-80-C-0001, DAAK70-82-C-0001, DA Proj 1L2-63104-D-150)
(AD-A113461, AFLRL-144-Vol-1) Avail NTIS HC A10/MF A01 CSCL 15/5

Activities and findings are reported for a 12-month program aimed at the development of procedures for accelerating the qualification of new fuels on Army equipment, emphasizing those derived from oil shale and coal Prinicpal activities were identification of key tactical and combat surface and air vehicles, powerplants, and fuels systems components, identification of critical properties peculiar to new fuels anticipated to have significant impact upon Army materiel, laboratory evaluations of materials compatibility and fuels characteristics (including lubricity, elastomer compatibility, thermal stability, and corrosion), full-scale fuel systems component testing, and an overall review and evaluation of existing engine/fuel system qualification procedures Conclusions and recommendations are presented in terms of methodology and criteria which will realistically address key peculiarities of altnerative fuels and thus serve to accelerate their qualification for field Army use Author (GRA)

N82-27318# Southwest Research Inst, San Antonio, Tex Army Fuels and Lubricants Research Lab
DEVELOPMENT OF ACCELERATED FUEL-ENGINES QUALIFICATION PROCEDURES METHODOLOGY. VOLUME 1: APPENDICES Interim Report, Oct. 1980 - Sep. 1981
J A Russell, J P Cuellar, Jr, J C Tyler, J Erwin, R A Alvarez, W K Knutson, R L Stenberg (Army Aviation Research and Development Command), F O Zimmer (Army Aviation

Research and Development Command), R L Rentz (Mueller Associates, Inc), T J Timbario (Mueller Associates, Inc) et al Dec 1981 438 p 2 Vol
(Contracts DAAK70-81-C-0209, DAAK70-82-C-0001, DAAK70-80-C-0001)
(AD-A113532, AFLRL-144-Vol-2) Avail NTIS HC A19/MF A01 CSCL 15/5

Aircraft engine component listings are included, along with elastomer swell and hardness data and retention properties Several shale oil fuel test plans are presented Pre and post test definition data, spot calibration, flow test, fuel characteristics, lubricity and interfacial tension data are also given Component test results, disassembly and inspection, identification of critical fuel system components, and existing engine qualification procedures are also included S L

N82-27319*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
QUIET SHORT-HAUL RESEARCH AIRPLANE (QSRA) MODEL SELECT PANEL FUNCTIONAL DESCRIPTION
DeLamar M Watson May 1982 121 p refs
(NASA-TM-84243, A-8915, NAS 1 15 84243) Avail NTIS HC A06/MF A01 CSCL 01C

The QSRA, when equipped with programmable color cathode ray tube displays, a head up display, a general purpose digital computer and a microwave landing system receiver, will provide a capability to do handling qualities studies and terminal area operating systems experiments as well as to enhance an experimenter's ability to obtain repeatable aircraft performance data The operating systems experiments include the capability to generate minimum fuel approach and departure paths and to conduct precision approaches to a STOLport runway The mode select panel is designed to provide both the flexibility needed for a variety of flight test experiments and the minimum workload operation required by pilots flying into congested terminal traffic areas T M

N82-27320# Eagle Technology, Inc, Arlington, Va
RELIABILITY AND MAINTAINABILITY ANALYSIS OF FLUIDIC BACK-UP FLIGHT CONTROL SYSTEM AND COMPONENTS Final Report
William H Skewis and David R Keyser Sep 1981 61 p refs
(Contract N62269-81-M-3047)
(AD-A110496, NADC-80227-60) Avail NTIS HC A04/MF A01 CSCL 01/4

Fluidic components being used in various aircraft applications are demonstrating extremely high reliability However, the unique design of new fluidic components results in a very limited failure rate data base and prevents the determination of numerical values of fluidic system reliability at a sufficient confidence level This report identifies the potential failure modes of typical components used in a Fluidic Backup Flight Control System and establishes their frequencies of occurrence from published test reports Author (GRA)

N82-27321# Air Force Inst of Tech Wright-Patterson AFB, Ohio
DIGITAL COMMAND AUGMENTATION FOR LATERAL DIRECTIONAL AIRCRAFT DYNAMICS M.S. Thesis
David Atzhorn May 1981 203 p refs
(AD-A107264 AFIT-CI-81-55T) Avail NTIS HC A10/MF A01 CSCL 09/2

Linear-quadratic sampled-data regulator theory is used to design several Type 0 and Type 1 control laws for lateral-directional aircraft dynamics Control structures are defined for singular command inputs and for control rate outputs, the former allows for precise following of a command whose integral appears in the state vector, while the latter uses both a difference approximation and the Tustin transform to characterize control rate in the discrete-time domain Type 0 controllers with control rate restraint and 'equivalent' Type 1 controllers are implemented in a microprocessor-based digital flight control system, and flight tests are conducted using Princeton University's Variable-Response Research Aircraft The control system, entitled CAS-4, offers four combinations of control direct (unaugmented) control, Type 0 control with both roll rate/sideslip angle and roll rate/lateral acceleration command combinations, and Type 1 control with roll rate/sideslip angle command Ground-based hybrid simulation and flight tests results show that major closed-loop response features are unaffected by the choice of sampling rate when sampled-data regulator is used Consequently, much lower sampling rates than would normally be expected can be used when control laws are derived in this manner (a sampling rate of 10 sps is primarily used in this investigation, though lower sampling rates are investigated as well) The results derived through this investigation and presented herein provide additional evidence that digital flight control through modern control theory will be a practical way of implementing flight control systems in future high performance aircraft GRA

N82-27322# Systems Research Labs, Inc, Dayton, Ohio
NOTES ON LATERAL-DIRECTIONAL PILOT INDUCED OSCILLATIONS Final Report, May 1979 - May 1981
Ralph H Smith Wright-Patterson AFB, Ohio AFWAL Mar 1982 84 p refs
(Contract F33615-79-C-3620, AF Proj 2403)
(AD-A113996, AFWAL-TR-81-3090) Avail NTIS HC A05/MF A01 CSCL 05/8

