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Aeronautical Engineering
A Continuing Bibliography with Indexes

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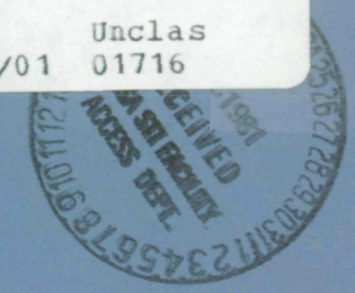

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ACCESSION NUMBER RANGES

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

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NASA SP–7037(140)

AERONAUTICAL ENGINEERING

A Continuing Bibliography

Supplement 140

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 1981 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 Since that time, monthly supplements have been issued

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 386 reports, journal articles, and other documents originally announced in September 1981 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

An annual cumulative index will be published.

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TABLE OF CONTENTS

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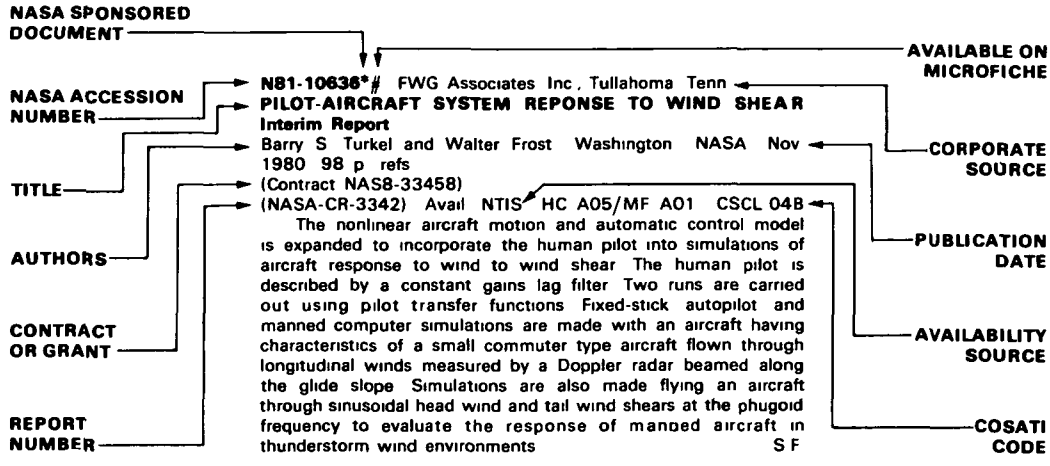

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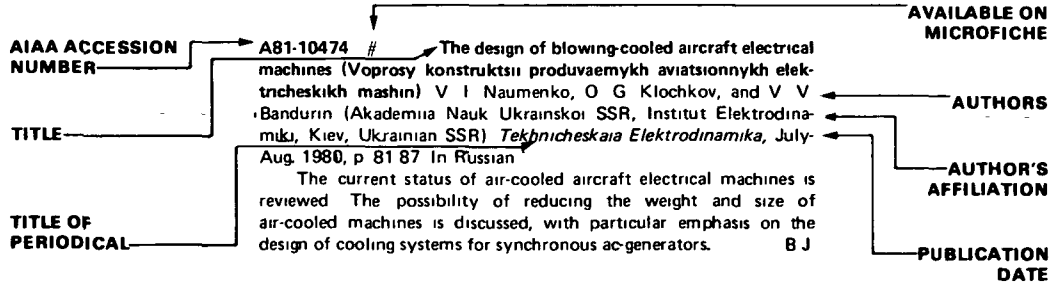

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 140)

OCTOBER 1981

IAA ENTRIES

A81-37633 # **Integrated flexible sheet metal components - Manufacturing center (Integriertes flexibles Blechteile - Fertigungszentrum)** H Becker (Vereinigte Flugtechnische Werke-Fokker GmbH, Bremen, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 26 p In German

More efficient production procedures in the European aircraft industry can be obtained by concentrating manufacturing operations, in the case of certain processing activities, at one location for an optimal utilization of the required facilities These considerations were first applied to the performance of metal-cutting operations Experience obtained in this connection provides the basis for applications related to the execution of sheet-metal work Approaches are discussed for making sheet-metal operations more efficient and improving component quality A reduction of manual activities appears particularly important The technology of sheet-metal manufacturing operations is examined, taking into account possible improvements on the basis of automation and mechanization Attention is given to the use of a drilling and milling center with automatic control features, the elimination of manual deburring operations, the utilization of opto-electronic sensors, heat treating, the pressworking of metals, and aspects of production control and supervision G R

A81-37634 # **Pilot installations for deposition techniques in the case of components exposed to heat and for diffusion joining of power plant components (Pilotanlagen zur Beschichtungstechnik von Heissteilen und zum Diffusionsverbinden von Triebwerksteilen)** P Adam (Motoren- und Turbinen-Union Munchen GmbH, Munich, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 30 p In German

The development of new technical procedures and materials requires generally the preparation of prototypes for the determination of the most appropriate designs and processing procedures Pilot installations are important for the reproducible preparation of prototypes Such pilot plants are urgently needed in connection with investigations conducted to provide components, such as turbine blades, with protection against corrosion caused by hot gases Pilot plants are also required for the development of diffusion joining technology, providing superior design possibilities and having the capability to reduce cost related to repair work Aluminum or chromium can be used for coating the surfaces to be protected At the hot temperatures used, the aluminum or chromium diffuse into the base metal and a 'diffusion' protective coating is formed The protective elements can also be applied by physical vapor deposition (PVD) or by a thermal spray process In the joining process considered, PVD is used to deposit an intermediate layer on both surfaces to be joined The surfaces are brought together, the intermediate layer is melted, and a firm bond is formed upon solidification. G R

A81-37635 # **Design, construction and testing of an improved aircraft propeller (Entwurf, Bau und Erprobung eines verbesserten Propellers fur Flugzeuge der Allgemeinen Luftfahrt)** I U Borchers, H Zimmer, P Bartels (Dornier GmbH, Friedrichshafen, West Germany), G Muhlbauer (Hoffmann GmbH und Co., Rosenheim, West Germany), H Koster (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Braunschweig, West Germany), F R Grosche (Deutsche Forschungs- und Raumfahrt, Gottingen, West Germany), and F X Wortmann (Stuttgart, Universitat, Stuttgart, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper* 95 p 29 refs In German Bundesministerium fur Forschung und Technologie Contract No LFK-7831

Improvements in propeller thrust are being developed for twin engine aircraft to shorten take off runs, increase flying range, and reduce noise pollution Aerodynamic experiments included the design and testing of various propeller blade models A four-blade propeller proved to have better starting and ascending thrust than did a three-blade propeller, and also produced less noise and vibration The new propeller designs were distinguished by their wider blade roots and blade tip sweepback, which resulted in optimal lift coefficients, circulation and induced axial velocity Acoustical experiments, done at short and long range field propeller thrusts, revealed that the improved propeller models had higher noise levels than the standard models at lower thrusts, due to blade density *Aerodynamic and acoustical data on the propeller models* were compared and an optimal model was constructed, which will be subject to detailed performance and noise tests Numerous graphs and photographs of the propellers are provided for comparison J F

A81-37636 # **Efficient manufacturing procedures for the production of helicopter rotor blades (Rationelle Fertigungsverfahren zur Herstellung von Hubschrauber-Rotorblattern)** K Brunsch (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 25 p In German (MBB-UD-312-80-OE)

The helicopter B0-105 was first offered for sale more than 10 years ago It was the first series-produced helicopter using rotor blades made of glass-fiber reinforced plastics for the main and the tail rotors The rotor blades made of the new material proved to be a great success. In connection with high wages in West Germany and favorable sales prognoses, it was decided to mechanize the manufacture of rotor blades A description is presented of the technical and economic objectives related to this decision, taking into account current specifications for rotor blades, the design of the B0-105 rotor blades, and feasible steps for a partial mechanization of rotor blade manufacture Current developments towards the mechanization of rotor blade production are examined, giving attention also to advances in the U S and France G R

A81-37637 # **Manufacturing technology for aircraft structural components made of carbon-fiber reinforced plastics (Fertigungstechnologie für Flugzeugbauteile aus kohlefaserverstärkten Kunststoffen /CFK/).** H Conen (Dornier GmbH, Friedrichshafen, West Germany) *Bundesministerium fur Forschung und Technologie,*

Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper 35 p In German

Possibilities for an employment of carbon-fiber reinforced plastics are examined The primary objective of a use of this plastic material is related to the saving of weight This saving of weight can be realized in every individual component, although in varying degrees and at differing costs The basic materials, including carbon fiber and epoxy resin, are considered along with aspects of processing. Differences between the processing of reinforced plastics and that of metallic materials are examined and the origin of current carbon-fiber reinforced plastics technology is explored, taking into account the early use of glass-fiber reinforced plastics and the extension of the range of applications of fiber-reinforced plastics related to the replacement of the glass fiber by the carbon fiber A description is given of the technological developments of the 1970s and 1980s G R

A81-37638 # **Integrated wing-engine system for airliners (Integriertes Flugel-Antriebssystem fur Verkehrsflugzeuge)** B Ewald (Vereinigte Flugtechnische Werke-Fokker GmbH, Bremen, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper* 47 p In German

Aerodynamic development work conducted in West Germany is considered This work is conducted as part of a program which is concerned with the development of components for civil aircraft Improvements in aerodynamic efficiency reduce the consumption of fuel The economic significance of aerodynamic development work is, therefore, enhanced as a consequence of the increasing fuel costs The part of the program dealing with the wing section is discussed, taking into account aspects of planning, profile and wind developments, the development of computational procedures for calculating interaction processes occurring at wing-fuselage and wing-engine configurations in supercritical flow, tests with large models, and the obtained results The second phase of the considered program is concerned with the design of the integrated wing engine system for developments related to the European Airbus family Attention is given to evolution objectives for the Airbus family, the technology of the supercritical wing, wing engine interactions, high-lift systems for future Airbus aircraft, and future technologies for airliners G R

A81-37639 # **Wing of new technology test specimen - Structural design and method of wing construction (TNT-Erprobungstrager - Strukturelle Auslegung und Bauweise des Flugels)** M Flemming (Dornier GmbH, Friedrichshafen, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 26 p In German.

The test specimen of the 'wing of new technology' consists of an extended fuselage, which corresponds to a large degree to the body of the Skyservant, the rudder unit taken from the Skyservant, and a new elevator unit The wing design is the result of recent development work in which increased use was made of an integrated construction technology The new components were developed as part of a government-supported research project Flight tests were also conducted The wing and the associated components provide the basis for an aircraft of general aviation with 15 or 19 seats which is currently being developed by a German aerospace company A novel approach taken with respect to the construction of the wing is related to an extended employment of milling operations, which are also used to produce the rib flanges This approach makes it possible to obtain a very smooth external contour with corresponding advantages for the aerodynamic characteristics of the wing G R

A81-37641 # **Automatic riveting installation for spherical aircraft parts (Automatische Nietanlage fur spharisch verformte Flugzeugzellenstrukturen)** B Haberkorn (Messerschmitt-Bolkow-Blohm GmbH, Hamburg, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper* 24 p In German

A procedure for automatic riveting is being developed in Germany to lower the production costs and time required to join spherical parts of aircraft Automatic riveting reduces the noise, labor, and the number of production steps normally required for mechanical riveting This automation procedure involves manually digitizing the individual rivet parameters and their positions, with respect to the part contour, onto perforated tape, whereby the programmed riveting machine can select the correct rivet size and put it into place A three-axis NC-driven rivet installation can achieve 85% reduction in production time over manual riveting, and the planned five-axis installation would reduce this by another 50% An impact-resistant rivet is also under development, as is a means of adapting the sealing procedure, which requires hardening time, to the pace of the riveting A diagram shows the planned process of shell assembly, whereby a robot sets the clips and rivets the frame and individual parts into place J F

A81-37643 # **Integrated cockpit information system with color display equipment (Integriertes Cockpit-Informations-System mit Farbsichtgeraten)** H Kister (VDO Luftfahrtgerate Werk Adolf Schindling GmbH, Frankfurt am Main, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 17 p In German

Information for all essential functions in the new Airbus aircraft will be presented over electronic color displays The electronic flight instrument system (EFIS) consists of two color displays, the primary flight display, indicating the flight path angle, and the navigation display, operating at four different modes The system and warning displays, independent from the EFIS, warn of operational restraints and indicate correctional procedures, presenting aircraft system conditions in graphic form The software and modular structure of the computer/symbol generator allow adaption to a number of different functions A computer is connected to a stroke-writing symbol generator, capable of illustrating vectors, circles, arcs, and alphanumerics An additional scanning generator permits skyshading and weather radar data to be taken, while an interface module scans data input, checking it for correct bit number and synchronization deficiencies The color display makes use of high resolution shadowmask CRTs, providing good color stability A complete modulating test system and software have also been developed to simulate aircraft signals A test rack for the Airbus display system is given, along with brief statistical data on the color displays, the computer memory, and the stroke-writing generator J F

A81-37644 # **Components in hybrid- and fiber technology for commercial aircraft of the Airbus family /flap support, spoiler, and window frame/ (Komponenten in Hybrid- und Fasertechnologie fur Verkehrsflugzeuge der Airbus-Familie /Landeklappentrager, Spoiler und Fensterrahmen/)** E Loechelt (Vereinigte Flugtechnische Werke-Fokker GmbH, Bremen, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 50 p In German

Research and development work related to flap supports, spoilers, and window frames, which has been conducted jointly by two German aerospace companies and the Institute of Structural Mechanics of the DFVLR in West Germany, has the objective to improve the economics of civil transport aircraft by reducing the structural weight It is felt that carbon-fiber reinforced plastics alone or in combination with other fibers (glass and aramid) and metal have a great short and medium-term potential for realizing this objective The described investigations are concerned with the acquisition of the information needed for this realization and with the collection of data regarding the operational characteristics of the material Attention is given to hybrid material consisting of carbon fiber-reinforced plastic and titanium G R

A81-37645 # **Aerodynamic efficiency of the wing of new technology, a comparison of design expectation and flight test result (Aerodynamische Leistungen des Tragflugels neuer Technologie /TNT/, ein vergleich zwischen Auslegungserwartung und Flugversuchsergebnis)** H Max (Dornier GmbH, Friedrichshafen, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 35 p 8 refs In German Bundesministerium fur Forschung und

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n 1975, a number of technology programs were initiated, , if successful, will contribute to the development of new ft types that will be superior to competitive aircraft on a nical and economical basis The basis of the technology programs scussed along with the program for the development of the wing new technology, the aerodynamic design of the wing of new hnology, and the flight tests conducted with the new design The perimental aircraft incorporating the new wing made its first flight June 14, 1979 The data obtained in the flight tests have verified e expectations concerning the efficiency of the new design Flight ests for prototypes of feeder aircraft with 15 and 19 seats are cheduled for spring 1981 G R

A81-37646 # **Multifunctional color displays for cockpits (Farbsichtgerat zur Mehrfach-Funktionsanzeige im Cockpit)** J Missun (Telefunken AG, Frankfurt am Main, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 6 p In German

Color displays offer several advantages over monochromatic ones now being used the variety of information can be increased, and the evaluation of complex signals can be accomplished with greater ease, thereby reducing the pilot's reaction time Moreover, critical information displayed on a color screen will have a greater effect on the viewer's concentration A multifunctional color display uses cathode ray tubes, offering better contrast, greater luminous intensity, satisfactory color stability, higher resolution, a broader range of operating temperatures, greater lifetime, and better resistance to shock and vibration The disadvantages inherent in the currently used shadow mask tubes may be circumvented by the radiation-index method This method uses no shadow mask, resulting in greater luminous intensity, and only one CRT, thereby avoiding convergence problems It uses two deflection amplifiers, a video amplifier, and power supply units, as does the monochromatic display, but has an additional index signal separation, produced from index signal impulses by electronic switches that scan the color information from the three video receivers and transmit it in sequential form to the CRT This sequential scanning of three video receivers demands a bandwidth that is three times greater than that for monochromatic displays of comparable resolution J F

A81-37647 # **Computer-aided design and manufacture in aircraft production /CAD/CAM/ (Rechnergestutztes konstruieren und fertigen im Flugzeugbau /CAD/CAM/)** J Nagel (Dornier GmbH, Friedrichshafen, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 37 p 8 refs In German

The considered project is being conducted jointly by three German aerospace companies It is concerned with the introduction of procedures which utilize computers to make the work related to the provision of manufacturing plans and information more efficient Attention is given to a utilization of a computer graphics augmented design and manufacturing system, the study of fundamental fluid flow problems related to the determination of the shape of the aircraft, the solution of problems of structural mechanics on the basis of idealized models obtained by methods of improved efficiency, the design of manufacturing aids for aircraft production, the programming for automatically programmed tools, and operations related to production planning G R

A81-37648 # **Air data computer for the measurement and evaluation of data of flight physics (Luftwerterechner zum Messen und Auswerten von flugphysikalischen Grössen)** M Risch (Kollsman System-Technik GmbH, Munich, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper.* 11 p In German

A description is presented of an air data computer provided by a German company The objectives of a use of air data computers in an avionics system are examined and the system concept of the considered digital air data computer is discussed Attention is given to integrated pressure sensors, external sensors, digital output and interface, the modular construction of the computer system, technical data, and areas of application The computer system makes use of a 16-bit microprocessor It is pointed out that executive aircraft, in particular, with their variety of equipment variants will rely on digital air data computer of the discussed type, because of flexibility considerations G R

A81-37649 # **The state-of-the-art in avionics (Uberblick uber die Forderung der Luftfahrt-elektronik)** H Schak (Bundesministerium fur Forschung und Technologie, Bonn, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 17 p 5 refs In German

The Federal Rebuplic of Germany's research in avionics covers three fields (1) the DAS Program, which is concerned with the standardization of international navigation procedures and equipment, (2) the integrated digital flight control system, whose main goals are the application of electronics to aircraft design in addition to aircraft equipment, and the reduction of fuel consumption, and (3) a program for avionics, aimed at increasing the FRG's role in electronic hardware production The government has allotted grants to several industries for the design and manufacture of high quality aviation components, hoping to establish a long-term cooperation between aircraft and aircraft equipment producers The number of planned components (24 total) are statistically represented, and a graph illustrates the money alloted for grants over a four year period The aviation equipment under development is described with its grant recipients J F

A81-37650 # **The optical-fiber interferometer gyroscope for aviation navigation (Der Faserkreisel, ein optischer Drehgeschwindigkeitsmesser zur Anwendung in bordautonomen Navigationssystemen)** E Schlemper and F Mohr (Standard Elektrik Lorenz AG, Stuttgart, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 13 p In German

The optical-fiber interferometer gyroscope, currently under development, is a potential high-accuracy, cost-effective instrument for aircraft navigation systems It offers the advantages of rigidity, compact size, long life, low current consumption, low cost, minimal maintenance requirements, suppression of lock-in effects, and a potential drift of around 10 deg/h Difficulties still lie in achieving polarization regulation, for which fine control elements are being developed Attempts to minimize noise through selection procedures are under investigation by testing the influence of coherent wave lengths of the semiconductor laser on accuracy Operation of the optical-fiber gyro is compared to that of the ring laser gyroscope, and diagrams of both models are presented Means of achieving optimal sensitivity and minimizing the effects of double refraction are also considered J F

A81-37651 # **Airbus - Rudder unit in carbon fiber technology (Airbus - Seitenleitwerk in Carbonfaser-Technologie)** D Schulz (Messerschmitt-Bolkow-Blohm GmbH, Hamburg, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 19 p In German Research supported by the Bundesministerium fur Forschung und Technologie

Since 1976 great efforts have been made to employ modern fiber materials in the secondary structure of the Airbus In 1978, the development of a rudder unit made of fiber-reinforced plastic was initiated In the case of the rudder unit, it was necessary to develop a completely new design The rib-reinforced metal rudder is to be replaced by a rudder made of carbon fiber reinforced plastic in a sandwich structure without interior ribs The simple design of the new rudder provides the basis for a reduction in weight by 18% and a lowering of total manufacturing costs The rudder unit will be the first large component of the primary structure of the Airbus which utilizes fiber technology The development program is subdivided in six sections During the time from 1984 to 1986 the reliability of the new rudder unit is to be demonstrated in regular service operation of the Lufthansa. G R

A81-37653 # **The DME-aided Azimuth System - DAS (Das DME-gestutzte Azimut System - DAS)** W Seith and H Vogel (Standard Elektrik Lorenz AG, Stuttgart, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 25 p In German

In 1972, the ICAO initiated a competition for the development of a new precision approach and landing system as replacement for the currently employed Instrument Landing System The DME-based Landing System (DLS) was the contribution of West Germany to this competition On a meeting of the ICAO it was recommended to develop two essential components of the DLS, including a precision-DME (Distance Measuring Equipment) and a cost-effective implementation of a 360 deg azimuth coverage on DME basis The DME-aided Azimuth System (DAS) is currently being developed in West Germany to comply with these recommendations Attention is given to the DAS development program, general system characteristics, DME principles of operation, details of DAS angular measurement, the integration of DAS into the future microwave landing system, the design of the ground transponder, the DAS azimuth station, DAS onboard equipment, the employment of DAS in Terminal Control Areas, and the DAS growth potential G R

A81-37654 # **Experimental aircraft of the DFVLR for in-flight simulation and flight control technology (Versuchsflugzeug der DFVLR fur In-Flight-Simulation und Flugfuhrungstechnologie)** F Thomas, R Onken, and D Hanke (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Braunschweig, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 24 p In German

It is pointed out that the utilization of digital flight control systems for aircraft operations will have the greatest effect on the employment characteristics of commercial airliners, military aircraft, and aircraft of general aviation The process of an introduction of the new technology will require, in addition to an employment of the computer and simulator, also the use of a flying experimental station for the realistic simulation of the characteristics and functions of an aircraft incorporating the new design features The German Research and Experimental Institute for Aeronautics and Astronautics consid-

A81-37655 # **Dynamically tunable, dry gyroscope in aeronautics and astronautics (Dynamisch abgestimmte trockene Kreisel im Bereich der Luft- und Raumfahrt)** H Tumback (Bodenseewerk Geratetechnik GmbH, Uberlingen, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 16 p In German

Gyroscopes have numerous applications, and depending on their use, require varying degrees of accuracy Measurements of gyro drift, expressed in degrees/hour, must be of increasingly greater accuracy for the following functions azimuth orientation, inertial navigation, course/position referencing, and flight/position regulation Several types of gyroscopes meet the accuracy requirements demanded for such measurements, but the dynamically tunable dry gyroscope, with an accuracy to 1000 deg/h, is economically and technically the most advantageous It offers mechanical simplicity and avoids sources of drift, which normally result from floating liquids and a flexible power supply to the gyro rotor J F

A81-37656 # **New technologies for compressors of aviation engines (Neue Technologien fur Verdichter von Luftfahrttriebwerken)** W Weiler (Motoren- und Turbinen-Union Munchen GmbH, Munich, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 50 p 14 refs In German Research supported by the Bundesministerium fur Forschung und Technologie

A description is given of a German technology project which has the objective to develop a compressor with axial-radial design features in the performance range from 650 to 1800 KW The project is concerned with the development and the testing of the latest technologies. It is to provide information for a better physical understanding of the processes which take place in a compressor The effect of compressor technology on the performance data of a gas turbine engine are examined An improvement of compressor efficiency of 1% will result in a decrease in fuel consumption of 1 6% The entire program consists of three sections, which are concerned with an axial-radial compressor, supercritical profiles for axial compressors, and high-strength materials for compressors In case of a realization of the intended development objectives, compressors of the considered category will have polytropic efficiencies of approximately 85% There will be a reduction in the number of stages and the blade number of the axial component of about 20 to 25% and a corresponding lowering of production costs G R

A81-37657 # **Contribution of the DFVLR to the DAS program (Beitrag der DFVLR zum DAS-Programm)** H Winter (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugfuhrung, Braunschweig, West Germany) *Bundesministerium fur Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, 2nd, Garmisch-Partenkirchen, West Germany, Oct 8, 9, 1980, Paper* 27 p In German

The German Research and Experimental Institute for Aeronautics and Astronautics participates in work related to the development of the DME-aided Azimuth System (DAS) Significant contributions of the Institute include the conduction of tests regarding the operation of a DAS station, research related to DME (Distance Measuring Equipment) technology and its growth potential, and a study of the operational potential of DAS compared to that of competing systems, such as VOR, DME, GPS, INS etc Onboard and ground equipment developed and built by industry are subjected by the DFVLR to ground and flight tests A hybrid flight measurement system is used for determination of the precision obtained as a function of the aircraft location within the area of coverage A system for the generation of an artificial traffic load permits the simulation of effects produced by other aircraft which communicate with the ground station G R

A81-37659 **Fiber optic system test results in a tactical military aircraft** R W Uhlhorn (McDonnell Aircraft Co , St Louis, MO) and R A Greenwell (U S Naval Ocean Systems Center, San Diego, CA) In Fiber optics for communications and control, Proceedings of the Seminar, Washington, DC, April 8, 9, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 27 32 6 refs Contract No N00019 76-C-0666

A program including extensive flight testing, environmental and mechanical testing of fiber optic components, and electromagnetic interference tests has been carried out in order to investigate the feasibility of incorporating fiber optics for data transfer on a fighter aircraft The specific findings of the flight test program include the following (1) fiber optic cables properly jacketed, connected, and strain relieved will survive the attack aircraft environment, and (2) fiber optics are immune to the electromagnetic environment present in and about Navy attack aircraft Consideration is given to the fiber optics systems designs, test equipment development, cabling and connection requirements, and fabrication and installation experience V L

A81-37681 **Evaluation of flight data from a mosaic sensor** W G Opyd (Lockheed Research Laboratories, Palo Alto, CA) In Infrared image sensor technology, Proceedings of the Seminar, Washington, DC, April 8, 9, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 144-153 6 refs Grant No DAAK40-75-C-0417

Evaluation of flight data from a prototype mosaic sensor is required for characterization of sensor performance and data quality analysis The high data rate from a mosaic sensor necessitates a processing facility designed to reduce large quantities of data to a few easily interpreted indicators A computer facility for this purpose is currently in operation Several of the sensor and system characteristics found to be significant are discussed as well as computer-aided techniques for their quantification in terms of an operational system Although data evaluation is addressed in terms of a radiometric staring mosaic sensor, many considerations are applicable to nonradiometric and scanning sensors (Author)

A81-37744 **Microprocessor-based airborne spectrometer system** J C Kates, Jr (U S Army, Office of Missile Electronic Warfare, White Sands Missile Range, NM) In Minicomputers and microprocessors in optical systems, Proceedings of the Seminar, Washington, DC, April 8, 9, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 60-69

Ground-based measurements have been conducted of spectral signatures of a variety of potential targets or threats To complement the ground-based signature data, an Airborne Infrared Measurement System (AIMS) has been developed to add an air-to-ground and air-to-air capability The AIMS had to be small, light, and rugged enough to fly in an UH1 'Huey' helicopter Sensitivity, target dynamics, and spectral resolution dictated the use of rapid scan Fourier transform spectrometers as sensors Attention is given to design concepts, design rules for limited production computer based systems, computer configuration and methodology, software design, AIMS functions, system calibration, and system self-test functions G R

A81-37749 **Microcomputer system for controlling an infrared scanning camera** C W Pender, Jr and J A Roux (ARO, Inc , Arnold Engineering Development Center, Arnold Air Force Station, TN) In Minicomputers and microprocessors in optical systems, Proceedings of the Seminar, Washington, DC, April 8, 9, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 120-129

Measurements of the IR signature of advanced aircraft and rockets under simulated flight conditions are necessary to evaluate concepts developed to meet requirements for minimum IR signatures A scanning IR camera with analog data acquisition is sufficient to satisfy many of the requirements The automated camera considered in this connection has a rapid scan rate, can view a wide field-of-view with good spatial resolution, and is capable of being used with an assortment of narrow band pass filters in the range from 2 to 5 5 micrometers The automation of an IR scanning camera is presented along with constraint requirements The IR plume radiation measurements made with the automated system are also described Experimental results are presented for a rocket motor test in which the automated IR scanning system was used to obtain flow visualization and radiance measurements The experimental results further demonstrate the utility of the microcomputer based controller G R

A81-37796 **Control of particulate emissions from turbine engine test cells by cooling water injection** J D Stockham, M D Lannis (IIT Research Institute, Chicago, IL), M G MacNaughton, and J J Tarquinio (USAF, Engineering and Services Center, Tyndall AFB, FL) *Air Pollution Control Association, Journal,* vol 31, June 1981, p 675-678

Water injected into test cells for structural cooling removes a substantial portion of turbine engine exhaust particles that cause test cells to violate opacity regulations Tests on a number three test cell in a J75-P17 aircraft turbine engine revealed that the percentage of particle removal increased with flow rate Removal efficiencies ranged from 28% at a flow rate of 1900 L/min to 55% at 3700 L/min A recommended 3028 L/min (to avoid droplet fallout at too high flow rates) would remove 50% of the solids at 95% of maximum RPM and have a higher removal percentage at lower engine RPM The water that would normally drain from the test cell was analyzed chemically and microscopically to differentiate between engine exhaust particles and solids present in the injected cooling water, and it was found that the injected water also removed hydrocarbons from the exhaust gases (Author)

A81-37798 **U of Dayton uses X-rays to study impact patterns at ballistic ranges** *Materials Evaluation,* vol 39, June 1981, p 621, 622

It is noted that when airplanes take off, the engines frequently ingest foreign objects, such as birds or runway debris, sometimes resulting in damage to the engine blades At the laboratory described, 'birds', made of microballoon gelatin and representing geese, ducks, pigeons, and other flying creatures, along with glass beads, BB pellets, steel rods and ice cubes, serve as the foreign objects in impact testing The bird phantoms undergo X ray examination before and after impact The projectile is then loaded into a 'sabot', a glass reinforced polycarbonate shell similar to a bullet or artillery shell casing When fired, the bird projectile and sabot speed down a long tapering barrel and, at the end, the barrel retains the sabot, releasing the projectile While in flight, the projectile's leading edge interrupts a laser beam, which instantly causes a discharge of flash X-ray beams C R

A81-37822 **A correlated random numbers generator and its use to estimate false alarm rates of airplane sensor failure detection algorithms** Y K Chan and R W Edsinger (Boeing Computer Services Co , Tukwila, WA) *IEEE Transactions on Automatic Control,* vol AC-26, June 1981, p 676-680 10 refs Research supported by the Boeing Commercial Airplane Co

The paper presents a routine procedure for generating random number series with specified power spectral density and mixed Gaussian probability distribution functions This procedure can be used to simulate aircraft sensor outputs in the synthesis and evaluation of failure detection schemes for redundant sensor sets An example is given which compares some statistics of simulated sensor outputs to their observed counterparts B J

A81-38015 # **Experimental substantiation for hovering rotor vertical impedance calculations** K Kato (Tokyo, University, Tokyo, Japan), T Nagashima, N Iboshi (Defense Academy, Yokosuka, Japan), T Yamane, and K Yamagishi *Journal of Aircraft,* vol 18, June 1981, p 445-450 15 refs

An experiment using a model rotor was conducted to ascertain the accuracy of theoretical impedance calculations A two-bladed balsa rotor of 1 2 m diam was constructed with a force-sensing device integrated within the hub The apparatus was so designed that the rotor could perform forced vertical oscillations of varying frequencies, and the resulting hub vertical loads were measured in the nonrotating frame The conclusions obtained after correlation of the measured and theoretical results were that the quasisteady aerodynamic assumption determines only the rough trend of these impedance characteristics and that a typical section aerodynamic analysis using Loewy's lift deficiency function can predict impedance peaks and clefts occurring near the multiples of the blade passage frequencies due to the preceding and returning wakes (Author)

A81-38017 # **Spanwise lift distribution of forward-and aft-swept wings in comparison to the optimum distribution form.** G Lobert (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) *Journal of Aircraft,* vol 18, June 1981, p 496-498

It is shown that when vortex drag is minimized for a given wing weight, a nonelliptical spanwise lift distribution form is obtained that shows reduced outer wing loading and correspondingly increased wing loading at the root The distribution form produces 5% less vortex drag than the elliptical distribution, and is approximated by a forward-swept trapezoidal plane wing with a taper ratio of 0 2 and -30 deg leading-edge sweep While the lift distribution of the corresponding aft-swept wing differs considerably from the optimum and will result in higher spanwise lift distribution deterioration at off-design conditions, an untwisted forward-swept wing fitted with an aeroisoclinic behavior will exhibit an almost ideal lift distribution at all subsonic points of the flight envelope O C

A81-38020 # **Effects of drive slots on parachute performance** D S Jorgensen and D J Cockrell (Leicester, University, Leicester, England) *Journal of Aircraft,* vol 18, June 1981, p 501-503 Research supported by the Ministry of Defence (Procurement Executive)

It is shown that the introduction of drive slots does not drastically alter the basic shapes of the aerodynamic coefficient curves of a GQ Aeroconical parachute The drive slots instead induce the parachute to seek a preferred nonzero equilibrium angle of attack, a process in which the existence of the slots alone is critical, their shape and disposition being of secondary importance O C

A81-38021 # **Orthogonal multiblade coordinates** J E Prussing (Illinois, University, Urbana, IL) *Journal of Aircraft,* vol 18, June 1981, p 504-506 8 refs Grant No DAAG29 78-G-0039

A modified set of multiblade coordinates is introduced, for which the transformation between individual blade coordinates and multiblade coordinates is orthogonal This property results in simplifications in the transformations of the equations of motion and their solutions Multiblade coordinates describe the overall rotor motion in a nonrotating coordinate frame fixed in the helicopter body O C

A81-38023 # **A geometrical study of the steady-state spin for a typical low-wing general aviation aircraft** A P Imbrie *Journal of Aircraft*, vol 18, June 1981, p 510-512 5 refs Research supported by the Schultz Foundation

Using test data for a low-wing, general aviation aircraft, results pertaining to aircraft orientation, flow patterns, and the aerodynamic driving mechanisms in a steady-state spin are presented It is assumed that flow is two-dimensional, and that the only significant contributions to the forces and moments come from the wings and horizontal and vertical tails The results presented could form the basis for an analytical study of the forces and moments acting on spinning aircraft O C

A81-38058 * # **Component research for future propulsion systems.** C L Walker, G J Weden (U S Army, Propulsion Laboratory, Cleveland, OH), and J Zuk (NASA, Ames Research Center, Moffett Field, CA) *NATO, AGARD, Specialists' Meeting, 57th, Toulouse, France, May 11-14, 1981, Paper* 14 p 13 refs

A review of factors related to the acquisition and life cycle cost, and mission reliability of helicopters is given The potential for advanced vehicle configurations with improvements in energy efficiency, operating economics, and characteristics to satisfy the demands of the future market are identified Special attention is given to advanced propulsion systems and related component technologies, and system requirements, powerplants and component thrusts, compressor designs, combustion systems, turbine efficiency, blade tip treatment concepts and shaft dynamics are discussed in detail E B

A81-38062 * # **Comparison of predicted engine core noise with proposed FAA helicopter noise certification requirements** U von Glahn and D Groesbeck (NASA, Lewis Research Center, Cleveland, OH) *Acoustical Society of America, Meeting, 101st, Ottawa, Canada, May 18-22, 1981, Paper* 17 p 8 refs

Calculated engine core noise levels, based on NASA-Lewis prediction procedures, for five representative helicopter engines are compared with measured total helicopter noise levels and proposed FAA helicopter noise certification requirements Comparisons are made for level flyover and approach procedures The measured noise levels are generally significantly greater than those predicted for the core noise levels, except for the Sikorsky S-61 and S-64 helicopters However, the predicted engine core noise levels are generally at or within 3 dB of the proposed FAA noise rules Consequently, helicopter engine core noise can be a significant contributor to the overall helicopter noise signature and, at this time, will provide a limiting floor to a further decrease in future noise regulations (Author)

A81-38064 * # **A nonlinear propulsion system simulation technique for piloted simulators** J R Mihaloew (NASA, Lewis Research Center, Cleveland, OH) *IEEE, ISA, SCS, SMCS, Annual Pittsburgh Conference on Modelling and Simulation, 12th, Pittsburgh, PA, Apr 30-May 1, 1981, Paper* 12 p 6 refs

A real time digital simulation technique providing the capabilities needed to evaluate propulsion system performance and aircraft system interaction on NASA manned flight simulators, is discussed A parameter correlation technique is used with real and pseudo dynamics in a stable integration convergence loop The cycle time reported was 2 0 ms on one computer and 5 7 ms on the simulator computer The model was found to be stable and accurate with time up to 50 ms It is concluded that the program has generated a valuable simulation technology and flight simulator experience by providing an adequate level of detail to evaluate propulsion systems in a simulated flight environment E B

A81-38077 * # **A PANSONIC Navier-Stokes solver** G K Cooper and J F Thompson (Mississippi State University, Mississippi State, MS) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 14th, Palo Alto, CA, June 23-25, 1981, Paper 81-1195* 8 p 9 refs Grant No NGR 25-001-005

A finite-difference formulation of the full Navier-Stokes equations which demonstrates a capability to economically solve two-dimensional problems has been developed The basic algorithm was derived from the full, Reynolds-averaged, conservative, Navier Stokes equations expressed in curvilinear coordinates Eddy viscosity was determined by the Baldwin and Lomax algebraic turbulence model This non-iterative, second order accurate, implicit, numerical algorithm is based on the approximate factorization finite-difference scheme of Beam and Warming Results indicate a facility for solving subsonic, transonic, and supersonic (hence PANSONIC) flows about arbitrary airfoils for a wide range of Reynolds numbers, Mach numbers, and angles of attack Current computations demonstrate that vectorized implementations of this algorithm can solve steady-state, two-dimensional problems in five to ten minutes of computer time (Author)

A81-38084 * # **Aerodynamic features of designed strake-wing configurations** J E Lamar and N T Frink (NASA, Langley Research Center, Subsonic-Transonic Aerodynamics Div , Hampton, VA) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 14th, Palo Alto, CA, June 23-25, 1981, Paper 81-1214* 11 p 10 refs

Sixteen analytically and empirically designed strakes have been aerodynamically tested on a common wing body to determine the longitudinal characteristics of the configurations These strakes were selected, in general, due to their superior performance in a water-tunnel test There they exhibited a good correlation between the hypothesized high value of angle of attack for strake vortex breakdown and the high value of leading-edge suction at the strake tip The lift and pitch data were reasonably well predicted by an extended suction analogy method, and the lift agreement improved with increasing strake area The strake-vortex-breakdown angle and configuration maximum lift generally increase with increasing strake area and, to some extent, strake tip leading-edge suction value The best strake configurations all developed about the same maximum area efficiency value despite their differences in size (Author)

A81-38096 # **Analysis of stalled airfoils by simultaneous perturbations to viscous and inviscid equations** B R Gilmer and D R Bristow (McDonnell Aircraft Co , St Louis, MO) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 14th, Palo Alto, CA, June 23-25, 1981, Paper 81-1239* 10 p 10 refs Research supported by the McDonnell Aircraft Independent Research and Development Program