A method is developed for the assessment of lateral-directional pilot induced oscillation (PIO) tendencies The method is applicable regardless of the flight control system mechanization The relations between linear and non-linear system effects on the probability or nature of PIO are discussed In its simplest form, the method proposed for PIO assessment is very similar to methods currently in use The principal difference is that quantitative methods are provided for the identification of specific frequencies at which appropriate stability criteria must be satisfied if PIO is not to be a possibility Based upon analyses in this report, the single axis, bank angle PIO is believed to be the most commonly encountered lateral-directional PIO The possibility for pitch only PIO in the longitudinal mode is discussed The methods of this report are believed to apply to the study of longitudinal PIO Author (GRA)

N82-27323# General Electric Co, Daytona Beach, Fla Space Div
SYSTEM DESCRIPTION-AVIATION WIDE-ANGLE VISUAL SYSTEM (AWAVS) COMPUTER IMAGE Final Report
D V Morland and F A Michler Orlando, Fla Naval Training Equipment Center May 1981 93 p refs
(Contracts N61339-76-C-0048, N61339-79-C-0143)
(AD-A111800, NAVTRAEQUIPC-76-C-0048-1) Avail NTIS HC A05/MF A01 CSCL 05/9

This report provides an overall description of the Aviation Wide Angle Visual System (AWAVS) Computer Image Generator (CIG) System installed at the Naval Training Equipment Center in Orlando, Florida The report includes descriptions of system functions and capabilities, system hardware and new technology features incorporated in the CIG System design This revised report includes descriptions of additions to original CIG which are identified by margin bars Also, the AWAVS name has been changed to Visual Technology Research Simulator, VTRS Author (GRA)

N82-27324# Canyon Research Group, Inc, Westlake Village, Calif
REPORTS BY SYSTEMS TECHNOLOGY, INC., IN SUPPORT OF CARRIER-LANDING RESEARCH IN THE VISUAL TECHNOLOGY RESEARCH SIMULATOR Interim Report, 1 May 1980 - 30 Nov. 1981
W F Jewell, H R Jex, R E Magdaleno, and R F Ringland Dec 1981 65 p refs
(Contract N61339-78-C-0060)
(AD-A112466, TR-81-025, NAVTRAEQUIPC-78-C-0060-10) Avail NTIS HC A04/MF A01 CSCL 01/2

The following work was undertaken (1) Development of a quasi-random turbulence model This model was preferred to the one provided initially with the VTRS system because it enabled better analysis of pilot responses to turbulence inputs The STI model is expected to be appropriate for tasks other than carrier landings and for simulations of other aircraft types (2) Modification of the T-2C simulation to more closely represent the A-7 and F-18 aircraft (3) Application and evaluation of STI's Non-Intrusive Pilot Identification Program (NIPIP), which was developed to estimate the pilot's input-output describing function and combined pilot-vehicle performance parameters such as crossover frequency and phase margin by using a time domain model of the pilot and a least-squares identification algorithm NIPIP functions in real-time and uses a sliding time window to maintain freshness in the data, thus time-varying characteristics in the pilot's control strategy can be measured GRA

N82-27325# Army Cold Regions Research and Engineering Lab, Hanover, N H
COLD REGIONS TESTING OF AN AIR TRANSPORTABLE SHELTER
Stephen N Flanders Aug 1981 28 p refs
(DA Proj 4A7-62730-AT-42)
(AD-A107131, CRREL-81-16) Avail NTIS HC A03/MF A01 CSCL 13/13

An air-transportable shelter designed and built at CRREL for use in cold regions underwent testing in Hanover, New Hampshire, and Ft Greely, Alaska The shelter demonstrated some of its capabilities for mobility by being towed for more than 60 miles behind various vehicles and by being transported on a C-130 cargo airplane, a CH-47 helicopter, and a trailer truck The shelter proved to be very easy for a crew of two to four to set up in all weather conditions including -40 F cold However, the gasoline-powered generator, which was a source for space heat as well as electricity, functioned very poorly Overall, the prototype successfully demonstrated qualities of self-reliance, ease of operation and thermal efficiency
Author (GRA)

N82-27326# Florida Univ, Gainesville Dept of Environmental Engineering Sciences
FIELD TEST OF AN IN STACK DIFFUSION CLASSIFIER ON AN AIRCRAFT ENGINE TEST CELL Final Report, Jun. - Dec. 1980
Dale A Lundgren and Brian J Hausknecht Tyndall AFB, Fla Air Force Engineering and Services Center Apr 1981 40 p
(Grant EPA-R-805762-02-2, AF Proj 1900)
(AD-A113811, AFESC/ESL-TR-81-21) Avail NTIS HC A03/MF A01 CSCL 14/2

An in-stack diffusion classifier was field tested at Tyndall Air Force Base, Florida Particle size distribution measurements were made on the exhaust stream from the engine test cell while running a J75-P17 jet engine Samples were collected at the test cell exhaust plane using a University of Washington in stack cascade impactor followed, in series, by an in stack diffusion classifier being developed at University of Florida In addition, total particulate samples were obtained using absolute filters to determine particulate mass concentration in the exhaust gases Opacity readings of the plume were also taken during sampling The procedures to collect significant data and the general problems encountered to generate a reasonable estimate of jet exhaust aerosol size distribution using a diffusion classifier are described in this report
Author (GRA)

N82-27411# Lockheed Missiles and Space Co, Palo Alto, Calif
PANEL OPTIMIZATION WITH INTEGRATED SOFTWARE (POIS), VOLUME 2. USER INSTRUCTIONS: ECHO AND RRSYS Final Report, Jun. 1976 - Oct. 1980
P Stern, B O Almroth, and P Stehlin Wright-Patterson AFB, Ohio AFWAL Mar 1981 135 p refs
(Contract F33615-76-C-3105, AF Proj 2307)
(AD-A112224, AFWAL-TR-81-3073-Vol-2) Avail NTIS HC A07/MF A01 CSCL 01/3

Optimization of structural panels with respect to bifurcation buckling constraints tends to lead to imperfection sensitive panels The panels may not represent least weight configurations if the influence of always present geometrical imperfections are taken into account A software package, POIS (Panel Optimization with Integrated Software) was developed in response to this problem Here user instructions are presented for Computer Program ECHO and RRSYS which are part of the POIS system ECHO is a collection of computer programs for least weight design of stiffened structural panels subjected to multiple combinations of inplane loads ECHO includes program modules for optimization of perfect panels and nonlinear static stress analysis of panels with random imperfections The optimization problem is carried out as a constrained function minimization problem in which buckling loads, stress, and strain may be constraints RRSYS is a program system for the nonlinear analysis of elastic structures by means of the Rayleigh-Ritz method RRSYS is designed to analyze such diverse structural phenomena as collapse, linear and nonlinear bifurcation, vibrations and transient dynamic response
Author (GRA)

N82-27434# Exxon Research and Engineering Co, Linden, N J Corporate Research-Technology Feasibility Center
RADIATION/CATALYTIC AUGMENTED COMBUSTION Final Report, 1 Jun. 1977 - 28 Feb. 1981
Moshe Lavid Jul 1981 40 p refs
(Contract F49620-77-C-0085, AF Proj 2308)
(AD-A112376, AFOSR-82-0132TR) Avail NTIS HC A03/MF A01 CSCL 21/2

Two techniques for extending aircraft operational range are reported They are radiative and catalytic augmentation techniques to enhance combustion initiation and reaction kinetics which restrict combustor operation via limits on flammability, flame propagation, ignition and stability Both techniques demonstrated the capability to enhance combustion processes and to broaden normally encountered stability limits The radiative technique under laboratory static conditions successfully ignited fuel air mixtures, and enhanced combustion processes, utilizing pulsed and continuous VUV light souces Similarly, the catalytic technique provided efficient combustion under normally difficult fuel lean, low temperature, conditions A complementary effort involves the development of analytical capability required for modeling the radiative and catalytic techniques Radiative ignition and combustion enhancement tests were performed on gaseous mixtures under various static conditions Successful radiative ignitions were obtained with pulsed and continuous VUV/UV light sources
GRA

N82-27436# Naval Postgraduate School, Monterey, Calif Dept of Aeronautics
MODELING SOLID-FUEL RAMJET COMBUSTION INCLUDING RADIATION HEAT TRANSFER TO THE FUEL SURFACE Interim Report
Michael E Metochianakis (Greek Air Force), William V Goodwin, Uri Katz, and David W Netzer Aug 1981 50 p refs
(AD-A107441, NPS67-81-012) Avail NTIS HC A03/MF A01 CSCL 21/5

Radiation heat transfer from soot in the flame zone to the fuel surface of a solid fuel ramjet was incorporated into an existing two-dimensional computer code Improved prediction of the fuel regression pattern was obtained Near-wall temperature measurements indicated that the model predicts too much turbulent mixing near the fuel surface
Author (GRA)

N82-27506# Naval Air Development Center Warminster, Pa Aircraft and Crew Systems Technology Directorate
CORROSION TESTS WITH MIL-H-83282 AND MIL-H-6083 AIRCRAFT HYDRAULIC FLUIDS Final Report
Alfeo A Conte, Jr 25 Jan 1982 12 p
(WF6154200)
(AD-A112437 NADC-81301-60) Avail NTIS HC A02/MF A01 CSCL 11/8

Corrosion tests were performed to determine whether MIL-H-83282 hydraulic fluid could be used in place of MIL-H-6083 preservative fluid in Intermediate Maintenance Activity (IMA) and NAVAIREWORKFAC hydraulic test stands The results presented in this report show that MIL-H-83282 can not be considered as a suitable alternative fluid
Author (GRA)

N82-27512# Dayton Univ, Ohio Research Inst
EVALUATION OF PLASMA SOURCE SPECTROMETERS FOR THE AIR FORCE OIL ANALYSIS PROGRAM Interim Report, 30 Aug. 1977 - 30 Sep. 1980
Wendell E Rhine, Costandy S Saba, Robert E Kauffman, John R Brown, and Patricia S Fair Wright-Patterson AFB, Ohio AFWAL Feb 1982 354 p refs
(Contract F33615-76-C-5312 AF Proj 2303)
(AD-A113809 AFWAL-TR-82-4017) Avail NTIS HC A16/MF A01 CSCL 14/2

An investigation was conducted in order to evaluate two plasma source emission spectrometers for use in the Air Force Oil Analysis Program (OAP) The high temperatures of the plasma sources were expected to improve the Oil Analysis Program's capability to analyze wear metal particulates The work is presented in two phases Phase I of the work dealt with determining the capabilities of the two plasma instruments as well as the currently used OAP spectrometers During this phase of the work the sample introduction systems were identified as the reason each instrument could not detect particles larger than 3-10 Microns Phase 2 of the work dealt with optimizing the sample introduction systems so that particles could be more efficiently transported where they could be analyzed The improved systems were capable of analyzing particles as large as 14-20 Microns
GRA

N82-27519*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
EFFECT OF SOME NITROGEN COMPOUNDS THERMAL STABILITY OF JET A
Albert C Antoine Jun 1982 20 p refs
(NASA-TM-82908, NAS 1 15 82908) Avail NTIS HC A02/MF A01 CSCL 21D

The effect of known concentrations of some nitrogen containing compounds on the thermal stability of a conventional fuel, namely, Jet A was investigated The concentration range from 0 01 to 0 1 wt% nitrogen was examined Solutions were made containing, individually, pyrrole, indole, quinoline, pyridine, and 4 ethylpyridine at 0 01, 0 03, 0 06, and 0 1 wt% nitrogen concentrations in Jet A The measurements were all made by using a standard ASTM test for evaluating fuel thermal oxidation behavior, namely, ASTM D3241, 'thermal oxidation stability of turbine fuels (JFTOT procedure)' Measurements were made at two temperature settings, and 'breakpoint temperatures' were determined The results show that the pyrrole and indole solutions have breakpoint temperatures substantially lower than those of the Jet A used S L