An iterative viscous-inviscid interaction method is presented for predicting the pressures, forces, and moment of an arbitrary airfoil with massive turbulent separation in incompressible, steady flow In each iteration cycle, the viscous-inviscid interaction is explicitly modeled by a mathematical expansion to a boundary layer method and a panel method Linear terms are retained to account for the complete first order coupling between the viscous and inviscid equations The system of linear, algebraic equations is solved for the perturbation to the displaced streamline geometry Example calculations are presented that demonstrate consistently rapid convergence and good agreement with wind tunnel data (Author)

A81-38119 # **Aerodynamic characteristics of two VSTOL fighter configurations** J R Lummus (General Dynamics Corp , Fort Worth, TX) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 14th, Palo Alto, CA, June 23-25, 1981, Paper 81-1292* 8 p 7 refs

The results of a series of wind tunnel tests of two Vectored-Engine-Over wing (VEO), Navy VSTOL fighter/attack configurations (E205 and R104) are analyzed to (1) assess prediction method capabilities, (2) evaluate the effect of such geometry variations as canard longitudinal locations and strake shapes, and (3) determine the effects of configuration changes associated with varying the propulsive lift system from a jet-diffuser ejector mode to that of a Remote Augmentation Lift System (RALS) Among the performance characteristics assessed are minimum drag, aerodynamic center travel with Mach number, zero-lift pitching moment, canard and wing flap effectiveness, and trimmed, buffet onset and lateral directional characteristics O C

A81-38174 **Is it safe - The safety assessment of aircraft systems V - Some particular techniques** W Tye and T Lloyd *Aircraft Engineering*, vol 53, May 1981, p 2-4

Various topics relating to aircraft safety are discussed The first deals with the damage caused by flying disc fragments It is pointed out that the probability of damage is the risk of engine failures leading to noncontainment of fragments multiplied by the risk that a

fragment will hit a vulnerable item Since the second risk is considered to be calculable, two models of engine failure are analyzed Next, the advantages of active control technology in aircraft safety are discussed, and it is shown how this technology could be applied to wing load alleviation Attention is also given to the growing use of digital techniques in civil aircraft systems which are critical to safety It is noted that since with digital systems many functions are dealt with in the same hardware, a single failure can have widespread and varying effects Methods for ensuring the quality of software are proposed Finally, the relationship between the operator and constructor is discussed in the context of the growing complexity of safety systems It is noted that minor changes can have obscure but significant effects on safety As a solution, it is recommended that the constructor prepare adequate guidance material to indicate what is and what is not critical to safety C R

A81-38195 **Soviets display heavy-lift helicopter** R R Ropelewski *Aviation Week and Space Technology,* vol 114, June 29, 1981, p 39-41, 43

The first preproduction version of the Soviet heavy-lift, all-weather Mil Mi-26 helicopter was displayed at the Paris air show this year With a normal operating weight of 49,500 kg and a maximum takeoff weight of 56,000 kg, the new helicopter was developed for oil exploration and drilling operations, and has a range of 800 km carrying a 20 metric ton payload Maximum speed is 295 km/hr and its normal cruise speed is 255 km/hr It has a normal operating ceiling of 4,500 meters and a hover out of-ground-effect ceiling of 1,800 meters at maximum gross weight The helicopter is expected to operate for periods of up to three to five days away from main support bases, and reliability and maintainability have therefore been emphasized A titanium hub has been used for lower weight and the vehicle sports an all-glass fiber tail rotor An eight blade main rotor has reduced vibration levels to about one tenth those of earlier Mi-26 The center console in the cockpit's four-man crew station has controls for stability augmentation systems, external hoist, radio, automatic pilot, and Doppler navigation moving map display J F

A81-38196 **CFM56 rejuvenates the DC-8** D Velupillai *Flight International,* vol 119, June 6, 1981, p 1763-1765

The CFM56 retrofitted DC 8 Series 70 will burn up to 25% less fuel than the Pratt and Whitney JT3D-powered versions, have a faster acceleration during take-off due to greater thrust (22,000 lb thrust engine), and a 10% reduction in required take-off field length The engine has an improved bypass-ratio (6 1), and meets FAA noise requirements The DC-8 will need few modifications to accommodate the CFM56-2 engine it is essentially unchanged, although each CFM56 pod adds about 1000 lb to aircraft weight Pylon-wing attachments also differ from those used for the P&W engine, but the CFM56 pylon fits any of the four wing positions on all Series 70 aircraft The CFM56 also features a power management control, which prolongs engine life and reduces pilot workload The first CFM56-DC-8-71 test flight will include stability evaluation, engine acceleration/deceleration, cruise performance, photographic session, and high and low speed descents Eighty-seven aircraft are scheduled to be retrofitted at present, and consideration is also being given to the KC-135 tanker and the Boeing 737-300 J F

A81-38209 **Advanced technology and the commuter aircraft - A look into the next two decades** J E Chacksfield (Short Brothers, Ltd , Belfast, Northern Ireland) *Aerospace* (UK), vol 8, June-July 1981, p 12 18 5 refs

Advanced technology is applied to commuter aircraft in order to maximize fuel economy, minimize drag, save weight, and maximize efficiency Limitations set by the environment (noise), competition from surface transportation, airport saturation, and the availability of investment sources are posed as constraining factors New engine designs, as well as digital instrumentation and systems will reduce fuel consumption, a good surface finish, as in the blending of wing/body junctions, will improve the lift-drag ratio performance The use of composite structures can lead to a 15%-20% reduction in weight, and propulsion technology, along with improvements in aerodynamics and design can maximize aircraft efficiency Future aircraft will feature smaller wing sizes, an increase in thickness/chord ratio, relaxed stability, and canard arrangements Consideration of ground handling time limits and methods must be made if commuter aircraft are to grow in size to satisfy increasing capacity demands J F

A81-38332 # **Not all student design projects end on paper - Chronology of the Chrysalis** J Langford (Lockheed Corp , Burbank, CA) *AIAA Student Journal,* vol 19, Spring 1981, p 4 13 9 refs

Consideration is given to the Chrysalis human-powered aircraft, noting its structural configuration models and radio-controlled models The test procedure is outlined, including the structural test section, test joints, fittings, airfoil tests, interplane strut tests and analog simulation of aircraft dynamics The test flights of the Chrysalis are described and future trends for human-powered aircraft are suggested S C S

A81-38333 # **Design and engineering of solar balloons** D Brown *AIAA Student Journal,* vol 19, Spring 1981, p 14 21

The history of solar ballooning is reviewed, and the first manned solar balloon flight, in 1973, is described Further developments of the design are discussed, including a double-envelope system in which the outer envelope is a double layer of Mylar It is noted that unlike hot-air balloons, solar balloons are silent Design improvements made by Fredrick Eshoo (1978) are outlined, including the single-envelope design S C S

A81-38372 **High intensity acoustic testing to determine structural fatigue life and to improve reliability in nuclear reactor and aerospace structures** L Yeh (GEC Power Engineering, Ltd , Mechanical Engineering Laboratory, Whetstone, Leics , England) *Materials Science and Engineering,* vol 48, May 1981, p 167 179 7 refs

Applications of high intensity acoustic testing in engineering practice are discussed with reference to nuclear reactor structure testing, satellite structure testing, and aircraft structure testing It is shown that the fatigue life of a complex structure in a gas-cooled reactor may be determined using a strain gauge response spectrum induced by a simulated reactor noise and the S-N curve of the material with appropriate stress concentration factors Simulated high intensity noise makes it possible to detect and eliminate electronic equipment malfunction in a satellite and to test unconventional aircraft, thus reducing the aircraft flying test time V L

A81-38499 **Design for safety** D B Thurston New York, McGraw-Hill Book Co , 1980 204 p 56 refs $14 95

After presenting accident statistics and an analysis of these data to determine what types of accidents can be eliminated, an extensive discussion is undertaken on such issues as the relation of pilot-error accidents to aircraft design, and the modification of existing aircraft to enhance safety without significant cost penalties Among the topics covered are (1) stall/spin mechanics, (2) a description and illustration of a water loop, (3) safety criteria in configuration design, (4) crash-resistant structural design procedures and related impact curves, (5) flight procedures subject to revision, and (6) airport design and location recommendations Attention is also given to the opportunities for greater safety resulting from state-of-the-art avionics, such as the HUD, and powerplant, propeller and fuel system improvements O C

A81-38527 # **MATASS/LAMPS MK III** F D Buckley In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers
New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 1-6 (AIAA 81 1309)

A scheme first proposed by Buckley (1977) in which an airship of 1930 technology is used to deploy a towed array sonar system, monitor and report signals received while moored to the array cable, retrieve the array, and return to base is modified Here, two mission segments are added One relocates the array to a higher detection probability area on the basis of external information The other requires the airship to operate, as would a destroyer with LAMPS helicopters aboard, two ASW aircraft for 30 hours each to prosecute contacts generated by the array Structural weight of the airship is decreased from that presented earlier to reflect upgraded technology The airship volume required to carry out the mission is determined C R

A81-38528 # **Coast Guard airship development** L J Nivert and K E Williams (U S Coast Guard, Office of Research and Development, Washington, DC) In Lighter-Than Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute

of Aeronautics and Astronautics, Inc , 1981, p 7-12 7 refs (AIAA 81-1311)

The aims and methods of the U S Coast Guard research and development program for the development and evaluation of a maritime patrol airship, and the demonstration of a man-rated subscale vehicle in 1983/84, are described Among the missions which the new airship is expected to perform are (1) search and rescue, (2) military operations such as boarding and countermine device towing, (3) enforcement of laws and treaties, (4) surveillance of marine environment response to pollutants, (5) port and environmental safety tasks such as the escorting of hazardous cargo vessels, (6) icebreaking services, (7) marine science activities, such as oceanographic monitoring, and (8) the maintenance of short-range navigation aids The specifications to be met by the subscale demonstrator craft are detailed O C

A81-38529 # **Twin-rotor patrol airship flying model** J A Eney (U S Naval Material Command, Naval Air Development Center, Warminster, PA) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 13-16 (AIAA 81-1312)

A 32-foot long, 1/10-scale flying model is described which will be used in the study of tilt-rotor propulsion/hover systems for future, highly controlable VTOL cargo airships operating near neutral buoyancy The twin-rotor design that will be tested initially employs two rotors scaled to represent those of the XV-15 tilt-rotor research aircraft, located near the hull midpoint so that the load distribution can be similar to that of conventional nonrigid airships Assuming a buoyancy ratio at takeoff of 0 85, a propulsive lift system must provide thrust slightly greater that 15% of gross weight Follow-on testing is planned for three- and four-rotor configurations, using the same baseline hull and empennage O C

A81-38532 # **LTA developments in Great Britain** A W L Nayler (Royal Aeronautical Society, London, England) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 37-47 11 refs (AIAA 18-1321)

A review is presented of LTA research and development work, mostly on nonrigid designs, recently undertaken in Great Britain Among the concepts covered are nonrigid cargo and passenger craft, sport-flying thermal buoyancy designs, and rigid cargo carriers Detailed specifications are given for the Airfloat MF 70-passenger craft, the entire projected Skyship series of nonrigid cargo vehicles, the R150 Metalclad rigid airship, and the Thundercolt AS-80 hot-air airship It is concluded that while such airship missions as maritime patrol will be successfully demonstrated in the next few years, passenger-carrying designs will most likely be left for the next generation of this technology's development O C

A81-38533 # **Airship survivability in atmospheric turbulence** J D DeLaurier and K C K Hui (Toronto, University, Toronto, Canada) In Lighter Than Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 48-61 15 refs Research supported by the Transport Canada and Natural Sciences and Engineering Research Council of Canada (AIAA 81 1323)

A linear-dynamic analysis has been developed which statistically predicts the survivability and lifetime of an airship responding to atmospheric turbulence This analysis was applied to the U S Navy airship, ZRS-4, which is representative of the most modern of historic rigid-airship designs The results of this research showed that operational lifetimes could be very low for airships flown at maximum speeds with barely sufficient control to give dynamic stability, but that lifetimes greatly increased with decreasing speeds or increasing stability These results indicate shortcomings in historic-airship design and operation, and show a clear requirement for strong stability in modern designs (Author)

A81-38534 # **The Shenandoah flies again - A computer simulation** J R Evans and J D DeLaurier (Toronto, University, Toronto, Canada) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 62 73 13 refs Research supported by Transport Canada and Natural Sciences and Engineering Research Council of Canada (AIAA 81-1325)

The purpose of this work has been to quantitatively assess the motion and structural-load responses of airships to control inputs and atmospheric turbulence This has been accomplished with a nonlinear flight-dynamic simulation which utilizes cross-flow aerodynamic theory to model large-angle-of-attack behavior of the hull and fins This simulation was applied to the U S Navy Airship ZR 1, 'Shenandoah', as a numerical example, and the specific cases studied were (1) a hard right turn at maximum speed in smooth air, (2) translational flight at maximum speed through a 1-cosine lateral gust (Author)

A81-38535 # **Predictive steering control of dirigibles using the switching curve approach** S G Cavalcanti (Toronto, University, Toronto, Canada) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8 10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 74 77 6 refs Research supported by the Conselho Nacional de Pesquisas and Ministerio da Aeronautica of Brazil (AIAA 81 1327)

The predictive steering control technique has been presented by several authors as a useful means of steering vehicles with slow responses such as dirigibles This report contributes to this technique by introducing the optimal switching curve approach This new approach utilizes the classical theory of optimal control to predict the point where the steering control system has to switch the control from one extreme position to the other in order to synchronize the vehicle heading with the required heading in minimum time These points will be on a switching curve that is calculated when the new heading is required The report describes the theory used and shows the results of simulations for three airships (Author)

A81-38536 # **Bulkheads in airships** D E Woodward (Association of Balloon and Airship Constructors, Alexandria, VA) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 78-82 10 refs (AIAA 81-1328)

Loading of the transverse frames of compartmented airships by pressure on the bulkheads is affected by pretensioning to give metacentric stability against gas surging Known results for radial wire bulkheads are incomplete because they depend on the unknown pretensions The necessary pretensions to limit the reduction in metacentric height to a specified value are derived for bulkheads with or without axial restraint, in terms of the geometry of the compartments, the unit lift of gas, and the elastic properties of the bulkhead A numerical comparison is made of the various types of bulkhead construction (Author)

A81-38537 # **Design and development of a thermal airship** S Cutter (World Balloon Corp , Albuquerque, NM) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 83-85 (AIAA 81-1330)

This paper is a descriptive evolution of a cost-effective, practical, non-rigid airship utilizing hot air as buoyancy The design criterion was for a dirigible aircraft capable of carrying 4 occupants in light to moderate wind conditions for promotional exhibition and advertising missions Many problems encountered in the construction, flight testing, and operation phases were solved by trial and error methods because no airship engineering data was available that addressed the thermal expansion and contraction phenomena of this design The designer merged proven components from the balloon and aircraft industries resulting in a dependable and safe flying system (Author)

A81-38538 # **Quasi-hybrid airships** D M Layton (U S Naval Postgraduate School, Monterey, CA) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p

86-89 5 refs (AIAA 81 1333)

The dynamic lift required for operating even a conventionally shaped nonrigid airship with a weight in excess of the static buoyancy may be obtained by operating in a quasi hybrid mode wherein the deflected longitudinal control surfaces are used to obtain dynamic lift at near zero angles of attack of the airship envelope This results in a significant reduction in the drag of the airship and, as a result, a decrease in the power required to fly at a given airspeed (Author)

A81-38539 # **Dynamics and control of a Heavy Lift Airship in cross wind hover** B L Nagabhushan and N P Tomlinson (Goodyear Aerospace Corp , Defense Systems Div , Akron, OH) In Lighter-Than Air Systems Technology Conference, Annapolis, MD, July 8 10, 1981, Collection of Technical Papers
New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 90-95 7 refs (AIAA 81-1334)

Dynamics and control characteristics of a quadrotor Heavy Lift Airship with a sling load are determined while the vehicle is hovering in a turbulent cross wind Results are presented which show the significance of the dynamic coupling between the vehicle and payload in their response to wind disturbances and control inputs Typical characteristics of a closed loop control system and its ability to limit the excursions of the vehicle and payload during loading or unloading are also examined (Author)

A81-38540 * # **Simulation of Heavy Lift Airship dynamics over large ranges of incidence and speed** M B Tischler, H R Jex, and R F Ringland (Systems Technology, Inc , Hawthorne, CA) In Lighter Than Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers
New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 96-115 40 refs Contract No NAS2 10330 (AIAA 81-1335)

A nonlinear, multibody, six-degrees-of freedom digital simulation has been developed to study generic Heavy Lift Airship (HLA) dynamics and control The basic aerodynamic functions developed to model the hull, tail, and rotor loads continuously over all incidence ranges are reviewed and applied to a Quadrotor HLA with a low fineness ratio hull and a small vee-tail Trim calculations for a test vehicle suggest control power deficiencies in crosswind stationkeeping for the unloaded vehicle Gust responses show the importance of correctly calculating loads due to accelerated relative motion of air and hull Numerically linearized dynamics for the test vehicle show the existence of a divergent yaw mode, and an oscillatory pitch mode whose stability characteristics are sensitive to flight speed A considerable improvement in the vehicle's stability and response results from a simple multi-axis closed loop control system operating on the rotors and propeller blades (Author)

A81-38541 # **Low cost start-up for rigid-pressure airship** M Bredt (BUZ Airship Co , New Orleans, LA) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8 10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 116-121 (AIAA 81 1337)

This design proposal involves an airship that combines the compartmented rigid zeppelin principle with the pressure ship This is accomplished by longitudinal, peripheral girders that separate an inner envelope under pressure and an outer, concentric envelope that can be perforated for boundary layer control The air space between the envelopes can be sucked rearwardly and exhausted out by a propeller mounted internally on the stern axis This supresses super heat The same air can also be recirculated to pick up engine heat and thereby heat up the helium, which in turn increases take-off lift The molded nose area has directional thrusters including a reverse mode (Author)

A81-38542 # **Aerodynamic estimation techniques for aerostats and airships** S P Jones and J D DeLaurier (Toronto, University, Downsview, Ontario, Canada) In Lighter-Than-Air Systems Technology Conference, Annapolis, MD, July 8-10, 1981, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1981, p 122-130 20 refs (AIAA 81-1339)

A semi-empirical steady-state model of a finned axisymmetric body is developed and used to compute hull-fin mutual interference factors and cross flow drag coefficients from wind tunnel data on five aerostats and airships The results are in general agreement with expectations from theory and provide a basis for predicting aerodynamic coefficients The model is extended to unsteady motion by considering the local flow on finite hull segments and the fins This dynamic model is applicable to nonlinear simulations and the computation of rotational stability derivatives for which equations are derived For one aerostat, rotational stability derivatives calculated from static wind tunnel data are compared with experimental results from a whirling-arm tow tank (Author)

A81-38571 **An investigation of the liquid impact properties of a GFRP radome material** M J Matthewson and D A Gorham (Cambridge University, Cambridge, England) *Journal of Materials Science,* vol 16, June 1981, p 1616-1626 11 refs Research supported by the Ministry of Defence (Procurement Executive), Science Research Council, and Cambridge University

The high-velocity liquid impact properties of a glass fiber reinforced plastic material developed for the radome of the Concorde supersonic aircraft have been studied as a function of jet velocity, size, and angle of impact The threshold velocities for damage have been found as a function of the jet (rain drop) diameter, indicating that the few impacts with the largest rain drops will control the initial stages of erosion A strong oblique impact anomaly is exhibited by the material investigated impacts at moderately oblique angles (10 to 30 deg) produce more damage than at normal incidence This effect becomes more pronounced with subsequent impacts V L

A81-38801 # **The new utility - Commuter-technology in the sky** R Birrenbach *Dornier Post* (English Edition), no 3, 1981, p 6-11