N82-27523# Amoco Oil Co, Naperville, Ill Research and Development Dept
EVALUATION OF HYDROCRACKING CATALYSTS FOR CONVERSION OF WHOLE SHALE OIL INTO HIGH YIELDS OF JET FUELS Final Report, Dec 1979 - Oct. 1981
A M Tait and A L Hensley Wright-Patterson AFB, Ohio AFWAL Oct 1981 196 p refs
(Contract F33615-79-C-2095, AF Proj 3048)
(AD-A112820 M81-65 AFWAL-TR-81-2098) Avail NTIS HC A09/MF A01 CSCL 21/4

A catalyst development and screening program has led to a formulation capable of upgrading whole shale oil into high yields of military jet fuel in a single operation The catalyst is multifaceted in its functionality in that it sequentially saturates, denitrogenates, and hydrocracks the feedstock in the presence of high levels of contaminants, such as organic nitrogen compounds and ammonia while maintaining a high selectivity towards jet-fuel, boiling range material The catalyst, developed by optimization of both chemical and physical properties, consists of 1 5% cobalt oxide, 10% chromium oxide, and 15% molybdenum oxide on a support of 50% ultrastable molecular sieve in alumina The effectiveness of the catalyst for the direct upgrading of an Occidental whole shale oil was demonstrated in a 100-day test The feed, containing approximately 15 weight percent material boiling within the range for JP-4 and containing 13 000 ppm nitrogen, was upgraded to a water-white product containing 1 to 3 ppm nitrogen and approximately 75% JP-4 material The hydrogen consumption required for this level of upgrading and conversion was approximately 1800 SCFB The catalyst developed represents an advance in shale oil upgrading technology over more conventional petroleum-based technology Author (GRA)

N82-27524# Simmonds Precision Products, Inc, Vergennes, Vermont
COMMERCIAL AIRCRAFT AIRFRAME FUEL SYSTEMS SURVEYS Interim Report, Oct. 1980 - Oct. 1981
P G Weitz Atlantic City FAA Feb 1982 55 p refs
(Contract DTFA03-80-C-0080)
(AD-A112241 E-2304 FAA-CT-82/12) Avail NTIS HC A04/MF A01 CSCL 20/4

A selection of commercial aircraft airframe fuel systems has been studied to determine areas where incompatibility with antimisting kerosene fuel (AMK) may exist Incompatibility can be due to reduced fuel system component performance with AMK or shear degradation of the AMK by the fuel system components Survey results, to date, indicate that potential component performance problems with AMK are more significant than loss of AMK flammability protection due to shear degradation Components of interest include ejector pumps, fuel filters, and auxiliary power units The solubility of water in AMK and its effect on fuel system performance under actual operating conditions is also of major importance Author (GRA)

N82-27527# Naval Postgraduate School, Monterey, Calif
AN INVESTIGATION OF ENGINE AND TEST CELL OPERATING CONDITIONS ON THE EFFECTIVENESS OF SMOKE SUPPRESSANT FUEL ADDITIVES M.S. Thesis
Donald Wendell Thornburg Dec 1981 103 p refs
(Contract N6237681-WR-00014)
(AD-A112800) Avail NTIS HC A06/MF A01 CSCL 13/2

Tests were conducted in a one-eighth scale turbojet test cell with a ramjet type combustor to investigate the effects of fuel additives on smoke reduction Particle size and mass concentrations were determined at the engine and stack exhaust using three wavelength optical detector systems Particulate samples were also collected at the engine exhaust and analyzed with a scanning electron microscope Combustor temperature and fuel additives were found to significantly affect particulate mass concentrations emitted from the engine while particle size appeared to be unaffected No significant changes in the particulate size or mass occurred from the engine exhaust to the stack exhaust The optical determination of exhaust mean particulate size/mass concentration with three wavelength optical detector systems appears to be a good and reasonably accurate technique for evaluating the effects of engine and test cell operating conditions and fuel composition changes on the emitted particulates Author (GRA)

N82-27548# National Bureau of Standards Washington, D C
HURRICANE-INDUCED WIND LOADS
Martin E Batts and Emil Simiu Aug 1981 23 p refs
(Grant NSF CEE-80-25718)
(PB82-132267, NBS-DF-81/005A) Avail NTIS HC A02/MF A01 CSCL 13M

A computer program was developed that uses as input the aerodynamic coefficients corresponding to eight or sixteen compass directions and produces as output wind loads on cladding or structural members corresponding to various mean recurrence intervals GRA

N82-27558* National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston, Tex
SPIRAL SLOTTED PHASED ANTENNA ARRAY Patent
Haynes Ellis, Jr, inventor (to NASA) (Rockwell International Corp, Downey, Calif) Issued 9 Feb 1982 7 p Filed 25 Jul 1980 Supersedes N80-29543 (18 - 20, p 2685) Sponsored by NASA
(NASA-Case-MSC-18532-1 US-Patent-4,315,266, US-Patent-Appl-SN-172099, US-Patent-Class-343-895, US-Patent-Class-343-789) Avail US Patent and Trademark Office CSCL 20N

A flush mounting, cavity-backed, dual orthogonal slot antenna for aircraft and space vehicles is described Improved radiation pattern characteristics are obtained by making the spiral slot pattern elliptical in the aperture plane A cavity and a flanged aperture plate are configured such that one slot pair is orthogonal with respect to another slot pair within the aperture plate Coaxial split-tube baluns are used to drive the junctions between corresponding slot pairs An optional cavity dielectric is provided and a drive coupling arrangement includes a four port comparator hybrid having sum and difference ports respectively, for alternate excitation to produce a single lobe or a double lobe pattern with null Switching apparatus is provided to connect a common terminal to either of the ports
Official Gazette of the U S Patent and Trademark Office

N82-27561# Auburn Univ, Ala Engineering Experiment Station
AUTOMATIC HANDOFF OF MULTIPLE TARGETS Final Technial Report, 10 Oct. 1980 - 14 Sep 1981
J S Boland, III, H S Ranganath, and D V Satish Chandra Redstone Arsenal, Ala Army Missile Command 14 Sep 1981 166 p refs
(Contract DAAH01-80-C-0258)
(AD-A107490, AD-E950176 DRSMI/RG-CR-81-4) Avail NTIS HC A08/MF A01 CSCL 17/5

In order to fully utilize the potential of the 'fire and forget' class of helicopter-borne missiles it is necessary to solve the technical problems associated with acquiring and handing off multiple targets from a precision pointing and tracking system (PTS) to several missile seekers simultaneously or almost so in a short period of time The multiple target problem is that of locating targets and missile seeker aim points within the PTS field of view, deciding which target is to be assigned to each missile, generating error signals to the torquers in order to slew the missile LOS such that its assigned target is in the center of its FOV, and initiating automatic seeker tracking The task of locating a given smaller image within a larger image is known as 'image registration A detailed comparison of the important multiple image registration methods based on the number of arithmetic operations for software implementation and the complexity of hardware for real time implementation is presented

New methods of accomplishing multiple image registration which are computationally more efficient than the most commonly used template matching techniques (correlation and sequential similarity detection algorithm) are described Several methods are compared with respect to hardware requirements and speed of computation Author (GRA)

N82-27573# Federal Aviation Administration, Atlantic City, N J Technical Center
SOFTWARE FUNCTIONAL DESCRIPTION OF MASS WEATHER DISSEMINATION SYSTEM EXPLORATORY ENGINEERING MODEL Final Report
Louis Delemarre Feb 1982 52 p
(FAA Proj 131-401-835)
(AD-A112706, DOT/FAA/CT-81/33, FAA-RD-82-1) Avail NTIS HC A04/MF A01 CSCL 17/2

This report describes the Mass Weather Dissemination System Exploratory Engineering Model software currently being evaluated in the Flight Service Station Engineering Laboratory The object of this effort is to investigate, through development, test and evaluation, the application of digital technology to the dissemination of meteorological and aeronautical information The prototype model is a fully-automated system designed to transfer a significant amount of workload from the flight service station specialist to system hardware/software in order to provide better service to the flying public Author (GRA)

N82-27588# Ball Aerospace Systems Div, Boulder, Colo
ADVANCED MICROSTRIP ANTENNA DEVELOPMENTS. VOLUME 2: MICROSTRIP GPS ANTENNAS FOR GENERAL AVIATION AIRCRAFT Final Report, Apr. 1979 - Jun. 1980
Gary G Sanford and Brian D Gross Mar 1982 48 p
(Grant DOT-TSC-1397-1)
(AD-A113620, FAA-EM-80-12-2, TSC-FAA-80-15-Vol-2) Avail NTIS HC A03/MF A01 CSCL 09/5

This report describes the application of microstrip antenna technology to the design of general aviation (G/A) aircraft antennas for use with the Global Positioning System (GPS) For most G/A aircraft, only single frequency operation will be required However, air-carrier and some large corporate aircraft may make use of dual-frequency operation For this reason, some dual-frequency designs have been investigated The main effort was given to the design of antennas with broad beamwidths which could be switched or steered to compensate for aircraft maneuvers, with the goal of maintaining near-hemispherical carriage in flight A hybrid microstrip crossed-slot and sleeve-dipole element used with a suitable combining network gives a suitable, controllable broad-beam pattern This element and its performance are described In addition, radiation patterns are presented using scale-model aircraft and simple crossed-slot antennas Author (GRA)

N82-27609# Forschungsinstitut fuer Anthropotechnik, Bonn (West Germany)
INFLUENCE OF CONTRAST ON SPATIAL PERCEPTION IN TV DISPLAY OF MOVING IMAGES [EINFLUSS DES KONTRASTES AUF DIE RAUMWAHRNEHMUNG BEI TV -FLUGAUSSENSICHT- DARSTELLUNGEN]
H Heising Sep 1981 80 p refs In GERMAN ENGLISH summary
(FB-50) Avail NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 10

A low cost visual simulation system was developed which involves a hybrid computer controlled transformation of perspective on a raster scan TV display It is applicable to a wide range of simulation tasks, including training and research, but is especially useful in facilitating detection of moving objects and reducing frame rate in RPV applications with a number of advantages, e g, reduction of bandwidth and improved protection against jamming Because of the perspective transformation in TV raster scan a change of contrast can occur during the display of moving images Therefore, it is of interest to know the effect of this contrast change on human spatial perception The investigations undertaken led to the conclusion that the physical contrast in the ratio range of I II to 1 25 (by a medium illuminance of 7 cd/sqm at the white parts of the picture) does not influence human distance and height judgments Author (ESA)

N82-27658# Boeing Military Airplane Development, Seattle, Wash Mechanical/Electrical Systems Technology
PROTECTION OF ADVANCED ELECTRICAL POWER SYSTEMS FROM ATMOSPHERIC ELECTROMAGNETIC HAZARDS Final Report, 15 Jun. 1979 - 15 Oct. 1981
David L Sommer Wright-Patterson AFB, Ohio AFWAL Dec 1981 233 p refs
(Contract F33615-79-C-2006, AF Proj 3145)
(AD-A112612, D180-26154-2, AFWAL-TR-81-2117) Avail NTIS HC A11/MF A01 CSCL 01/3