A detailed introduction is presented to the design features and operational characteristics of the Do228 twin-engine commuter aircraft's 15 seat 228 100 and 19 seat 228 200 versions The design incorporates 715 shp turboprop engines, supercritical airfoil section wings and mixed passenger/cargo operational capability Among the advantages of the design are (1) low operating costs due to low fuel consumption, (2) ease of operation and maintenance, (3) high degree of independence from ground equipment, (4) the ability to operate from short, unprepared airfields, and (5) structural design adequate for 30,000 flights of 0 8-hour duration without major repair Detailed dimensions and performance figures are presented O C

A81-38802 # **Advanced production methods for the Dornier 228** H -E Mundt and R F Christ *Dornier Post* (English Edition), no 3, 1981, p 12 15

An overview is given of the advanced fabrication techniques used in the production of Do228-series commuter aircraft Among the methods employed on fuselage, wing and empennage structures are (1) numerically controlled machining (2) sheet metal chemical milling, (3) anodic secondary surface protection for corrosion resistance, (4) carbon fiber reinforced plastic composites, and (5) electron beam welding Emphasis is put on the high degree of structural commonality between the Do228 100 and -200 versions, and between both of them and the precursor, Do128 aircraft O C

A81-38804 # **Experimental-programme - Transonic wing-TST** D Thomas (Dornier GmbH, Friedrichshafen, West Germany) *Dornier Post* (English Edition), no 3, 1981, p 32-37

The Transonic Tragflugel (TST) supercritical profile transonic wing test aircraft, a retrofitted Alpha Jet, is discussed from the viewpoint of an advanced technology's effective yet inexpensive development The Alpha Jet was chosen because it represents the class of aircraft expected to benefit most from supercritical wing technology, small size, and relative wing structure simplicity The modified wing has the following features (1) maneuvering flaps at leading and trailing edges, (2) wing/fuselage blending at the root in keeping with area ruling, and (3) slightly modified leading edge sawtooth position Test flight results show a transonic severe drag rise Mach number increase 5-6% closer to the speed of sound over the conventional aircraft, and similar or better level and turn performance despite the 20% increase of wing thickness O C

A81-38805 # **New structural technologies for future fighters** E Johst and K -F Sahm *Dornier Post* (English Edition), no 3, 1981, p 38-43

The demonstration of recent developments in carbon fiber-reinforced plastic composite technologies by Alpha Jet ground support aircraft is discussed, with a view to the incorporation of novel primary structure designs, construction methods and test procedures in future fighter designs Among the composite structural components demonstrated on the Alpha Jet are (1) air brakes, (2) rudder, (3) horizontal tail, and (4) wing In addition, possible applications are covered for new aluminum alloy casting technologies, high-strength aluminum powder metallurgy, and the superplastic forming/diffusion bonding of titanium alloy sheet metal and sandwich structures O C

A81-38806 # **The Bundeswehr Drone Program - Where are we today** W Klaar *Dornier Post* (English Edition), no 3, 1981, p 48-51

A status report is presented on the German Armed Forces RPV and drone aircraft programs Among the systems covered are (1) the CL 89 and CL 289, for target location and reconnaissance, (2) the Argus real-time artillery surveillance and fire-control system, for deployment in the second half of the 1980s, (3) minidrone and minihelicopter systems for target location, and (4) air attack systems such as the anti-radar minidrone and standoff missile (SOM) It is expected that the complexity and operator demands of these systems will remain constant even as their electronics and operational capabilities are developed to greater versatility and effectiveness O C

A81-38857 **F/A-18A Initial Sea Trials** D Richards (U S Naval Air Test Center, Patuxent River, MD) and C D Pilcher (McDonnell Aircraft Co , St Louis, MO) *Society of Experimental Test Pilots, Technical Review*, vol 16, no 1, 1981, p 10-22

Initial Sea Trials (IST) of the F/A-18A were carried out on the USS America over a five day period The Navy test team focused on documenting catapult, bolter and waveoff performance, and characterizing flying qualities during catapult launch and carrier approach Compatibility of the aircraft's hardware to shipboard hardware was measured, along with the electromagnetic susceptibility to the avionics system Three test configurations were carried out catapult configuration at half flap, landing configuration at full flap, and single engine characteristics at half flap The catapult launch envelope shows that the aircraft is limited to 5 4 g's longitudinal acceleration for light gross weights, and by launch bar loads for medium gross weights up to 51,900 lb Arrested landings concentrated on flying qualities (glideslope, line up control) and performance (WOD required for maintaining aircraft kinetic energy) A 'toed-in' rudder configuration improved nose wheel liftoff, and the aircraft's insensitivity to turbulence and quick engine acceleration gave it good landing performance Although IST on the F/A 18A proved successful overall, structural deficiencies were found in the shock strut and the nose landing gear holdback spring cartridge J F

A81-38897 # **Effect of acceleration switching during INS in-flight alignment** B Porat and I Y Bar Itzhack (Technion Israel Institute of Technology, Haifa, Israel) *Journal of Guidance and Control*, vol 4, July-Aug 1981, p 385 389

Covariance simulation results are presented that show that the application of alternating axial acceleration to inertial navigation systems (INS) during planar in-flight alignment (IFA) results in an alignment time that is longer than that produced by a constant axial acceleration Similarly, an S-shaped maneuver, which by its nature requires acceleration sign changes, yields a longer alignment time than that produced by a circular flight path These results are also obtained analytically when simple IFA models, developed in an earlier work, are used Using the simple models it is shown that acceleration sign changes produce a correlation coefficient between the measured INS velocity error and the azimuth misalignment angle that crosses zero This finding yields the explanation to the phenomenon of increased alignment time when the acceleration changes sign during the IFA (Author)

A81-38899 # **Pole placement with output feedback** E Y Shapiro, D A Fredricks, R H Rooney (Lockheed-California Co , Burbank, CA), and B R Barmish (Rochester, University, Rochester, NY) *Journal of Guidance and Control*, vol 4, July-Aug 1981, p 441, 442

It is noted that, from a practical standpoint, the problem of determining constant output feedback gains for the control of systems with inaccessible states is an important one A method of the pole placement type depending only on the minimization of a function of a distance between the desired poles and the poles of the closed-loop system is discussed A set of conceptual and computational pole placement procedures that resolve the problem of providing output feedback applicable to arbitrary open-loop systems is outlined It is noted that, in addition, the designer can impose structural constraints on the controller than eliminate some preselected gains corresponding to accessible output C R

A81-39006 # **Numerical simulation for the design of a supersonic cruise nozzle with a fluid noise shield** E J Kowalski, K M Peery, and G W Klees (Boeing Co , Seattle, WA) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 14th, Palo Alto, CA, June 23-25, 1981, Paper 81 1218* 9 p 9 refs

A two-dimensional/axisymmetric flow analysis procedure is used to simulate the plug nozzle flow field with an acoustic shield Using this flow analysis, the unexpectedly low shield nozzle discharge coefficients are explained and the optimum offset between the shield nozzle and primary nozzle exit planes for maximum shield nozzle discharge coefficient is then determined The purpose is to illustrate the utility of a flow analysis procedure for interpreting experimental flow data and for acquiring design information for a nozzle system of current interest C R

A81-39012 # **An optimal-surface-transpiration subsonic panel-method for iterative design of complex aircraft configurations** J B Malone (Lockheed-Georgia Co , Marietta, GA) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 14th, Palo Alto, CA, June 23-25, 1981, Paper 81-1254* 12 p 19 refs

An iterative-design method for the generation of wing geome tries with specified surface-pressure distributions is described The design method is an adaptation of the well-known surface transpiration technique for approximating boundary layer effects A velocity distribution normal to the aircraft surface is sought which minimizes the difference between computed and desired pressures The transpiration distribution for a given initial wing geometry is determined by numerical optimization and is then used to reloft the configuration The use of this iterative procedure with a subsonic surface-singularity panel-method is illustrated for several example design problems (Author)

A81-39039 # **Suppression of jet noise peak by velocity profile reshaping** S Fujii, H Nishiwaki, and K Takeda (National Aerospace Laboratory, Tokyo, Japan) *AIAA Journal*, vol 19, July 1981, p 872-877 26 refs Research supported by the Environment Protection Agency of Japan

Proposed here is an efficient noise-abating system having the potential for application to a broad spectrum of turbofan engines An exhaust system with the core nozzle reshaped into an elliptic exit section from the conventional circular nozzle is recommended The comparison of the scale-model tests revealed that a 5 dB decrease in peak noise levels was realized with a slight increase of the sound pressure at large emission angles A laser Doppler velocimeter was used to quantify the high-temperature flow turbulence With the elliptic core nozzle, the jet flow was more diffused axially and spread radially along the major axis The noise reduction was attributed to the enhancement of the sound refraction and to the lower sound generation, due to the turbulence suppression as well as the lowered mean density gradients at the noise source (Author)

A81-39046 **Investigation of shot peening as a forming process for aircraft wing skins** K M Kulkarni (SCM Corp , Glidden Metals Group, Cleveland, OH), J A Schey (Waterloo, University, Waterloo, Ontario, Canada), and D V Badger (Boeing Co , Seattle, WA) *Journal of Applied Metalworking*, vol 1, Jan 1981, p 34-44 13 refs Research sponsored by the Boeing Co

Generating curvatures in thin sheets by shot peening is used to form airplane wing skins to controlled contours An experiment was

conducted on 6 by 24 inch 2024-T3 and 7075-T6 aluminum alloy sheets of up to 0 5 inch thickness to measure the effects of workpiece geometry and process variables on resulting curvatures Shot of 0 023 to 0 066 in diam were used on a wheel abrator machine at speeds up to 250 ft/s, with shot size, shot speed, shot density, and specimen length-to-width ratio as the major variables Resulting curvatures in the two principal directions, coverage, dimple diameter and depth, as well as residual stresses were measured, showing curvature increases with increasing shot diameter, velocity and density, and with decreasing thickness and yield strength of the material The depth of dimples increased with increasing shot energy and decreasing flow stress of the workpiece material, coverage increased with increasing shot density, as did roughness with shot size and velocity Residual stresses were always compressive on the peened surface, but their magnitude and distribution could not be correlated with curvature Specimens with a length-to-width ratio near unity had equal stiffness in the two directions, leading to a basic instability of curvature J F

A81-39074 * # **Measurement of recovery temperature on an airfoil in the Langley 0 3-m transonic cryogenic tunnel** C B Johnson and J B Adcock (NASA, Langley Research Center, Subsonic-Transonic Aerodynamics Div , Hampton, VA) *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 16th, Palo Alto, CA, June 23-25, 1981, Paper 81-1062* 11 p 14 refs

Experimental measurements of recovery temperature were made on an airfoil in the Langley 0 3-m Transonic Cryogenic Tunnel at Mach numbers of 0 60 and 0 84 over a Reynolds number per meter range from about 15,000,000 to about 335,000,000 The measured recovery temperatures were considerably below those associated with ideal-gas ambient temperature wind tunnels This difference was accentuated as the stagnation pressure increased and the total temperature decreased A boundary layer code modified for use with cryogenic nitrogen adequately predicted the measured adiabatic wall temperature at all conditions A quantitative, on-line assessment of the nonadiabatic condition of a model can be made during the operation of a cryogenic wind tunnel by using a correlation for the adiabatic wall temperature which is only a function of total temperature, total pressure, and local Mach number on the model (Author)

A81-39104 # **Kevlar - Thermophysical properties** J M Elias and C E Waugh (Martin Marietta Aerospace, Orlando, FL) *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 16th, Palo Alto, CA, June 23-25, 1981, Paper 81-1104* 6 p

The thermophysical properties of Kevlar, a high modular organic fiber used to reinforce matrix resins, are analyzed Thermophysical property pretest results and conversion factors are given and the data indicate that the Kevlar composite starts to degrade at about 460 F with rapid degradation occurring at about 800 F High heat flux tests performed with Kevlar 49/HBRF55A resin composite specimens at the ramburner test facility provided a data base, showing an ablation temperature of 800 F, and heat of ablation of 300 Btu/lb m, in good agreement with the predictions A series of quartz lamp pre- and post-tests are described in which the expected flight heat flux environment was simulated, and the data will allow effective thermal modeling and high confidence prediction for surface and in-depth temperature It is concluded that Kevlar composites have strong, lightweight, durable characteristics useful to missile motorcases manufacture E B

A81-39107 # **Modeling of 2D-nozzle plume for IR signature prediction under static conditions** C -W Chu and J Der, Jr (Northorp Corp , Hawthorne, CA) *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 16th, Palo Alto, CA, June 23-25, 1981, Paper 81-1108* 11 p 12 refs

A simple modeling technique for the calculation of 2D-nozzle plumes for IR signature prediction under static conditions is described extending it to ADEN type nozzles A procedure accounting for large-scale mixing in 2D-nozzles and plumes due to the effects of the inherent engine swirl is presented analyzing the characteristics of the plume flow properties The model demonstrates that a significant effect of the engine swirl is the reduction of maximum total plume temperature (400 - 500 R) through exchanges of large masses of hot gas and cold external air The technique yields good agreement with experimental data for a wide range of nozzle geometry E B

A81-39131 * # **Fireworthiness of transport aircraft interior systems** J A Parker and D A Kourtides (NASA, Ames Research Center, Moffett Field, CA) *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 16th, Palo Alto, CA, June 23-25, 1981, Paper 81-1142* 13 p 30 refs

This paper presents an overview of certain aspects of the evaluation of the fireworthiness of transport aircraft interiors First, it addresses the key materials question concerning the effect of interior systems on the survival of passengers and crew in the case of an uncontrolled fire Second, it examines some technical opportunities that are available today through the modification of aircraft interior subsystem components, modifications that may reasonably by expected to provide improvements in aircraft fire safety Cost and risk benefits still remain to be determined (Author)

A81-39134 * # **A survey of heating and turbulent boundary layer characteristics of several hypersonic research aircraft configurations** P L Lawing (NASA, Langley Research Center, Transonic Aerodynamics Div , Hampton, VA) *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 16th, Palo Alto, CA, June 23-25, 1981, Paper 81-1145* 11 p 26 refs

Four of the configurations investigated during a proposed NASA-Langley hypersonic research aircraft program were selected for phase-change-paint heat-transfer testing and forebody boundary layer pitot surveys In anticipation of future hypersonic aircraft, both published and unpublished data and results are reviewed and presented with the purpose of providing a synoptic heat-transfer data base from the research effort Engineering heat transfer predictions are compared with experimental data on both a global and a local basis The global predictions are shown to be sufficient for purposes of configuration development, and even the local predictions can be adequate when interpreted in light of the proper flow field In that regard, cross flow in the forebody boundary layers was examined for significant heating and aerodynamic effect on the scramjet engines A design philosophy which evolved from the research airplane effort is used to design a forebody shape that produces thin, uniform, forebody boundary layers on a hypersonic airbreathing missile Finally, heating/boundary layer phenomena which are not predictable with state-of the-art knowledge and techniques are shown and discussed (Author)

A81-39159 # **The application of interactive graphics to thermal modeling** M J Kutkus and R L Negvesky (Hughes Aircraft Co , Los Angeles, CA) *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 16th, Palo Alto, CA, June 23-25, 1981, Paper 81-1180* 11 p 6 refs

Interactive graphics (IG) systems are an effective means for 3-dimensional modeling of complex aerospace structures IG can quickly and accurately generate models of all surface types along with their nongeometric properties, thereby circumventing the difficult and time consuming process of describing spacecraft geometry via numerical parameters Besides providing constant visual feedback, IG allows portions of old models to be incorporated into the new models Moreover, the framework of the design can serve as input to the radiation interchange analysis program The different methods of surface definition used by NEVADA (Net Energy Verification and Determination Analyzer) and the graphics system are first discussed The software performing the data base conversion is then described, along with its special features, such as surface duplication, layering, and report graphing J F

A81-39217 # **Computer calculation of the characteristics of a hybrid system for the cooling of gas turbine blades (Raschet na EVM kharakteristik sistemy kombinirovannogo okhlazhdeniia lopatok gazovykh turbin)** V M Repukhov and I T Shvets (Akademiia Nauk Ukrainskoi SSR, Institut Tekhnicheskoi Teplofiziki, Kiev, Ukrainian SSR) *Promyshlennaia Teplotekhnika*, vol 3, May-June 1981, p 13-18 In Russian

The basic principles underlying the digital-computer calculation of a hybrid system for the cooling of gas turbine blades are described, and a block diagram of the program is presented The

program involves the combined use of three subprograms (1) a subprogram for calculating the coolant characteristics in the cooling system channels, (2) a subprogram for calculating the efficiency of the heat screen and heat transfer on the walls in the presence of the screen, and (3) a subprogram for calculating the temperature field in the body of the blade The program also makes it possible to calculate the parameters of the main gas flow at the edge of the boundary layer and the boundary conditions of heat transfer The computational possibilities of the program are considered P T H

A81-39238 # **An apparatus for the simulation of an air intake at high angle of attack in a compressor test facility (Dispositif de simulation au banc compresseur d'une prise d'air à grande incidence)** B Delahaye (SNECMA, Moissy Cramayel, Seine-et-Marne, France) and G Laruelle (ONERA, Châtillon sous-Bagneux, Hauts-de-Seine, France) *(NATO, AGARD, Symposium on Aerodynamics of Power Plant Installation, Toulouse, France, May 11-14, 1981) ONERA, TP* no 1981-35, 1981 16 p 6 refs In French Research supported by the Direction des Recherches, Etudes et Techniques

A simple device has been developed for the simulation of air intakes at high angle of attack in the evaluation of fighter aircraft engine compatibility with the flight environment in a compressor test facility The present paper presents results of the testing of the device, which consists of either a beveled tube or a tube with a leading edge of varying lip thickness, in a wind tunnel and in a compressor test facility Visualization studies performed in a hydraulic tunnel have shown the qualitative similarity of the flow patterns produced by the simulator devices and an air intake at angle of attack Wind tunnel tests performed at a Mach number of 0 6 and angle of attack up to 40 deg for an unmodified air intake and for three versions of the beveled simulator and the graded-thickness simulator under static conditions have allowed correspondences between the flows in the simulators and those in the cylindrical intake to be determined as a function of incidence Tests of an air intake beveled at 30 deg in a compressor test apparatus confirmed the capacity of the device to simulate the characteristics of flow at angle of attack with regard to mean efficiency, mean stagnation pressure distribution, distortion amplitude and location and level of pressure fluctuations A L W

A81-39239 # **Tests of air inlets at Reynolds numbers comparable to flight in the ONERA F1 and S1MA wind tunnels (Essais de prises d'air à des nombres de Reynolds comparables au vol dans les souffleries F1 et S1MA de l'ONERA)** J Leynaert (ONERA, Châtillon-sous-Bagneux, Hauts-de Seine, France) *(NATO, AGARD, Symposium on Aerodynamics of Power Plant Installation, Toulouse, France, May 11-14, 1981) ONERA, TP* no 1981 36, 1981 13 p 10 refs In French

Facilities and experimental techniques available for the study of the aerodynamics of jet engine air inlets at Reynolds numbers comparable to those encountered under flight conditions in the ONERA F1 and S1MA wind tunnels are presented The pressurized F1 wind tunnel is used for the determination of pressure distribu tions and separation limits for air inlets of large scale civil aircraft engine models and 1/4 scale military aircraft models at low subsonic flow velocities Complementary measurements may be performed on the same models in the S1MA wind tunnel at velocities up to Mach 1 A L W

A81-39240 # **An acquisition and analysis system for the dynamic testing of air intakes (Système d'acquisition et d'analyse pour essais dynamiques d'entrees d'air)** P Perrier (Avions Marcel Dassault Breguet Aviation, Saint-Cloud, Hauts de-Seine, France), B Delahaye (SNECMA, Moissy-Cramayel, Seine-et Marne, France), and G Laruelle (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(NATO, AGARD, Symposium on Aerodynamics of Power Plant Installation, Toulouse, France, May 11-14, 1981) ONERA, TP* no 1981-37, 1981 15 p 8 refs In French

A system for the acquisition and processing of measurements of the unsteady aerodynamic characteristics of the flow within the air intake of jet engines under development for advanced combat aircraft is presented Following a review of recent developments in aircraft design and performance leading to the need for the more economical acquisition of more complete data characterizing inlet air flows, various methods which may be used for the reduction of the amount of data to be processed from a dense set of flow measurements are indicated A means for the simplification of data processing and storage in wind tunnel tests which is based on a quick look approach in which only data from regions with the greatest flow distortion are analyzed in real time is then examined in detail, with particular emphasis on the indices and criteria used for the detection of significant distortions Specifications are then presented for a data acquisition and analysis system, with attention given to compatibility, data acquisition, complementary measurements, pass band, total acquisition time and volume, and precision, and proposed systems designed for operation in wind tunnel, compressor facility and flight tests are described A L W

A81-39242 # **A theoretical and experimental study of combustion chambers with recirculation (Etude théorique et expérimentale de chambres de combustion avec recirculation)** P Hebrard (ONERA, Centre d'Etudes et de Recherches de Toulouse, Toulouse, France) and P Magre (ONERA, Châtillon sous-Bagneux, Hauts-de-Seine, France) *(Association Technique Maritime et Aeronautique, Session, 81st, Paris, France, May 18-22, 1981) ONERA, TP* no 1981 39, 1981 19 p 16 refs In French

Experimental measurements are used to construct a one-dimensional model of the aerodynamics and chemical kinetics of combustion chambers characterized by zones of recirculating flow Various models of industrial and experimental turbojet engine combustors characterized by different geometries and fuel injection modes were employed in visualization studies of flow distribution in a hydraulic tunnel, hot-wire temperature measurement studies in a wind tunnel, measurements of the residence time distributions of gas in the chamber, and determinations of combustion performance by the analysis of combustion products under various operating conditions Experimental results, which have shown the presence of vortices forming the recirculation zones in each of the various combustor geometries, are then used to derive a modular model in which the combustion chamber is represented by a series of reactors, the nature, size and connections of which are obtained from experimental data, with combustion modeled by both a global mechanism of kerosene combustion with a pollution reaction and a quasi global reaction scheme Predictions of combustion efficiency made on the basis of the model are found to be in satisfactory agreement with measurements made in the primary combustion zone, its exit zone and at the chamber exit as a function of fuel/air ratio A L W

A81-39245 # **Wind-tunnel tests of engine-equipped models Comparison of two jet wash simulation methods (Essais en soufflerie de maquettes motorisées - Comparaison de deux méthodes de simulation des jets des reacteurs)** J P Becle (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) and R Perin (Societe Nationale Industrielle Aerospatiale, Toulouse, France) *(NATO, AGARD, Symposium on Aerodynamics of Power Plant Installation, Toulouse, France, May 11 14, 1981) ONERA, TP* no 1981-42, 1981 19 p In French

Two methods for the simulation of the jet wash in wind tunnel studies of jet interference around commercial transport aircraft are presented The first method makes use of an air turbine with a blower with characteristics similar to those of the actual jet engine, while in the second method the effects of air intake are simulated separately from those of the rear body The measurement principles, experimental apparatus, and calibration methods for the turbine powered simulator and blown jet methods are compared, and results are presented of the wind tunnel testing of half models representing a subsonic twin-engine transport aircraft Precisions on the order of 0 7 percent of the total aircraft drag are found for both methods, along with a general agreement to within 0 5 percent of the aircraft drag It is recommended that the two methods be used complementarily, with the simpler to use turbine powered simulator method used for studies of nacelle wing interactions for a given engine installation and the blown jet method used for comparative studies of different engines A L W

A81-39247 **Crack growth model for flight-type loading** G Baudin and M Robert (ONERA, Châtillon sous-Bagneux, Hauts-de Seine, France) *ONERA, TP* no 1981-44, 1981 13 p 13 refs

The ONERA model for crack growth prediction (adapted to loadings encountered in aeronautics), is described Basic crack tests, performed with 2 mm thick 2024-T3 aluminum material, with

constant amplitude with or without overload, and two level loading, are discussed A constant parameter is introduced and adapted to the type of loading considered, in addition to the experimental data Under these conditions the model provides lifetime predictions for standard loadings E B

A81-39263 # **A half-model free-oscillation rig for pitch-damping measurements in high speed wind tunnels** H S Murthy and K P Rao (National Aeronautical Laboratory, Bangalore, India) *Aeronautical Society of India, Journal*, vol 30, Aug Nov 1978 (Feb 1981), p 157-161 12 refs

Development of a wall-mounted half model free oscillation rig for use in high and low speed wind tunnels is presented Increased model size and oscillation amplitude are listed as improvements over sting mounted full models in addition to avoidance of sting induced drag and convenience of test equipment arrangement Aerodynamic damping is obtained as a difference of the measured logarithmic decrements of the model oscillations with wind on and wind off Models up to 12 in length can be tested at any angle of incidence and slender models can be measured for pitch damping Free oscillation is achieved with the model mounted on an elastic suspension, forming a single degree of freedom system oscillation in a plane perpendicular to the wall D H K

A81-39267 # **Aerodynamic characteristics of wings of arbitrary planform** S K Chakrabartty (Indian Institute of Technology, Kharagpur, India) *Aeronautical Society of India, Journal*, vol 30, Aug-Nov 1978 (Feb 1981), p 183-187 8 refs

A computer program is developed in this Note for calculating the aerodynamic characteristics applicable to general wing planform shapes The vortex lattice method is used to consider an inviscid incompressible flow past an infinitely thin wing of arbitrary planform at small angles of incidence A general program in FORTRAN is given to compute distribution of vortex strength, total lift coefficient, overall moment coefficient, and the nondimensional lift coefficient per unit span Examples are given for application to rectangular and delta type wings of varying aspect ratios and a better fit to empirical data is found than with other available methods D H K

A81-39320 **Simulation model validation - Airport applications** W J Dunlay, Jr (Peat, Marwick, Mitchell and Co , San Francisco, CA) *ASCE, Transportation Engineering Journal*, vol 107, July 1981, p 401-412 8 refs

Basic principles are presented for the validation of a fast-time stochastic or Monte Carlo simulation model of airport operations, with emphasis on organizational procedures and statistical validation considerations It is shown that (1) the internal workings and assumptions of a simulation model should be disclosed in a validation, since statistical comparisons of outputs with observational data are necessary but not sufficient, (2) the validation of a computer simulation model is a largely subjective process based on a variety of quantitative and qualitative considerations of the model's logic, goodness-of-fit, and predictive power, (3) autocorrelation of simulation model outputs and their corresponding observed airport operation time histories should be considered in statistical hypothesis tests of the two series, and (4) an analysis of model convergence should be performed to obtain a guide on the number of model replications required for an adequate level of confidence O C

A81-39335 **Forward looking infrared /FLIR/ image enhancement for the automatic target cuer system** C M Lo (Northrop Corp , Electro-Mechanical Div , Anaheim, CA) In Image processing for missile guidance, Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 91-102 Research supported by the Northrop Corp and U S Army

The goal of FLIR image enhancement is to obtain a good quality display by compressing the global scene dynamic range while enhancing the local area contrast This paper presents the investigation and the implementation of six candidates for FLIR image enhancement and shows some experimental results The six enhancement candidates are (1) variable threshold zonal filtering, (2) statistical differencing operator, (3) unsharp masking, (4) prototype automatic target screener technique, (5) constant variance, and (6) histogram equalization All the enhancement techniques make use of the local nonstationary mean, the local variance, or both, to achieve edge enhancement or contrast stretching in local regions The local nonstationary mean and the local variance, in each case, are computed by a two-dimensional rolling window averaging processor Finally, an experiment based on subjective criteria to judge the enhanced image quality was conducted The results showed that the variable threshold zonal filter, prototype automatic target screener, and unsharp masking methods were the superior techniques (Author)

A81-39337 **Evaluation of image processing for man-in-loop target acquisition** L J Pinson (Tennessee, University, Tullahoma, TN) and J L Baumann (U S Army, Missile Command, Redstone Arsenal, AL) In Image processing for missile guidance, Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 119-125 6 refs

A major operational need facing the next generation of Scout (ASH) and Attack (AAH) helicopters is to detect targets from nap-of earth altitudes, on a realistic battlefield in a complex and cluttered scene The targets of interest here are primarily the single, high threat target which will not be contained with the main body of target tanks and will not present many detection cues Various image enhancement methods have been evaluated in terms of improved operator performance Quantitative performance measures such as contrast, resolution and signal-to-noise ratio are computed for selected algorithms and related to observer performance probabilities This paper presents analysis and simulation results for an image enhancement method known as local area gain control It shows dependence on parameter selection and develops criteria for evaluation in terms relatable to detection probability (Author)

A81-39338 **Feature extraction from forward looking infrared /FLIR/ imagery** E M Rounds, T King, and D Steffy (Technology Service Corp , Santa Monica, CA) In Image processing for missile guidance, Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 126-135 16 refs

Many image processing tasks require the ability to extract useful features from digital images The selection of a set of appropriate attributes to be extracted from an image constitutes a major problem This paper examines a number of region features for their utility in target detection and object recognition A simple hierarchical detection scheme is constructed which can be easily extended to perform classification Experimental results are presented for FLIR images of tactical targets (Author)

A81-39349 **Model-based scene matching** D Y Tseng, D K Conti, W O Eckhardt, K E Olin (Hughes Research Laboratories, Malibu, CA), T A McCulloh (Hughes Aircraft Co , Culver City, CA), and R Nevatia In Image processing for missile guidance, Proceedings of the Seminar, San Diego, CA, July 29 August 1, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 225-231 5 refs Contract No F33615-77-C-1227

Advanced pattern matching techniques were developed that are capable of matching complex terrain scenes for use in midcourse navigational updating of aircraft and missiles This method utilizes key features in an image to represent scene content The key features are converted into a line-based model, which is then used in the actual matching process The pattern matching approach is more tolerant of scene diversities than are correlation techniques, and it can match scenes containing severe contrast reversal, small prominent features, or scale and orientation differences Both high- and low-altitude flight profiles are considered, with matches performed for each case Comparisons with conventional correlation are made for a variety of scenes ,Author)

A81-39417 **Long focal length, high altitude standoff reconnaissance, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980** Seminar sponsored by the Society of Photo Optical Instrumentation Engineers Edited by D H Harvis (U S Navy, Naval Air Systems Command, Washington, DC) Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings

Volume 242), 1980 182 p $39

Reconnaissance systems are considered along with technology and technical considerations for standoff reconnaissance, applications and image exploitation, and subsystems technology Attention is given to a 72-inch long range oblique photography camera, a KS-127A long range oblique reconnaissance camera for RF-4 aircraft, applications of the KA-102A, the RF-5E tactical reconnaissance standoff photography concept, design considerations for long focal length reconnaissance systems from an applications point of view, effects of internal compartment turbulence on camera optical performance, the hurdles to long focal length high-altitude standoff photography, an introduction to long focal length catadioptric systems, a high performance apochromatic refractor for long focal length reconnaissance, a new film for reconnaissance and earth resources applications, human factors issues related to optical and electro-optical devices in tactical reconnaissance, standoff reconnaissance imagery, an advanced aerial film processing system for long range reconnaissance, the feasibility of long focal length photography in a Central European environment, remote sensing analysis instrumentation, a scattered light imaging system, and image stabilization techniques for a long range reconnaissance camera G R

A81-39419 KS-127A long range oblique reconnaissance camera for RF-4 aircraft R C Ruck and O J Smith (Recon/Optical, Inc , Barrington, IL) In Long focal length, high altitude standoff reconnaissance, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 22-31

The increased requirement for long range standoff aerial photography led to the development of the KS 127A camera, a 66-inch focal length (fl) camera designed to fit within the nose of a standard, unmodified RF-4 aircraft The paper describes the folding of the 66-inch optical path allowing the camera to fit within the existing RF-4 nose and the development of the 66-inch fl, f/8 diffraction-limited lens Also described is the use of a stabilized scan head for reducing the effects of aircraft motion, and allowing remote manual pointing of the camera for photographing targets of opportunity Included are descriptions of an automatic temperature control system, and automatic focus system and an automatic exposure control, all items necessary for obtaining high resolution photography Test results showing both dynamic bench testing as well as in-flight performance are presented The development of the KS-127A camera, which has already demonstrated high reliability and ease of maintenance during day-to-day flight conditions, has given the RF-4 aircraft a capability previously unavailable (Author)

A81-39421 RF-5E tactical reconnaissance standoff photography concept R M Gibb (Northrop Corp , Aircraft Div , Hawthorne, CA) In Long focal length, high altitude standoff reconnaissance, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 40-51

Standoff oblique photography should become an increasingly important requirement for tactical reconnaissance systems in any future conflict Strongly defended targets and limited command resources may make over-flights undesirable, with the result that intelligence data may be obtained from standoff imagery Rapidly changing scenarios and new hardware development make it mandatory that tactical recon systems provide full-flight envelope data acquisition capability Photography is a very efficient and cost-effective data collection system and is compatible with many of the world's air forces' resource capabilities The RF-5E reconnaissance aircraft has been developed to meet the standoff oblique photography requirements in addition to the standard vertical photo and infrared reconnaissance requirements The RF-5E incorporates prism type panoramic cameras, combined with aircraft primary V-type windows to permit in-flight selection by the pilot of vertical or wide angle, left or right, standoff photos In addition, the RF-5E incorporates a pallet concept which permits mission reconfiguration from a 24-inch focal length pan camera to a 66-inch focal length multiframe camera This paper describes the development history, concepts and capabilities of the RF-5E aircraft relative to standoff photography (Author)

A81-39435 Big 'R', little 'c', integrated data annotation and sensor control for long range oblique photography /LOROP/ W G Fishell (Fairchild Space and Electronics Co , Germantown, MD) In Long focal length, high altitude standoff reconnaissance, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 142 152

The data annotation requirements of the Long Range Oblique Photography (LOROP) reconnaissance system are considered, and sensor control functions are discussed from the standpoint of those control signals that are common to most elements of a multi-sensor system, including a LOROP camera It is shown that the integration of sensor control and data annotation functions increases system simplicity and reliability, since the two components need common inputs and interfaces with cockpit controls A detailed description of the AN/ASQ-172 Sensor Control/Data Display set illustrates how the two functions are combined to save power, space and weight in the F 14 Tactical Air Reconnaissance Pod System (TARPS) O C

A81-39436 Image stabilization techniques for long range reconnaissance camera G R Lewis (Recon/Optical, Inc , Barrington, IL) In Long focal length, high altitude standoff reconnaissance, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 153 158

International political considerations call for overt photographic intelligence collection at distances greater than 10 n mi from the reconnaissance aircraft To obtain adequate ground resolution at those ranges, camera focal lengths have increased to 66 inches or more Aircraft motion becomes magnified by the long focal length lens and can be the limiting factor in system resolution Two methods of reducing aircraft motion effects are apparent the lens aperture can be made large, collecting more light, which allows shorter exposure times and thus less smear at the film plane, or the camera can be presented with a space stabilized image using a two axis stabilized mirror to reduce the effects of the aircraft motion allowing a smaller aperture lens Two-axis stabilized mirrors, usually termed scan heads, have proven in flight that this approach is a viable, attractive alternative to large aperture lenses This paper discusses the rationale for scan heads and describes one practical example A method of ground testing scan heads for disturbance rejection is presented A set of data from ground tests of a scan head

A81-39438 Integrated sensor control system for RF-5E demonstrator M W Ellis (Bowmar Instrument Corp , Fort Wayne, IN) In Long focal length, high altitude standoff reconnaissance, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 163-166

A sensor control system which contains several of the traditional reconnaissance sensor control functions, such as sensor selection and control camera trip pulse generation, image motion compensation (IMC) voltage generation, and V/H conversion, as well as data annotation, built-in test equipment, and display of film frames remaining, was developed for the Demonstration RF-5E Some of the methods employed on the RF-5E Demo to obtain functions such as microprocessor V/H conversion, IMC voltage generation, camera trip pulse generation, and data annotation are applicable to long range oblique photography The above four functions are described in some detail, and the circuit techniques to implement them in the RF-5E Demo Integrated Sensor Control System are discussed (Author)

A81-39503 Test facility for the measurement of infrared radiation from jet engine exhaust systems W M Cornette (Boeing Military Airplane Co , Seattle, WA) In Contemporary infrared sensors and instruments, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 96-102 Research supported by the Boeing Military Airplane Co and Boeing Aerospace Co

The effectiveness of Boeing's Optical Signature Measurement Laboratory and Large Test Chamber to provide preliminary design information on low infrared signature jet exhaust systems has been confirmed This test facility permits the evaluation of various candidate designs prior to any wind tunnel testing The visualization

of the shock structure of the flow field can be compared with analytical flow field predictions and various radiation models In addition, the high resolution transmission and emission data have been used to validate various analytical IR models The data obtained on nozzle and mixer designs can provide extensive information for the design of aircraft and missile systems with low IR signatures

B J

A81-39505 Design characteristics of Michelson interferometers used on the AFGL NKC-135 infrared flying laboratory R P Walker, J D Rex, and J H Schummers (USAF, Geophysics Laboratory, Bedford, MA) In Contemporary infrared sensors and instruments, Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 109-115

Michelson interferometers used in airborne measurements of infrared emissions are described in the context of their mechanical and electromechanical characteristics Methods of coping with the harsh aircraft environment of high vibration and unstable cabin temperatures are described The use of position sensing servo drives, flexure pivots in the moving mirror transport system, and piezoelec tric crystal auto-alignment of stationary mirrors is also described The newest interferometer to be placed in service is described with regard to its sliding piston mirror drive and associated electronic control systems This instrument has already provided promising *spectra with 0 125/cm resolution* (Author)

A81-39526 Acousto-optic deflection applied to a laser tracker C R Pond and L L Slack (Boeing Aerospace Co , Seattle, WA) *In Advances in laser engineering and applications, Proceedings* of the Seminar, San Diego, CA, July 31, August 1, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 180-184

An airborne laser tracker was designed around a two-level beam deflection system An xy acoustooptic beam deflector provides high angular rate control of the 1 mrad divergence helium-neon laser beam over a 0 8 degree square field of view Wide angle pointing (20 deg azimuth and 50 deg elevation) is accomplished with a 2 axis mirror beam deflector The outgoing and return beams are coaxial The angular accuracy is less than 5 milliradian The track-loop angular velocity is greater than one radian/second (Author)

A81-39555 Dynamic simulation of hybrid video compression K Dutta and M Millman (Lockheed Research Laboratories, Palo Alto, CA) In Advances in image transmission II, Proceedings of the Seminar, San Diego, CA, July 31, August 1, 1980 Bellingham, WA, Society of Photo Optical Instrumentation Engineers, 1980, p 21-27 5 refs

Recent experience with airborne video reconnaissance systems has shown that artifacts associated with specific video bandwidth compression techniques can not be fully recognized by viewing simulations of static frames This is particularly true when there are *significant channel errors For this reason, a facility has been* established to dynamically simulate video image compression and transmission systems, including channel errors, for up to 300 consecutive or subsampled frames, representing 10 seconds to 40 minutes of continuous video This capability is useful in optimizing compression parameters and performing human factors analysis (Author)