The effects of lightning strikes on aircraft and the resulting transients coupled onto the electrical systems were investigated The historical background and overall scope of the study are presented The lightning threat is defined and electrical system math models are developed The normal design of aircraft for inherent hardness is evaluated Wire routing, equipment location, fiber optics, threat level comparisons and the evaluation of specific electrical circuits are assessed The effects of using add on protection to suppress induced transients on the electrical system are analyzed Protection schemes include cable shielding, linear protection devices, nonlinear protection devices and conductive coatings applied to the aircraft skin The design guide provides the most appropriate lightning hardening techniques is summarized Reliability/maintainability, system safety and design to cost considerations are discussed Protection criteria to develop a lightning tolerant electrical system are included E A K

N82-27659# Boeing Military Airplane Development, Seattle, Wash Mechanical/Electrical Systems Technology
PROTECTION OF ELECTRICAL SYSTEMS FROM EM HAZARDS: DESIGN GUIDE Interim Report, Jun. 1979 - Oct. 1981
David L Sommer Wright-Patterson AFB, Ohio AFWAL Sep 1981 211 p refs
(Contract F33615-79-C-2006)
(AD-A112707, D180-26154-3, AFWAL-TR-81-2118) Avail NTIS HC A10/MF A01 CSCL 01/3

This report contains results of a two-phase study program investigating the effects of lightning strikes on aircraft and the resulting transients coupled on to the electrical systems The design guide contains the historical background and the lighting threat assessment in the sections 1 and 2 Section 3 of the design guide contains the techniques for inherent hardening against the lightning strike electromagnetic energy Section of 4 of the design guide provides two methods for evaluating electrical systems to determine the levels of transients that can be induced The first method allows an electrical systems designer to make a preliminary assessment of the lightning strike threats The second method allows a more detailed evaluation using a computer program called PRESTO Section 5 identifies and examines the various military specifications covering the transients that existing electrical equipment has to withstand Using this information, add-on protection hardware and hardening techniques were evaluated in Sections 6 and 7 Section 8 provides examples for selecting hardening techniques for advanced electrical systems Sections 9, 10, and 11 discuss the reliability/maintainability, system safety and Design to Cost considerations in selection of the appropriate hardening techniques Author (GRA)

N82-27663# McDonnell Aircraft Co, St Louis, Mo Lightning-Lab
ASSESSMENT OF LIGHTNING SIMULATION TEST TECHNIQUES, PART 1 Final Report, Jul. 1980 - Oct. 1981
W G Butters, D W Clifford K P Murphy, and K S Zeisel Oct 1981 128 p refs Sponsored in part by Navy
(Contract F33615-80-C-3406, AF Proj 2402)
(AD-A112626 AFWAL-TR-81-3075-Pt-1) Avail NTIS HC A07/MF A01 CSCL 14/2

The program objective was to assess the current pulse and shock-excitation lightning simulation test techniques The current pulse test technique applies a pulsed current stimulus to the test article, while the shock-excitation technique first charges the test article to a high voltage which then produces a rapid voltage/current pulse on the test article as the spark gap (between the test article and the return conductors) breaks down Direct comparisons of the induced voltage response on interior circuits were made for the two test techniques The interior circuits were high-impedance differential wire pairs typical of many flight-critical in advanced aircraft The program was divided into three tasks (1) an analytical task to model both test techniques to provide a theoretical base, (2) comparative tests using an aluminum cylinder and simple interior circuits that were readily modeled, and (3) comparative tests on the flight control circuits of a full-scale YF-16 fighter aircraft The cylinder test configuration was modeled as two coupled transmission line circuits The generator, cylinder, return lines, and the output configuration between the cylinder and the return line comprise the primary tranmission line that interacts with an interior circuit transmission line via aperture coupling GRA

N82-27743*# Curtiss-Wright Corp, Wood-Ridge, N J Rotary Engine Facility

ADVANCED STRATIFIED CHARGE ROTARY AIRCRAFT ENGINE DESIGN STUDY

P Badgley, M Berkowitz, C Jones, D Myers E Norwood, W B Pratt, D R Ellis (Cessna Aircraft Corp) G Huggins (Cessna Aircraft Corp) A Mueller (Cessna Aircraft Corp), and J H Hembrey (Cessna Aircraft Corp) 29 Jan 1982 149 p refs
(Contract NAS3-21285)
(NASA-CR-165398, NAS 1 26 165398, CW-WR-81 021) Avail NTIS HC A07/MF A01 CSCL 21A

A technology base of new developments which offered potential benefits to a general aviation engine was compiled and ranked Using design approaches selected from the ranked list conceptual design studies were performed of an advanced and a highly advanced engine sized to provide 186/250 shaft Kw/HP under cruise conditions at 7620/25,000 m/ft altitude These are turbocharged direct-injected stratified charge engines intended for commercial introduction in the early 1990's The engine descriptive data includes tables, curves, and drawings depicting configuration, performance, weights and sizes, heat rejection ignition and fuel injection system descriptions, maintenance requirements, and scaling data for varying power An engine-airframe integration study of the resulting engines in advanced airframes was performed on a comparative basis with current production type engines The results show airplane performance costs noise & installation factors The rotary-engined airplanes display substantial improvements over the baseline, including 30 to 35% lower fuel usage A R H

N82-27784# Systems Research Labs, Inc, Dayton, Ohio Research Applications Div

MECHANICAL PROPERTY CHARACTERIZATION AND MODELING OF STRUCTURAL MATERIALS Final Report, Jun. 1979 - May 1981

Noel E Ashbaugh, Henry L Bernstein, Bhaskar Majumdar, and Jalees Ahmad Wright-Patterson AFB, Ohio AFWAL Feb 1982 132 p refs
(Contract F33615-79-C-5025, AF Proj 2307)
(AD-A113841, SRL-9799 AFWAL-TR-81-4187) Avail NTIS HC A07/MF A01 CSCL 11/4

The crack growth behavior of engine disk nickel base superalloys operating in the temperature range 538-760 C was investigated The effects of sustained load upon crack growth, crack growth in deleterious environments, and crack initiation and growth of short cracks were emphasized Crack growth rate models were developed based upon experimental results and upon analytical characterization of fundamental processes which occur during crack growth Mechanical property data were generated from tests including uniaxial tension compression, bend, creep fatigue, low cycle fatigue crack initiation, sustained load crack growth, and fatigue crack growth The materials tested included nickel base superalloys, titanium, aluminum, and other structural materials GRA

N82-27864# Ministry of the Environment, Ottawa (Ontario) Pollution Control Branch

TRANSPORTATION NOISE, ITS IMPACT, PLANNING AND REGULATION

J Manuel 1981 19 p refs Presented at the Intern Symp on Transportation Noise, Pretoria 21-23 Oct 1981
(S-258) Avail NTIS HC A02/MF A01

Examples of the effects transportation noise has on communities are provided Recent work in noise pollution in Canada is highlighted National policies were examined and regulations were reviewed T M

N82-27865# Airbus Industrie, Blagnac (France) Acoustics Dept of Aerospatiale

AIRBUS INDUSTRIE AND COMMUNITY NOISE

J Chausonnet 1981 35 p Presented at the Intern Symp on Transportation Noise, Pretoria 21-23 Oct 1981
Avail NTIS HC A03/MF A01

The contributions of the total noise perceived outside an aircraft during takeoff and landing by the engine and the aerodynamics of the aircraft are considered The reduction of engine noise by design, the location of the engine and acoustic treatment of the nacelles is discussed Aerodynamic noise reduction is considered in terms of aircraft design, operational procedures, and aircraft weight A noise measuring facility used for checking operational procedures and measuring noise levels is described Author

N82-27869# Air Force Inst of Tech, Wright-Patterson AFB, Ohio

CONTROL OF AIR POLLUTION FROM AVIATION: THE EMISSION STANDARD SETTING PROCESS Ph.D Thesis

Dennis Freeman Naugle 1981 260 p refs
(AD-A107435 AFIT-CI-81-26D) Avail NTIS HC A12/MF A01 CSCL 01/2

The potential effects of aviation on ambient air quality with special emphasis on the requirement and techniques for setting aviation control standards are discussed A logical framework called the 'hypothesis decision model' was developed It offers a structured way of dealing with complex issues Application of the model focuses on aircraft sources but a generic version is also proposed Adoption would explicitly document the manner that technical evidence is considered in a variety of decisions concerning the establishment of emission standards Author

N82-27900# Ohio State Univ, Columbus Dept of Geodetic Science and Surveying

THE EARTH'S GRAVITY FIELD TO DEGREE AND ORDER 180 USING SEASAT ALTIMETER DATA, TERRESTRIAL GRAVITY DATA AND OTHER DATA

Richard H Rapp Hanscom AFB, Mass AFGL Dec 1981 58 p refs
(Contract F19628-79-C-0027, AF Proj 2309)
(AD-A113098, DGS-322, SCIENTIFIC-12, AFGL-TR-82-0019) Avail NTIS HC A04/MF A01 CSCL 08/14

The spherical harmonic expansion of the Earth's gravitational field has been obtained to degree 180 by combining several sources of data The first data set was an a priori set of potential coefficients to degree 36 based on number of recent solutions including a substantial of resonance terms A second data set was a 1 x 1 deg anomaly field derived from the SEASAT data set, while the third data set was an updated 1 x 1 deg terrestrial field The last two fields were combined into one set containing 56761 1 x 1 deg values The remaining values were computed from the a priori potential coefficients A rigorous combination solution was not carried out Instead all anomalies were weighted in such a way that the normal equations were diagonal The results of the adjustment were 64800 1 x 1 deg anomalies that were expanded into spherical harmonics using the optimum quadrature procedure developed by Colombo Accuracy estimates for each coefficient were obtained considering noise propagation and sampling error caused by the finite block size in which the anomalies are given The percentage error of the solution reaches 100% near degree 120 The coefficients and their accuracy to degree 50 are listed in an appendix GRA

N82-27924# Federal Aviation Administration, Atlantic City N J

TEST AND EVALUATION OF THE AIRPORT RADAR WIND SHEAR DETECTION SYSTEM Final Report, Mar 1978 - May 1981

Dominick L Offi, William Lewis, Tai Lee, and Alfred DeLaMarche Feb 1982 39 p refs
(FAA Proj 022-242-830)
(AD-A112663 DOT/FAA/CT-81/63, FAA-RD-81-85) Avail NTIS HC A03/MF A01 CSCL 17/9

A wind shear detection system developed to operate with airport surveillance radar ASH-(8) was installed and tested Initial tests consisted of hardware and software shakedown and feasibility determinations Second phase tests compared radar with aircraft and tower winds, evaluated the wind shear measurement capability under various weather conditions, and investigated the effectiveness of a simple two azimuth pointing strategy Final efforts consisted of observations in all weather regimes and tests of a modified velocity azimuth display (VAD) and a glide slope scan Results showed the system was compatible with and operate satisfactorily with the ASR-8 The processing and spectral display of clear air and precipitation returns is feasible The accuracy of agreement, between radar measured winds and components of the aircraft measured winds in both radially oriented flights and runway offset flights using a two azimuth pointing technique a glide slope scan, and a modified VAD was examined GRA

N82-28007# McDonnell-Douglas Electronics Co St Charles Mo

ADVANCED TRAINING TECHNIQUES USING COMPUTER GENERATED IMAGERY Annual Technique Report, 16 May 1980 - 15 Jul 1981

D Hauck and D Soblitz 15 Sep 1981 74 p refs

(Contract F49620-79-C-0067, AF Proj 2313)

(AD-A111979 MDC-M3026, AFOSR-82-0160TR) Avail NTIS HC A04/MF A01 CSCL 05/9

Aircraft simulator systems have been primarily designed as substitutes for actual aircraft The computer generated imagery of these systems provides the flexibility to enhance training in ways that cannot be done in the real world The thrust of this research is to conceive and demonstrate training approaches to take advantage of this flexibility as a step towards reducing pilot combat attrition and increasing readiness Two broad categories of techniques are available to us (1) synthesizing tasks that are untrainable in aircraft during peacetime but are required during combat and (2) application of teaching/learning methods unavailable in aircraft Exploratory testing has begun on numerous techniques A VITAL IV computer generated image (CGI) system has been used for testing and demonstration