A81-39573 Development of an aviator's night vision imaging system /ANVIS/ D Jenkins (U S Army, Night Vision Electro-Optics Laboratory, Fort Belvoir, VA) and A Efkeman (Bell and Howell Co , Chicago, IL) In Optomechanical Systems Design, Proceedings of the Seminar, San Diego, CA, July 31, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 18-23

The development of a high performance, lightweight, night vision imaging system for use by helicopter pilots is discussed with reference to the historical background, system requirements, optical concept, and mechanical design of the system The advanced night vision system ANVIS, uses new image intensifiers which provide operational capability under all light level, the tube design and components have been optimized to provide improved resolution and MTF Primary emphasis is on the use of lightweight, precision molded, aspheric plastic optical elements and injection-molded plastic mechanical components V L

A81-39636 Staring infrared mosaic observation of an F-15 aircraft R E Murphy, T Andrada, F Cook, F Billingsley (USAF, Geophysics Laboratory, Bedford, MA), W F Grieder (Boston College, Newton, MA), and B K Yap (SSG, Inc , Waltham, MA) In Modern utilization of infrared technology VI, Proceedings of the Seminar, San Diego, CA, July 31, August 1, 1980

Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 152-259 USAF- supported research

As part of the Balloon Altitude Mosaic Measurements series, down-looking staring mosaic infrared data of an USAF F-15A aircraft at 50 kft were gathered in May, 1979 Infrared background *measurements were made from a balloon-borne platform floating* between 70 and 88 kft and containing a 4 x 4 detector mosaic dual filter radiometer, and a 4 x 4 detector mosaic Michelson interferometer, both boresighted with a real-time TV scene monitoring system The instruments were pointed for nadir viewing and the aircraft completed several flybys which traversed the television and instruments fields of view The entire spectral and infrared signature of the aircraft in the 2 5 to 5 5 micron region was measured The interferograms were Fourier transformed to produce infrared spectra All interferometer spectra in each scene were integrated over spectral bands to form radiance time histories The radiometer data scenes and time radiance records were processed and correlated with the recorded visual data Aircraft infrared signals were further enhanced using standard second order differencing, bandpass filtering, and pixel-to-pixel subtraction techniques K S

A81-39640 Aircraft penetration under cloud cover M F Sentovich (Rockwell International Corp , Seal Beach, CA) and J M Haynes (SRI International, Menlo Park, CA) In Modern utilization of infrared technology VI, Proceedings of the Seminar, San Diego, CA, July 31, August 1, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 181-186 Contract No F04701-77-C-0107

In regions of partial cloud cover, strategic aircraft will penetrate their attack corridors a finite distance before detection by an electro-optical sensor Malick and Allen (1978) have quantified by geographic region the probability of an E-O sensor establishing a track on an aircraft flying under partial cloud cover This paper shows the importance of cloud distribution within the critical region and quantifies expected penetration distance A statistical analysis has been developed which is based on cloud cover data from the USAF ETAC 3-DNEPH grid Expected penetration distance before detection is presented for a variety of geographic regions, seasons, times of day and attack altitudes Excellent detection of a raid is shown regardless of penetration altitude, and particularly cloudy attack routes are identified (Author)

A81-39647 Design considerations for U S Coast Guard search and surveillance Forward Looking Infrared /FLIR/ system D R Freezer (U S Coast Guard, Office of Research and Development, Washington, DC) In Modern utilization of infrared technology VI, Proceedings of the Seminar, San Diego, CA, July 31, August 1, 1980 Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p 247-253

The Forward Looking Infrared system /FLIR/ has been designed to improve the U S Coast Guard's night search capabilities Under

US Army Night Vision Laboratory tests, FLIR excelled under both night and limited visibility conditions, and displayed the ability to detect oil spills and other forms of pollution FLIR requirements called for a wide field of view /FOV/ of 30 deg x 40 deg for a large area search and a narrow FOV 10 deg x 13 3 deg - for a closer look at small targets A common module design was selected, and specifications required a DC restoration sufficient enough to allow an object with a temperature difference of one order of magnitude less than that of an adjacent object to be imaged on the display Additional constraints included the ability to slew plus 90 deg in azimuth and from plus 15 deg to minus 75 deg in elevation, plus a desired maximum weight of 150 pounds The HH-52A aircraft size and load carrying capability had to be considered for equipment arrangement design The turret assembly and support structures are described, as well as vibration testing data Additional consideration was given to a focal lens assembly, the crew station, monitor design specifications, handgrip assembly, search modes, cockpit installation, and control display J F

A81-39680 French Army testing of Forward Looking Infra-Red System /FLIR/ on helicopters /November 1976-June 1977/ (L'expérimentation du système F L I R dans l'aviation légère de l'armée de terre /Novembre 1976-Juin 1977/) A Gay *Médecine Aéronautique et Spatiale, Médecine Subaquatique et Hyperbare,* vol 20, 1st Quarter, 1981, p 30-35 23 refs In French

The night vision imaging system involves sensing of infra red radiation and display on television screens placed before the pilot Navigation depends upon the pilot's skill in reading the luminescent screen and the system permits operations by night or day over all terrain and in all weather conditions as well as the firing of weapons, especially missiles Six helicopters and their personnel carried out a total of 250 flight hours and the ophthalmic capacities for night vision of the personnel were tested The results show that there are no permanent and irreversible disturbances of vision but use of system produces fatigue as concerns binocular vision with increased exophoris Special selection of personnel for night flying is recommended on ophthalmologic grounds and specialized personnel should be carefully trained to use television images D B

A81-39695 Contribution of technological progress to energy savings and conservation to the design of new aircraft (Contribution du progrès technologique à l'économie et à la conservation de l'énergie dans la définition des avions nouveaux) G Cormery and J Rech (Societe Nationale Industrielle Aerospatiale, Paris, France) *L'Aéronautique et l'Astronautique,* no 88, 1989, p 4 18 In French

Construction of new transport aircraft involves project phases lasting 3-5 years including configuration choice, market and profitability study and scale of product The constructor's technical options are sorted by optimization criteria minimizing operating costs, life cycle cost and fuel consumption and maximizing life cycle profitability Current criteria may be irrational as in case of higher speeds which led to the commercially unsuccessful Concorde Constructors must be at the international technical level as concerns computers or Mach and Reynolds number-simulation in cryogenic wind tunnels New materials including carbon-based and titanium products will be used along with numerical technology and microprocessors for auto-control systems Constructors will fully benefit from progress if they apply design to cost and computer-assisted conception and production methods Optimization of air economics involves a relation between kilometer prices and real demand and deregulation could increase passenger use and generate new aircraft designs D B

A81-39696 ATR 42 - A regional transport aircraft designed to save energy (Un avion de transport regional conçu pour les économies d'énergie - l'ATR 42) P Pebereau (Societe Nationale Industrielle Aerospatiale, Toulouse, France) *L'Aéronautique et l'Astronautique,* no 88, 1981, p 19 22 In French

Increased interest in regional transport directed attention towards turboprops and the ATR 42 concept was developed in 1977 1980 The criteria were minimal production and low exploitation costs, i e low energy consumption The configuration offers reduced drag and can carry 42 (later 58) passengers Comparisons with other regional transport systems show that from a specific fuel consumption point of view the train is most economical but the aircraft is relatively economic and does not consume more than a medium size car for more than 500 km, but it covers longer distances in shorter times The aircraft is more economical by 15-20 percent than planes of the same generation with comparable technology Improved turboprops will soon attain speeds of Mach 0 65 or Mach 0 8 and at the end of the 1980's will carry 80 100 passengers D B

A81-39697 Optimization of aircraft propulsion (Optimisation de la propulsion des avions) V Bensimhon (SNECMA, Melun-Villaroche, Seine-et-Marne, France) *L'Aeronautique et l'Astronautique,* no 88, 1981, p 27-36 In French

Optimization involves reduction of fuel consumption, taking into account anti pollution constraints Jet engines have evolved towards lower specific fuel consumption while pressures and temperatures increased from 900 C and 4 (1956) to 1300 C and 30 Motor mass also affects fuel consumption and is largely determined by turbine input temperature Motor yields have reached relatively high levels and it is becoming increasingly difficult to improve them since a 15 C rise in turbine blade temperature cuts the lifespan in half Limits are also fixed by anti-noise regulations to jet speeds and specific thrusts which may even drop in the future Turboprops will be important in the future, along with unconventional motors such as rotary exchanger jets whose specific consumption gains over current engines is 10 percent Supersonic jets are more fuel efficient than subsonics but are constrained by anti-noise regulations In general, future engines will be largely determined by energy costs D B

A81-39698 Propellers for economic flight at high speeds (Hélices pour vol économique à grandes vitesses) J M Bousquet (ONERA, Châtillon sous Bagueux, Hauts de Seine, France) *L'Aeronautique et l'Astronautique,* no 88, 1981, p 37-51 23 refs In French Research supported by the Direction des Recherches, Etudes et Techniques and Direction Generale de l'Aviation Civile

A review is presented of NASA and ONERA research on composite material prop fans designed to replace turboprops and turbofans for high speed air transport The NASA studies comprised efficiency measurements and wind tunnel trials for development of aerodynamic and acoustic codes The performance of thin profile, swept back prop fans, mounted on the wings or fuselage, and turbofans are compared and fuel savings of 9 7 to 23 percent and 3 to 8 2 percent operational savings are shown with use of prop-fans Flight tests were made for comparison with the wind tunnel tests, especially for projected 135 dB cabin noise levels, and performance parameters for a Mach 8 cruise speed at 35,000 ft are given, performances are rated for different blade profiles Efficiency levels were 79 5 percent for the American trials while the French program showed 75 5 percent Results from model tests in the S1 Modane wind tunnel are provided, noting that future ONERA studies will be concerned with developing generalized codes for propellers and defining optimized aerodynamic and acoustic codes for transonic propellers D B

A81-39699 Civil aviation Onboard electronic equipment and fuel savings (Aviation civile - L'electronique de bord et les economies de carburant) F Muszynski (Compagnie Nationale Air France, Service Developpement Technique, Paris, France) *L'Aéronautique et l'Astronautique,* no 88, 1981, p 73 78 In French

Numerical processing equipment is now increasingly being introduced in aircraft as part of the drive towards fuel savings The areas in which savings are now being made are optimization of speeds for ascent, cruising level and descents, correction of flight trajectories, improved piloting, reduction of aircraft mass through better technology, improved airspace and route management and better aircraft performance The recently introduced electronic equipment includes Performance Management Systems with integrated computer for monitoring and display of flight parameters and possible automatic piloting with consequent fuel savings, Flight Management System with computerized navigational aid, improved anti collision systems, coded communication systems, improved automatic pilots, Delayed Flaps Approach system facilitating slower landings and Wing Load Alleviation system for adjustment of wing lift D B

A81 39874 * # **Application of unsteady airfoil theory to rotary wings** K R V Kaza (NASA, Lewis Research Center, Cleveland, Toledo, University, Toledo, OH) and R G Kvaternik (NASA, Langley Research Center, Hampton, VA) *Journal of Aircraft*, vol 18, July 1981, p 604, 605 5 refs

A clarification is presented on recent work concerning the application of unsteady airfoil theory to rotary wings The application of this theory may be seen as consisting of four steps (1) the selection of an appropriate unsteady airfoil theory, (2) the resolution of that velocity which is the resultant of aerodynamic and dynamic velocities at a point on the elastic axis into radial, tangential and perpendicular components, and the angular velocity of a blade section about the deformed axis, (3) the expression of lift and pitching moments in terms of the three components, and (4) the derivation of explicit expressions for the components in terms of flight velocity, induced flow, rotor rotational speed, blade motion variables, etc O C

A81 39896 * **Development of a comprehensive analysis for rotorcraft I - Rotor model and wake analysis** W Johnson (NASA, Ames Research Center, U S Army, Aeromechanics Laboratory, Moffett Field, CA) *Vertica*, vol 5, no 2, 1989, p 99 129 22 refs

The development of a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described Particular emphasis is given to describing the reasons behind the choices and decisions involved in constructing the model The analysis is designed to calculate rotor performance, loads and noise helicopter vibration and gust response, flight dynamics and handling qualities, and system aeroelastic stability It is intended for use in the design, testing and evaluation of a wide class of rotors and rotorcraft, and to be the basis for further development of rotary wing theories The general characteristics of the geometric, structural, inertial, and aerodynamic models used for the rotorcraft components are described, including the assumptions introduced by the chosen models and the resulting capabilities and limitations Finally, some examples from recent applications of the analysis are given (Author)

A81-39897 **Development of a bearingless helicopter tail-rotor** H Huber, H Frommlet, and W Buchs (Messerschmitt Bolkow-Blohm GmbH, Munich, West Germany) *(European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, Sept 16 19 1980) Vertica*, vol 5, no 2, 1981, p 131-147 9 refs

In order to achieve greater aerodynamic efficiency, simplicity and weight and cost reductions, three- and four-bladed composite bearingless tailrotors currently under development employ a fiber glass bending torsion flexure to accommodate bending deflections and collective pitch control The use of low chordwise stiffness results in low blade stresses, control loads and weight Among the topics covered are (1) basic layout considerations, (2) structural properties and dynamic characteristics, (3) an analytical model of dynamic characteristics, (4) parametric influences and loads prediction, (5) component testing, (6) manufacturing of hardware, and (7) weight and cost estimates O C

A81 39898 **Experimental and analytical studies of a model helicopter rotor in hover** F X Caradonna and C Tung (U S Army, Aeromechanics Laboratory, Moffett Field, CA) *Vertica*, vol 5, no 2, 1981, p 149-161 18 refs

The present study is a benchmark test to aid the development of various rotor performance codes The study involves simultaneous blade pressure measurements and tip vortex surveys Measurements were made for a wide range of tip Mach numbers including the transonic flow regime The measured tip vortex strength and geometry permit effective blade loading predictions when used as input to a prescribed wake lifting surface code It is also shown that with proper inflow and boundary layer modeling, the supercritical flow regime can be accurately predicted (Author)

A81-39899 **Co-axial rotor aerodynamics in hover** M J Andrew (Southampton, University, Southampton, England) *(European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, Sept 16-19, 1980) Vertica*, vol 5, no 2, 1981, p 163-172 32 refs Research supported by the Science Research Council

A remotely piloted, coaxial contrarotating twin rotor (CCTR) helicopter extensively modified for research was used to investigate the hover aerodynamics of such configurations Good agreement has been found between experimental, induced downwash distributions and overall rotor performances and a theoretical model based on momentum, blade element and vortex theories Semiempirical equations are also derived for the initial viscous vortex core size and maximum swirl velocities It is shown that the conventional comparison of the CCTR with one of its own rotors is false, in that the single rotor is thrust-limited by the onset of blade stall When compared with a single rotor having the same thrust potential, the theory presented indicates that the CCTR layout generates more thrust per unit power in hover through a reduction in induced power of approximately 5% O C

A81-39900 **Gust response of rotary wing aircraft and its alleviation** S Saito, A Azuma (Tokyo, University, Tokyo, Japan), and M Nagao (Olympus Optical Co , Ltd , Tokyo, Japan) *Vertica*, vol 5, no 2, 1981, p 173-184 12 refs

A simple feedback mechanism is described for helicopter rotor gust response alleviation, comprising sensors for the detection of flapping motion in rotor blades and in pitch-control actuators which are controlled by gust-alleviation signals The validity of the system is demonstrated by applying a theoretical calculation, based on local momentum theory, to the responses of a helicopter that is considered as a complete dynamic system while it penetrates into (1) a sinusoidal gust and (2) a step gust Extensive dimensional data are furnished for both the rotor and the helicopter exemplified, as well as thrust coefficient comparisons for the feedback and non-feedback systems O C

A81-39981 **Alternative aircraft fuels - When will the action start** C Bulloch *Interavia*, vol 36, July 1981, p 715-717

A comparative study is presented of the relative advantages and disadvantages of the development and use, in the near future, of synthetic Jet A fuel ('synjet'), liquid hydrogen, liquid methane, and alcohol In all cases, the aircraft for which the fuels are considered is a Mach 0 85-cruise, turbofan powered airliner In addition to performance figure comparisons for short, medium and long range flights, the alternative fuels are considered from the viewpoint of cost, process energy expenditure and capital investment Attention is also given to the problem arising from the physical properties of liquefied, cryogenic fuels such as hydrogen and methane, and the extensive redesign of both airframe and airport facilities that they entail It is concluded that despite the low-pollution, high-energy combustion characteristics of hydrogen, synjet fuel is a more reliable and less expensive alternative for next-generation aircraft O C

A81-40019 # **Investigation of the influence of the radial nonuniformity of initial temperature and energy losses on flow structure in a highly loaded turbine stage (Issledovanie vliianiia radial'noi neravnomernosti nachal'noi temperatury i poter' energii na strukturu potoka v vysokonagruzhennoi turbinnoi stupeni)** N N Afanas'eva, A I Kirillov, and S Iu Olennikov (Leningradskii Politekhnicheskii Institut, Leningrad, USSR) *Energetika*, vol 23, Nov 1980, p 42 49 In Russian

Under certain conditions (e g , decrease of the inlet flow angle), the radial nonuniformity of the temperature field behind the combustion chamber and energy losses have a significant effect on flow parameters in a high temperature gas turbine stage This effect is studied on the basis of the complete system of equations describing the motion of a steady axisymmetric flow of an ideal fluid, with approximate allowance for viscosity Equations are obtained which make it possible to assess the effect of radial gradients of initial gas temperature and energy loss coefficients on the flow structure and the main gasdynamic parameters of the first stage of a high-temperature gas turbine B J

A81-40020 # **Investigation of the cooling of the turbine rotor blade of a gas-turbine power system (Issledovanie okhlazhdeniia rabochei lopatki turbiny energeticheskoi GTU)** L V Arsen'ev, I B Mitriaev, and I S Choban (Leningradskii Politekhnicheskii Institut, Leningrad, USSR) *Energetika*, vol 23, Nov 1980 p 60-64 5 refs In Russian

Experimental results are presented on the thermal stress states of two types of turbine rotor blades a cast blade with a complex transverse-longitudinal pattern of coolant flow, and a shell-type blade with a longitudinal pattern of coolant flow Both blades are

subjected to compressive stresses at the external surface and tensile stresses at the internal surface, but the maximum values of these stresses for the shell-type blade are significantly less than for the cast blade, specifically, the compressive stress does not exceed 21 kg/cu mm and the tensile stress does not exceed 27 kg/cu mm for the shell-type blade, which are about 3-4 times less than in the cast blade It is concluded that the shell-type blade has a clear advantage over the cast blade in terms of thermal stress state B J

A81-40022 # **Experimental determination of the circumferential drift of edge wakes of guide vanes in a turbine stage (Eksperimental'noe opredelenie okruzhnogo snosa kromochnykh sledov napravliaiushchikh lopatok v turbinnoi stupeni)** K L Lapshin and V N Sadovnichii (Leningradskii Politekhnicheskii Institut, Leningrad, USSR) *Energetika*, vol 23, Nov 1980, p 109-111 In Russian

A81-40023 # **Calculation of the coefficients of head and local drag of bluff bodies (K raschetu koeffitsientov lobovogo i mestnogo soprotivlenii plokho obtekaemykh tel)** A M Grabovskii and V A Budarin (Odesskii Politekhnicheskii Institut, Odessa, Ukrainian SSR) *Energetika*, vol 23, Dec 1980, p 60-64 7 refs In Russian

Equations are obtained that relate the coefficients of head drag of bluff bodies in unbounded and bounded flows in a circular tube, with allowance for the nonuniform velocity distribution It is shown that the head drag coefficient can be used to characterize the force interaction of the bounded flow with the body In addition, an equation is obtained which can be used to determine the local drag coefficient of bluff bodies in a circular tube B J