Author (GRA)

N82-28016# Honeywell Systems and Research Center, Minneapolis, Minn Operations Training Div

COMPUTER IMAGE GENERATION ADVANCED VISUAL/SENSOR SIMULATION Final Report

David Serreyn and David Duncan Brooks AFB Texas AFHRL Oct 1981 51 p refs

(Contract F33615-80-C-0006 AF Proj 6114)

(AD-A107098, AFHRL-TP-81-23) Avail NTIS HC A04/MF A01 CSCL 14/5

This study investigated developed, and evaluated various Computer Image Generation (CIG) techniques to overcome the qualitative limitations of current CIG imaginery produced by edge-based systems The study concluded with an integration of techniques into a system concept This report describes the techniques investigated, the system concept developed, and the general hardware implementations which are useful for cost/benefit tradeoffs The system concept presented is based on the use of textured terrain for realistic simulation In areas where the technique was for training effectiveness and an algorithmically unified system The approach also involves the display of terrain as curved surfaces represented by bicubic splines Author (GRA)

N82-28044# Transportation Systems Center, Cambridge, Mass

AN ANALYSIS OF SELECTED ENHANCEMENTS TO THE EN ROUTE CENTRAL COMPUTING COMPLEX Final Report, May - Sep. 1981

William Broadley, Harvey Freeman, James Oiesen, Ronald Rutledge and Kenneth Thurber Washington Sep 1981 105 p refs

(AD-A113575, DOT-TSC-FAA-81-20) Avail NTIS HC A06/MF A01 CSCL 09/2

This report analyzes selected hardware enhancements that could improve the performance of the 9020 computer systems, which are used to provide en route air traffic control services These enhancements could be implemented quickly, would be relatively inexpensive, and would provide a solution to the short-term but not the long-term problems that the system faces Three memory enhancements are discussed First, the storage element (SE) memory boxes could be replaced Second, the memory stacks in the SE's could be replaced Third, the memory stacks in the input-output control elements (IOCE's) could be replaced Three processor enhancements are discussed First, the processors in the compute elements (CE's) could be sped up Second, the processors in the IOCE's could be sped up Third, the CE's could be replaced

GRA

N82-28134*# Stanford Univ, Calif Joint Inst for Aeronautics and Acoustics

THE ANNOYANCE OF IMPULSIVE HELICOPTER NOISE Final Report, Jan. - Dec 1981

K Karamcheti Dec 1981 27 p refs

(Grant NAG1-17)

(NASA-CR-169123 NAS 1 26 169123) Avail NTIS HC A03/MF A01 CSCL 20A

A total of 96 impulsive and non-impulsive sounds were rated for annoyance by 10 subjects The signals had the same amplitude spectrum with a maximum frequency of 4 75 kHz By changing the phase of the spectral components different levels of impulsivity were obtained The signals had coefficients of impulsivity of 10.8, 7 9, and -0 2 respectively Further, signals had intensity levels 89 and 95 dBA, pulse repetition rates 10 and 20 Hz, and half the signals had pink noise added at a level 12 dBA lower than the level of the sound The significant results were The four females and six male subjects rated the impulsive sounds respectively 3 7 dB less annoying and 2 6 dB more annoying than the non-impulsive sounds Overall impulsivity had no effect The hish pulse repetition rate increased annoyance by 2 2 dB Addition of pink noise increased annoyance of the non-impulsive sounds 1 2 dB but decreased the annoyance of the impulsive sounds 0 5 dB

T M

N82-28210# Clemson Univ S C Dept of Mathematical Sciences

LEARNING AND COSTS IN AIRFRAME PRODUCTION, PART 1

Norman K Womer and Thomas R Gulledge, Jr (Louisiana State Univ) Oct 1981 19 p refs Presented at the ORSA-TIMS Joint Natl Meeting Houston, Tex, 11-14 Oct 1981

(Contracts N00014-75-C-0451 F33615-81-K5116, NR Proj 365-049)

(AD-A112948 N131) Avail NTIS HC A02/MF A01 CSCL 05/1

In recent years there has been much interest in exploring the impact of learning and changes in production rate on program costs Most researchers agree that learning is an important determinant of cost, but agreement on the cost impact of production rate changes has been less certain Still, common sense and economic theory suggest that production rate should be an important determinant of cost This importance is also suggested by the fact that cost penalties for production rate changes now occur in some department of defense contracts This paper does not present a theoretical justification for the integration of learning curves with traditional neoclassical economic theory The general theoretical framework for this paper is published in previous reserach The purpose of this paper is to extend the range of applicability of the general framework by considering a previously unexplored specification In particular, this paper explores the joint production situation, where learning and output are simultaneously produced, and a model is presented that has potential application in the airframe industry The theoretical properties of the model are explored, and a cost minimizing solution is presented Finally, a strategy is proposed for adapting the model to a particular airframe program

Author (GRA)

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1. Report No	2 Government Accession No	3 Recipient's Catalog No
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4. Title and Subtitle	5. Report Date
Aeronautical Engineering A Continuing Bibliography (Supplement 153)	October 1982
	6. Performing Organization Code
7 Author(s)	8 Performing Organization Report No
	10 Work Unit No.
9 Performing Organization Name and Address National Aeronautics and Space Administration Washington, D.C. 20546	11 Contract or Grant No
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15. Supplementary Notes

16 Abstract

This bibliography lists 535 reports, articles and other documents introduced into the NASA Scientific and Technical Information System in September 1982.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Aerodynamics Aeronautical Engineering Aeronautics Bibliographies	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22 Price*
Unclassified	Unclassified	156	$5.00 HC

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