A81-40024 # **Fluctuation of gas parameters behind the combustion chamber of gas turbine engines (Pro pul'satsii parametriv gazu za kameroiu zgoriannia gazoturbinnikh dviguniv)** V A Merzliakov *Akademiia Nauk Ukrains'koi RSR, Visnik*, vol 45, June 1981, p 54-59 6 refs In Ukrainian

Experimental results for an open-loop gas turbine engine indicate that the gas flow leaving the combustion chamber is characterized by static pressure fluctuations Three fluctuation frequency ranges have been identified 10-30 Hz, 120-160 Hz, and 200-390 Hz The frequency of pulsations increases with the air temperature at the suction end of the turbine The results are explained in terms of a pulsed ignition model V L

A81-40078 **The future role of helicopters in public transport** J A Cameron (British Airways Helicopters, Ltd , Gatwick Airport, Surrey, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 7 p

A brief historical overview is given of the development of helicopter passenger services, their economic failure, and the nature of current successful operations between Penzance and the Isles of Scilly in the British Isles Among the obstacles to be overcome by viable helicopter passenger services are (1) the unavailability of helicopters with full, category A airworthiness certification, (2) the external noise generated by rotorcraft in urban airspace, (3) the inherently higher seat mile costs of helicopters, by comparison with jet aircraft, and (4) the difficulty of air traffic control of such helicopter operations in already-crowded air corridors These objections are considered, and it is concluded that the application of emerging technology will economically allow all to be overcome O C

A81-40079 **The developing technology and economics of large helicopters** J J Schneider (Boeing Vertol Co , Philadelphia, PA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 16 p

This paper discusses the changing helicopter scene and the natural evolution to larger aircraft Future needs for transport services are examined and some analogies with fixed wing transport development are presented Studies of the developing technologies enhancing the design of larger helicopters show that tandem helicopters offer the same efficiency advantages of size as do fixed wing airplanes and that there are no formidable reasons why the tandem helicopter cannot continue to grow in size The civil growth potential of the larger helicopters and their economics are discussed and their characteristics compared with other modes of transport. Projections of future market developments are presented showing that with proper market development, large tandem helicopters could thrive and multiply in the short haul transportation role (Author)

A81-40080 **A review of some topics of UK research on helicopters** R L Maltby (Royal Aircraft Establishment, Farnborough, Hants , England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 9 p

A review is presented of British research work over the last decade in (1) helicopter rotor blade aerodynamics, (2) rotor loads analysis, (3) experimental methods, (4) dynamic instabilities such as ground and air resonance, (5) rotor-induced vibration, and (6) all-weather operation It is shown that the two developments of greatest significance to all the fields mentioned were the emergence of large scale computation for the accurate prediction of rotor behavior, and the widespread application of fiber-reinforced materials and construction techniques to rotor blades Many of the developments considered will be integrated in the WG 34 helicopter, which is currently in its design phase O C

A81-40081 **European cooperation in the tactical transport helicopter** E Valente (Stato Maggiore Esercito, Rome, Italy) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 28 p

A wide-ranging review is presented of requirements and opportunities for their fulfillment in the European, multinational production of a tactical transport military helicopter Among the basic aims of such a joint program are (1) increased standardization and interoperability through reduction of the number of helicopter types operated by the NATO alliance, (2) reduction in cost and improvement of export prospects, and (3) the cultivation of a strong European helicopter industry Among the issues examined are (1) the class to which the future helicopter should belong, (2) the current status of research and development in required technologies, and expected progress, (3) the identification of operational tasks other than the military which the design may fulfill, and (4) the conditions essential for the implementation of a European program O C

A81-40082 **Westland WG30** R A Doe (Westland Helicopters, Ltd , Yeovil, Somerset, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 26 p

A detailed description is given of the WG30 helicopter's configuration and important subsystems Using the Lynx helicopter's main rotor components, the new design incorporates a novel airframe whose unobstructed cabin offers twice the volume of that of the Lynx The aircraft is intended for both military and civilian markets Attention is given the main rotor's external noise and aerodynamic effects and the rationale for either replacement or retention of Lynx systems The redesign of the tail rotor is justified by external noise considerations Flight development is outlined, including a brief comparison of flight test results for main rotor stresses with theoretical predictions Diagrams, graphs and charts are provided O C

A81-40083 **The development of the AS 355 Ecureuil 2/Twinstar** J P Libeer (Societé Nationale Industrielle Aerospatiale, Division Helicopteres, Marignane, Bouches-du-Rhône, France) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16 19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 13 p

A description is given of the AS 355 helicopter, which is a twin-engine development of the single-engine Astar aircraft and makes extensive use of its precursor's systems In addition to the use of Astar components, the AS 355 design goals were (1) low manufacturing costs, (2) low operational costs through improved

reliability and simplified maintenance, (3) performance comparable to that of the Astar, (4) low cabin noise and vibration levels, (5) IFR equipment fitting capability, (6) an intensive development and industrialization schedule, and (7) a large number of certificated options, such as off shore, corporate, ambulance and aerial work roles O C

A81-40084 ABC aircraft development status D S Jenney (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 18 p 10 refs

A progress report is presented for the flight test program of the Advancing Blade Concept (ABC) demonstrator aircraft Instrumented flight testing has reached 238 kt in level flight, and load factors of zero to 2 0 at 210 kt It is shown that (1) the ABC concept offers advantages for VTOL missions requiring high speeds, (2) the compactness of its rotor blades benefits both shipboard and nap-of-the-earth missions, (3) its low disk loading is suited to unprepared landing areas, rescue missions and missions requiring extensive loiter time, and (4) the agility and good handling qualities of the concept are suited to gunship roles In addition, three applications of the concept are discussed (1) a 9,000 lb aircraft that may serve military scout and light attack requirements and civilian light utility and executive transport roles, (2) an 18,000-lb aircraft for attack, electronics, search and rescue military roles, for air taxi and civil utility functions, and (3) a 36,000-lb aircraft for assault, naval ASW and AEW missions, and civil transport roles O C

A81-40085 STOL performance of the tilt rotor S Martin, Jr , L H Erb, and K W Sambell (Bell Helicopter Textron, Fort Worth, TX) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 11 p

Using as a baseline the 30-passenger D326 aircraft proposed for off-shore oil rig support, a short takeoff, vertical landing version designated D326 S-V is investigated, and compared with a hypothetical helicopter employing a comparable level of technology It is found that for a 300-nautical mile radius off-shore support mission, a definition of productivity as payload times cruise speed, divided by empty weight, yields a figure for the D326 S V that is 39% greater than the D326 and 87% greater than the helicopter It is concluded that a short takeoff, vertical landing tilt rotor offers a highly productive and energy efficient aircraft that could find many commercial and military applications, although additional testing of the XV-15 demonstration aircraft will be needed to optimize short takeoff and vertical landing techniques O C

A81-40086 Analysis and application of compliant rotor technology J G Yen and W H Weller (Bell Helicopter Textron, Fort Worth, TX) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 10 p 6 refs

Application of compliant rotor techniques to a four bladed hingeless rotor indicates how this new technology can be used to control steady and one-per rev blade elastic twist In tests of a blade with positive camber airfoils, the steady and one-per-rev blade elastic twist increased with airspeed and gave rise to large steady and oscillatory control loads and stresses at blade midspan Analysis indicated that a negative camber over 80-87-percent radius would have a beneficial effect on rotor loads without detrimental effects on performance, handling qualities, or cabin vibrations These analytical predictions were verified by flight test of blades with negative camber Correlation of the analysis with measured loads and performance is presented in this paper (Author)

A81-40087 Investigations of helicopter structural dynamics and a comparison with ground vibration tests J Stoppel (Messerschmitt Bolkow-Blohm GmbH, Munich, West Germany) and M Degener (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Göttingen, West Germany) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 18 p Research supported by the Bundesministerium fur Forschung und Technologie

A helicopter structural dynamics study is presented The aircraft is modelled using two different versions of a finite element program one for a low degree of freedom, the other for greater complexity, using superelement techniques Test calculations show that the moderate storage advantage of the simple model is limited by the accuracy of results at higher modes By contrast, the complex model has the advantage of ease of parameter modification, calling only for the change of the affected substructure In addition, higher modes are calculated with greater accuracy It is shown that careful placing of the concentrated masses in the analysis set and selection of the analysis points is necessary, and that a basic understanding of the modal pattern is a prerequisite for obtaining accurate results A special ground vibration test is carried out in order to check the finite element model of the helicopter O C

A81-40088 Stability of nonuniform rotor blades in hover using a mixed formulation W B Stephens, D H Hodges (U S Army, Aeromechanics Laboratory, Moffett Field, CA), J H Avila, and R-M Kung (Technology Development of California, Santa Clara, CA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 20 p 24 refs

A mixed formulation for calculating the static equilibrium and stability eigenvalues of nonuniform rotor blades in hover is presented, in which the static equilibrium equations are linear and solved by an accurate and efficient collocation method and the linearized perturbation equations are solved by a one-step, second-order integration scheme It is found that the present ordering scheme does not achieve completely equivalent models based on mixed and displacement formulations, due to the neglect of the order of squares of rotation with respect to unity Numerical results for a hypothetical nonuniform blade, including the nonlinear static equilibrium solution, were obtained with effort and computer time equivalent to that required for a uniform blade O C

A81-40089 * Rotor blade aeroelastic stability and response in forward flight P P Friedmann and S B R Kottapalli (California, University, Los Angeles, CA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 35 p 30 refs Army-supported research, Grant No NsG-1578

The aeroelastic stability and response problem of the coupled flap lag-torsional dynamics of a hingeless rotor blade in forward flight is treated in a comprehensive manner The spatial dependence of the partial differential, nonlinear, equations of motion is discretized using a multimodal Galerkin method The aeroelastic problem is coupled with the trim state of the helicopter obtained from improved, representative, trim procedures The nonlinear time dependent equilibrium position, or response, about which the equations are linearized is obtained by solving a sequence of linear periodic response problems, using quasi-linearization Numerous results illustrating blade behavior in forward flight are presented (Author)

A81-40090 Helicopter vibration reduction through structural manipulation A J Sobey (Royal Aircraft Establishment, Structures Dept , Farnborough, Hants , England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 14 p 9 refs

The problem of modifying a given airframe so as to improve the structural response to given inputs from the head is seen to consist of two parts In the first, it is necessary to identify those parts of the airframe where useful changes to stiffness may be made In the second, the precise resizing of members is to be effected In this paper, the first of these two tasks is examined with the aid of the Vincent Circle Theorem (Author)

A81-40091 Development of antiresonance force isolators for helicopter vibration reduction D Braun (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 18 p 5 refs Research supported by the

Bundesministerium fur Forschung und Technologie

The development of two types of uniaxial antiresonance force isolators is described Both are to be arranged at several points and in various operating directions as connecting members between the engine gearbox and helicopter fuselage, to obtain multiaxis vibration isolation One of the isolators is a conventional design, the other is a novel type distinguished by (1) very low inherent damping, (2) symmetrical arrangement of all components, and (3) simple, wear resistant design Exact theoretical descriptions are developed for both isolators, and their effectiveness is tested by the use of a uniaxial functional model by which the free-free condition of the flying helicopter can be simulated in the vertical direction The new force isolator design shows excellent isolation efficiency O C

A81-40095 The influence of helicopter operating conditions on rotor noise characteristics and measurement repeatability M R P Law and J Williams (Royal Aircraft Establishment, Aerodynamics Dept , Farnborough, Hants , England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1

Bristol, University of Bristol, 1980 4 p

A study is presented based on extensive measurements of helicopter noise characteristics and associated flight path data, conducted with several helicopters in various operational modes over longitudinal and lateral arrays of ground based microphones under quiet airfield conditions An analysis is carried out for the case of a Lynx helicopter with standard rotor configuration, stressing the influence of various operating procedures on both main rotor and tail rotor noise characteristics and on the repeatability of measurements during level flight, oblique landing approach, and oblique take off Near-field noise signatures are also derived for the purposes of correlation by means of a tail boom-mounted microphone O C

A81-40096 Reduction of helicopter noise by use of a quiet tail rotor J W Leverton (Westland Helicopters, Ltd , Yeovil, Somerset, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 17 p 7 refs

It is shown that much of the noise associated with the main rotor during overflight is due to main rotor wake/tail rotor interactions, and that noise reductions on approach of up to 15 dB and of 5 dB in overhead noise can be achieved through the use of a tail rotor designed with carefully chosen operating parameters Such a design, the Q T/R (quiet tail rotor), is considered with respect to acoustics, aerodynamics and dynamics, associated mechanical systems, performance, test configurations and format, the generation of 'burble' and overhead interaction noise, loudness level variations with distance, and testing on a WG 30 helicopter The design and manufacture of the quiet tail rotor does not present problems because of the advanced airfoil sections now available, and its weight penalties are negligible O C

A81-40097 Experimental and analytical studies of a model helicopter rotor in hover F X Caradonna and C Tung (U S Army, Aeromechanics Laboratory, Moffett Field, CA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 20 p 18 refs

The present study is a benchmark test to aid the development of various rotor performance codes The study involves simultaneous blade pressure measurements and tip vortex surveys Measurements were made for a wide range of tip Mach numbers including the transonic flow regime The measured tip vortex strength and geometry permit effective blade loading predictions when used as input to a prescribed wake lifting surface code It is also shown that with proper inflow and boundary layer modeling, the supercritical flow regime can be accurately predicted (Author)

A81-40098 Aerodynamic study of a hovering rotor J M Pouradier (Societe Nationale Industrielle Aerospatiale, Division Helicopteres, Marignane, Bouches du-Rhône, France) and E Horo witz (ONERA, Châtillon sous-Bagneux, Hauts-de-Seine, France) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 14 p 14 refs

Part of a joint research program between ONERA and Aerospatiale, aimed to improve helicopter rotor performance, emphasizes an aerodynamic study of hovering flight A wind tunnel test was performed on a three-bladed rotor, using a two component laser velocimeter, to determine the tip vortex path and to study tip vortex core and development The tip vortex path was determined in two vertical planes the longitudinal axis and the transverse axis of the airflow vein, and except for three velocity peaks induced tangential velocities proved to be four or five times lower than axial velocities Success of the experiment demonstrated that the laser velocimeter can be used to study wake geometry and the formation and dilution of various vortex components A theoretical method for performance calculation is then presented, which is based on the vortex theory and provides for partial free wake analysis Calculations with free wake analysis closely approximated experimental results, whereas prescribed wake calculations often showed erroneous trends More over, calculated and measured tip vortex paths were accurately predicted, whereas the prescribed wake analysis gave too high an axial velocity J F

A81-40099 Aerodynamic design of the Aerospatiale SA 365 N Dauphin 2 helicopter P Roesch (Societe Nationale Industri elle Aerospatiale, Division Helicopteres, Marignane, Bouches-du Rhône, France) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16 19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 11 p 6 refs

The French twin engine SA 365 N helicopter was developed from the Dauphin SA 365 C when market studies showed the need for a medium-sized high performance helicopter for corporate and off shore use The paper describes the theoretical and experimental work, including wind tunnel and flight tests, which led to the final design of the SA 365 N Fuel efficiency, a large fuel capacity, and a very low empty weight to gross weight ratio (0 5) made large payloads over long ranges possible, while aerodynamic refinements reduced parasite drag to 1 05 sq m The pylon fairing design incorporates several features designed to depress the wake downwards, attenuating turbulence by introducing fresh steady air into the wake's core In addition, rotor performance was improved by increasing the lift/drag ratio and drag divergence Mach number To reduce external drag, engine air intakes were redesigned and new rotor blades developed for better performance while cruising or hovering Finally data on airframe, engines and rotors are given, including cargo volume of 2 20 cu m, take off power of 492 kW and main rotor diameter of 11 93 m J F

A81-40100 Recent progress in performance prediction of high advance ratio circulation controlled rotors E O Rogers (U S Naval Material Command, David W Taylor Naval Ship Research and Development Center, Bethesda, MD) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 23 p 15 refs Navy-DARPA-supported research

An employment of circulation control airfoils for helicopter rotors represents a great potential for improving speed and range-payload performance The operating regimes of the X-Wing stopped rotor concept are considered The critical design conditions for the X Wing rotor and blowing system occur in the vicinity of 0 7 advance ratio The ultimate success of the X-Wing and other high speed rotor concepts depends on the capability to optimize rotor performance in the previously unexplored high advance ratio lifting rotor range In connection with this situation, an extensive experimental and analytical program has been conducted The considered investigation is concerned with the analytical/physical complications of high advance ratio (0 4 to 0 7) operation, taking into account the evolution of analytical methods that have led to the successful correlation of experiment and theory Attention is also given to the subscale Reverse Blowing Circulation Control Rotor and a vortex wake computational model G R

A81-40102 The dominant acoustic radiation surfaces of a helicopter cabin K H Heron (Royal Aircraft Establishment, Farnborough, Hants , England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, Univer

sity of Bristol, 1980 14 p

Internal helicopter noise can be reduced by attaching acoustical transmission barriers to the inside of cabin surfaces A test was performed to determine the dominant acoustical radiation surfaces in a Lynx helicopter, whereby each surface under investigation was acoustically blanked off, and measurements of noise radiation were taken on all other surfaces Acoustical barriers used in the test were designed to have a reflective surface facing inwards, so that variations in cabin reverberation could be ignored Results show that at high frequencies, the rear half of the roof, the sides and milled frames, and the rear bulkhead are all important radiating surfaces, whereas the doors and forward half of the roof are unimportant radiators of noise Moreover, at 450 Hz, the floor radiated nearly as much noise as the roof, and if untreated, could achieve a maximum noise reduction of only 12 dB at low frequencies Thus, a floating floor was recommended for future helicopters Graphed comparisons are presented of bare and fully covered configurations, cockpit and cabin sound pressure levels, and microphone variability and repeatability, consistency exposure tests are given and compared with ground results J F

A81-40103 U K development of a rotor de icing system J E Clark (Westland Helicopters, Ltd , Yeovil, Somerset, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980,Conference Papers Part 1 Bristol, University of Bristol, 1980 24 p

The described investigation deals with the need for a rotor ice protection system, the instrumentation fit considered necessary for its development, and the results of flight trials in both high and low icing temperatures Ice formation on the rotor blades will cause a deterioration of the aerodynamic characteristics of the blades, which, without corrective action, will lead to an unacceptable degradation of the handling qualities of the aircraft. Conditions for shedding ice from the blade are examined Accumulated experience on unprotect ed rotors suggests that the combined effect of ice accretion and natural shedding leads to an equilibrium rotor performance penalty after (typically) 5 minutes in a given icing condition When a helicopter's operational requirements are not met by this limited capability, a rotor protection system is required The basic rotor de icing system which is being developed is discussed G R

A81-40104 Helicopter rotor ice accretion and protection research J T Carnsdale (Royal Aircraft Establishment, Farnborough, Hants , England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 1 Bristol, University of Bristol, 1980 19 p 11 refs

Recent research by RAE on helicopter rotor ice accretion and protection systems is summarized Results are presented of calculations of droplet trajectories around airfoils in compressible flow, showing the effect on droplet impingement of aerofoil section, chord and droplet size A computer model of the thermodynamic process of ice accretion in compressible flow has been used to predict the shape and position of rotor ice, results are compared with flight and tunnel observations Work on protection systems has involved tests of a non-rotating section of blade fitted with electrothermal deicing, tested in front of an open jet nozzle After initial demonstration of the feasibility of deicing in the absence of centrifugal force, a wide range of conditions was explored, with results which correlate well with flight trials (Author)

A81-40105 V/STOL combat aircraft progress from the powerplant viewpoint R M Denning and R Hurd (Rolls-Royce, Ltd , Bristol, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 29 p

A brief historical account is given of the development of jet-lift V/STOL aircraft since the 1950's, and the present operational requirements and future technological possibilities that recommend a continuation of development beyond the successful Harrier-series aircraft are cited Extensive recommendations are made with respect to configurational and propulsion-system design issues on the basis of lessons learned through past development of prototype systems It is concluded that (1) to fully exploit the jet V/STOL concept, supersonic combat aircraft must be developed, (2) V/STOL capability for new designs must be achieved in the simplest and most inexpensive way, and (3) limited demonstrator aircraft programs must be undertaken as a prerequisite to production O C

A81-40106 The requirements for and evolution of a test rig for exhaust gas recirculation studies of V/STOL aircraft C J Penrose (Rolls Royce, Ltd , Bristol, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 34 p

A test rig employing a moving scale model, developed for hot gas recirculation studies of V/STOL aircraft like the proposed, reheated vectorable exhaust Harrier fighter, has been developed and used Among the topics discussed are (1) the causes and implications of hot gas recirculation, such as thrust loss and airframe and deck heating, (2) test rig requirements, (3) half and complete-model testing at fixed height, (4) model and flow scaling, (5) tunnel working section, (6) carriage design, (7) rig starting and purging, and (8) sample test results Tests using the moving model rig have shown that a purely vertical takeoff of the proposed aircraft is acceptable if suitable operational procedures are adhered to O C

A81-40107 Prevention of corrosion and fatigue failure of helicopter gas turbine compressors R J H Wanhill, H J Kolkman, A J A Mom, and G F J A van Gestel (Nationaal Lucht en Ruimtevaartlaboratorium, Amsterdam, Netherlands) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 11 p Research supported by the Royal Netherlands Air Force

Corrosion pitting leading to fatigue cracking and failure of a rotor blade or stator vane was found to be the most probable cause of disintegration of a helicopter gas turbine compressor during normal operation in The Netherlands A subsequent corrosion investigation showed that the corrosion resistance of compressor rotor blades, which are manufactured from the same material as the rest of the compressor, could be much improved by applying commercially available protective coatings In particular, this was confirmed by evaluation in a compressor test rig which allowed simulation of the polluted service environment (Author)

A81-40108 T700 engine integral inlet separator - All weather operational protection M G Ray (General Electric Co , Aircraft Engine Group, Lynn, MA) and J L Browne (General Electric Co , Aircraft Engine Group, Cincinnati, OH) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 15 p

The T700 turboshaft helicopter engine's integrated inlet particle separator is described The device, located forward of the main engine frames, is fully anti-iced and provides a high degree of protection for the compressor from sand and dust ingestion, bird strikes, and similar environmentally caused damage The separator is designed to impart swirl to the entering airflow and extract that part of the flow containing the centrifuged foreign material by means of a mechanically driven blower scavenge duct The clean air is deswirled before entering the engine core Test results with birds and other foreign objects are presented, in addition to a synopsis of test data highlighting sand separation efficiency, rain, water and slush inges tion, and salt water mist trials Advanced concepts such as the axial flow and booster stage separators are briefly introduced O C

A81-40109 Design of rotorcraft powerplants Use of life cycle costing as an aid to design optimisation P V Langdell (Rolls Royce, Ltd , Leavesden, Herts , England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 15 p

A twin-engined helicopter in the eight-ton class, representing a medium weight rotorcraft with wide military and civil sales potential, is used as the basis for a numerical life cycle cost analysis of future powerplants in order to provide a design requirements framework Attention is given to the way in which design may be influenced by such cost parameter changes as a substantial rise in fuel prices The analysis covers a range of operational roles, annual utilizations and

fleet sizes appropriate to both military and civil operations, and is readily adaptable to helicopter powerplants of different size From the assumptions made, it is concluded that engine life cycle costs are significantly higher for those designs that achieve improved performance at the expense of increased production, research and development, and maintenance costs O C

A81-40110 An integrated performance and air data system for helicopters S Frost (Marconi Avionics, Ltd , Rochester, Kent, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 20 p

The XM-143 Helicopter Air Data Subsystem used by the AH-1S Enhanced Cobra attack helicopter is described By using a swivelling pitot-static pressure probe located in the rotor flow field together with an integral air pressure sensor, the system can determine essential air data parameters with great accuracy under all flight conditions The integrated Lift Margin System in turn combines air data parameters with engine, rotor and transmission sensor inputs to compute and display mission-critical performance information to the flight crew Among the performance parameters displayed are (1) ground effect power and weight margins, (2) maximum and vertical rates of climb, along with the airspeed at which they are achieved, (3) gross weight, center of gravity and cargo hook load, and (4) maximum range and endurance and the speeds at which to achieve them O C

A81-40111 Flight investigations of a helicopter low airspeed estimation system based on measurement of control parameters A J Faulkner and F Buchner (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 21 p 5 refs

An indirect airspeed estimation method suitable for the modern, hingeless-rotor helicopter, based on the measurement of parameters readily available in a flight control system, is described A brief outline is given of the system's theory, and experimental results obtained with a BO 105 helicopter are presented for the cases of trimmed and transient flight states in and out of ground effect, with attention to the rotor down-wash model The 16-bit microprocessor of the system is also described It was found as a by-product of the investigations that doubts about current rotor downwash models are justified O C

A81-40112 Real time analysis for helicopter flight testing K Lunn (Boeing Vertol Co , Philadelphia, PA) and J L Knopp (Boeing Computer Services, Inc , Philadelphia, PA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2

Bristol, University of Bristol, 1980 18 p 5 refs

A real time data system for use in the developmental or experimental testing of helicopters is described Among the system capabilities discussed are (1) the calculation of critical component alternating loads and rotor system critical damping ratios for envelope expansion, (2) harmonic and spectral analyses for vibration investigation, and (3) a calculations data base, residing in the processor disk storage for all flights of a given test program The data base allows fatigue damage calculations to be executed across multiple flights by simple terminal access Also summarized are increases in productive flight rate, data turn-around, test team involvement and extension of the data base to such areas as dynamics, performance and flying qualities O C

A81-40113 Commercial rotorcraft automatic controls - The next generation C D Griffith (Sperry Corp , Avionics Div , Phoenix, AZ) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 13 p

The equipment characteristics and benefits of IFR automatic flight controls (AECS) for light commercial helicopters are discussed It is argued that avionics presently under development will soon allow commercial helicopters to be equipped with automatic flight capabilities comparable to those of modern business jets and airliners This capability will extend to the presently VFR-only low speed flight and hover Among the avionic systems considered are such autopilot inner loop modes as stability augmentation (SAS) and attitude hold (ATT) System limitations are considered, and such new development activities as three-cue flight directors, inertial velocity stabilization, and heading stabilization through yaw are introduced O C

A81-40114 Lateral flutter of loads towed beneath helicopters and its avoidance A Simpson and J W Flower (Bristol, University, Bristol, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 23 p 9 refs

The aerodynamic instability problem of strop-supported freight loads is addressed An in-depth study is made of the lateral, low-frequency flutter of rectangular cargo containers supported by multi-strop arrangements, and it is shown that necessary conditions for flutter and divergence may be obtained in which the primary parameters are the static strop tensions at the current forward speed These criteria allow rapid assessment of lateral stability when only the longitudinal static aerodynamic characteristics are available for analysis An overview is also given of the state of the art of steady and unsteady aerodynamics for the case of towed bodies, and the need for more fundamental research in this area is highlighted O C

A81 40115 ASW helicopter/sonar dynamics mathematical model C R Guy, M J Williams, and N E Gilbert (Aeronautical Research Laboratories, Melbourne, Australia) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16 19, 1980, Conference Papers Part 2

Bristol, University of Bristol, 1980 17 p 19 refs

A mathematical model of a typical anti submarine warfare (ASW) helicopter and its sonar system is presented The model represents both performance and dynamic flight behavior over a wide range of conditions and incorporates the aerodynamics/kinematics of the helicopter, the control systems, pilot inputs, the cable/sonar dynamics and wind/sea state data The aerodynamics/kinematics is a three dimensional representation covering the operating flight envelope, where rotor aerodynamics are based on blade element and actuator disc theory The control systems contain models of both the flying controls and automatic flight control system, and the sonar cable and transducer model is formed by a number of attached, rigid links Consideration of the forces acting on each link enable the three-dimensional shape and motion of the complete cable and transducer to be predicted (Author)

A81-40116 A study of the effect of aft fuselage shape on helicopter drag D R Clark (Analytical Methods, Inc , Bellevue, WA) and F Wilson (Westland Helicopters, Ltd , Yeovil, Somerset, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 17 p 12 refs

The viscous flow into the base region of a typical helicopter fuselage is investigated by means of an analytic configuration modelling method A finite element, distributed singularity model was used for potential flow, with the presence of viscous effects (including the occurrence of separated flow regions) being accounted for iteratively A range of aft fuselage shapes was explored, with the lateral and vertical transition angles being changed independently It was found that (1) there was considerable interaction between the pressure fields generated by changes in vertical and horizontal cross section, and that (2) the pressure gradients experienced by the boundary layer on the surface can be extensively and favorably modified by the correct combination of the two effects O C

A81-40117 Aerodynamic design of engine air intakes for improved performance A Vuillet (Societe Nationale Industrielle Aérospatiale, Division Hélicopteres, Marignane, Bouches du-Rhône, France) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 9 p 8 refs

The methods and consequences of engine air intake design for small and medium-size helicopters are considered The research

efforts reported have made possible a significant reduction of fuel consumption and installation power losses It has also become possible to avoid major airstream separations on the fuselage, which would result in additional losses due to drag It is shown that the design parameters that fundamentally determine levels of efficiency are, in order of importance (1) the choice of air intake plane position on the fuselage, (2) intake surface area, (3) angle of incidence, (4) foreign object ingestion protection systems, (5) the relative thickness of the intake lips, (6) air duct design, and (7) the shape of the inlet lip It is concluded that although the performance prediction accuracy of theoretical methods is improving, wind tunnel tests remain necessary for high performance designs O C

A81 40118 An empirical prediction method for helicopter performance in low speed level flight and in vertical and forward flight climbs E H Smith (U S Navy, Naval Air Systems Command, Washington, DC) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 15 p 36 refs

This paper presents methods for the prediction of helicopter power requirements in low speed forward flight and in vertical and forward flight climbs The methodology is based on an extensive study of experimental data Available analytical prediction methods are summarized and compared with the data The data are reduced to non-dimensional forms that cause the data to collapse into a single trend for all of the aircraft considered The low speed forward flight data yield a single non-dimensional curve that relates the power required at any given speed to that required at hover and at the minimum power speed The vertical climb data also yield a single non-dimensional plot that relates the climb power requirement to the climb rate For forward climb, a single climb constant was found that is valid for all climb rates (Author)

A81-40119 A new approach to low speed-low height testing and flight manual data presentation A Faccenda, A Tedeschi, and M Galeazzi (Costruzioni Aeronautiche Giovanni Agusta S p A , Varese, Italy) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 17 p

A study is presented on (1) the minimization of low-speed, low-height flight testing hazards and costs, and (2) improvement of the presentation of flight manual information in the form of wheel height indicated air speed (height velocity, or HV) diagrams, which presently provide pilots with information that is often ambiguous The takeoff and landing path concept is treated as a minimum-risk zone, complemented by a high-risk zone that is defined more realistically than in the past For multi engine helicopters, a flyaway height is introduced as the upper boundary of the high-risk zone The use of a fly-away mathematical simulation model as an aid to test planning and as a presentation of information to operators is discussed, and calculated data are compared with flight test data for the A109A twin engine helicopter O C

A81-40120 * A pilot's assessment of helicopter handling-quality factors common to both agility and instrument flying tasks R M Gerdes (NASA, Ames Research Center, Moffett Field, CA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 18 p 7 refs

Results from a series of simulation and flight investigations undertaken to evaluate helicopter flying qualities and the effects of control system augmentation for nap-of-the-earth (NOE) agility and instrument flying tasks were analyzed to assess handling quality factors common to both tasks Precise attitude control was determined to be a key requirement for successful accomplishment of both tasks Factors that degraded attitude controllability were improper levels of control sensitivity and damping and rotor-system cross-coupling due to helicopter angular rate and collective pitch input. Application of rate-command, attitude-command, and control-input decouple augmentation schemes enhanced attitude control and significantly improved handling qualities for both tasks NOE agility and instrument flying handling-quality considerations, pilot rating philosophy, and supplemental flight evaluations are also discussed (Author)

A81-40121 Flight tests and statistical data analysis for flying qualities investigations K Sanders, H J Pausder, and D Hummes (Deutsche Forschungs- und Versuchsanstalt fur Luft und Raumfahrt, Institut fur Flugmechanik, Braunschweig, West Germany) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 25 p 5 refs

A new test and analysis technique has been developed and proven as a valuable tool for the evaluation of helicopter closed loop flying qualities in mission-oriented environments A detailed description is presented of the application of the technique to a hovering tracking mission element, selected from German anti tank helicopter mission specifications The statistical evaluation of the hovering tracking tests contains the determination of such parameters as standard deviations, variances, and peak-to-peak values The dynamical content of the measuring signals can be represented in such terms as steady states, reversals and continuous movements Diagrams are presented in which boundaries for pilot stress rating groups point out the optimal combination of tracking effectiveness and control activity O C

A81-40122 On the use of approximate models in helicopter flight mechanics G D Padfield (Royal Aircraft Establishment, Bedford, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 24 p 11 refs

This paper addresses several aspects of the prediction of helicopter flight behavior and emphasises the need for low order approximations to aid physical interpretation of important flying qualities The centre spring, rigid blade rotor model is used for predicting the integrated loads from hingeless and articulated rotors Stability derivatives, derived with this model, are then used in the search for simplified approximations to the short term pitch attitude response to cyclic pitch control, throughout the speed range The method of weakly coupled systems provides a mathematical frame work for the analysis which is applied to the prediction of flight path trajectories during transient manoeuvres The use of truncated dynamic models for combined pitch and roll maneuvres is also discussed (Author)

A81-40123 Parameter identification of a hingeless rotor helicopter in flight conditions with increased instability M Kloster, H Schaufele (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany), and J Kaletka (Deutsche Forschungs und Versuchsanstalt fur Luft und Raumfahrt, Braunschweig, West Germany) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 22 p 21 refs

Feedback control, input signal optimization and measurement equipment are described and discussed for helicopter flight test condition in which the helicopter phugoid showed increasing instability Among the topics discussed are (1) helicopter dynamics in hover and in forward level flight, (2) feedback control, (3) computer simulations, (4) data processing, and (5) the identification of force, rolling moment, pitching moment, yawing moment and control derivaties Good agreement was found between theoretical predictions and the identified derivatives O C

A81-40124 Research into a helicopter rotor's speed and load factor limits B Certain and J M Besse (Societe Nationale Industrielle Aerospatiale, Division Helicopteres, Marignane, Bouches du Rhône, France) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 12 p

Using as an example the performance of the SA 365N, 3,800-kg twin-engine helicopter, the origins of such physical phenomena forming barriers to the further expansion of helicopter flight envelopes as stall flutter and limit Mach number are probed The equipment used in measurement, in-flight monitoring and the processing and analysis of data is discussed, and the flight testing

method as a whole is described It is shown that the difficulty of flight envelope testing lies in its large number of parameters, the fragility of gauges, variable calibration, and interference, and also in the accuracy of such test points as load factors in entering or leaving a turn at a specified speed O C

A81-40125 * Identification of a linear model of rotor-fuselage dynamics from nonlinear simulation data R W DuVal and D B Mackie (NASA, Ames Research Center, Moffett Field, CA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 25 p 7 refs

Linear regression techniques are used to obtain 9- and 12-degree of-freedom linear rotorcraft models from the input-output data generated by a nonlinear, blade-element rotorcraft simulation in hover The resulting models are used to evaluate the coupling of the fuselage modes with the rotor flapping and lead-lag modes at various frequencies New techniques are proposed and evaluated to improve the identification process, including a method of verifying the assumed model structure by using data sets generated at different input frequencies (Author)

A81-40126 Reliability of commercial helicopters W B Petrie (Bristow Helicopters, Ltd , Redhill, Surrey, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 10 p

It is shown that reliability will directly affect the direct operating costs of an aircraft Attention is given to a reliability program which will rely on continuous routine assessment of system malfunctions, component defects, and failure rate trends Two basic questions which have to be answered before any reliability program is instituted are related to the effect of failure on safety and on economics Reliability problems are especially complex in the case of helicopters One of the reasons is related to the designer's inability to build in alternative structural load paths or redundant systems in the case of rotor blades, dynamic structures, and transmissions Other reasons include the high vibration levels of helicopter operation and the intolerant environment in which the helicopter spends most of its life Commercial helicopter operators would like aircraft design with greater emphasis on improved maintenance and reliability Attention is given to composite rotor blades, cockpit indication of blade integrity, and emergency lubrication systems G R

A81-40127 Advanced debris monitoring systems for helicopters T Tauber (Technical Development Co , Glenolden, PA) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 18 p

Bearing and gear failures, which can precipitate the loss of proper drive system operation, can be detected by monitoring the lubrication system for entrained metal debris particles which are shed into the oil by the failing water surfaces As new debris monitoring technologies emerge, some of them well suited to interfacing with future aircraft's computers, integration of the debris monitoring system into the entire helicopter will become essential Until recently, only three debris monitoring technologies were in use on helicopters, including magnetic chip detectors, electric chip detec tors, and spectrometric oil analysis Attention is given to full flow debris monitoring, the pulsed chip detector, and quantitative debris monitoring It is pointed out that a Quantitative Monitoring System is currently being considered for a major new European helicopter program G R

A81-40128 Helicopter cockpit design for night goggle compatibility G F H Lloyd (Royal Aircraft Establishment, Flight Systems Dept , Farnborough, Hants , England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 17 p 8 refs

The use of night goggles by helicopter pilots for low-altitude flying is examined with reference to the problems of instrument lighting, narrow depth of field inside the cockpit, and reflections The particular problems inherent in the 'superdim' lighting approach are explained by examining the different spectral responses of the human eye and image intensifiers and the behavior of tungsten-filament bulbs operated at lower than standard voltages A method of cockpit lighting is proposed whereby separate floodlights are used with no infrared emission, two improved focusing systems are described V L

A81-40129 Flight evaluation of a helmet mounted LED matrix display in a Lynx helicopter A Cort (Westland Helicopters, Ltd , Yeovil, Somerset, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 17 p

A prototype of a helmet mounted head-up display has been evaluated in a multi-role Lynx helicopter with reference to its usefulness as a means of providing pilots with flight or weapons information while allowing them to watch outside the cockpit The system employs an array of light emitting diodes whose light is projected onto a portion of the pilot's visor which nevertheless remains transparent to light coming from outside The system has been found effective, especially at low altitudes V L

A81-40130 Weapon system evolution of attack helicopters W Dieter and M Riffel (Elektronik-System-Gesellschaft mbH, Munich, West Germany) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 16 p

The latest developments in the avionics and weapons systems of helicopters are reviewed with reference to navigation and aircraft guidance, communications, reconnaissance, weapon delivery, and electronic warfare The trends discussed include the use of self-contained navigation systems in conjunction with opto-electronic imaging systems, the use of global positioning systems, head-up displays, jam resistant broad band data links, passive reconnaissance during nighttime with thermal imaging sensors, the use of wire-guided missile systems, identification and missile guidance by microwave radars, and the use of anti-helicopter armament V L

A81-40131 Integrated multiplex for the Agusta A-129 attack helicopter J I Ohlhaber (Harris Corp , Government Systems Group, Melbourne, FL) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16 19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 14 p

A program has been initiated to fully integrate the electrical and electronic subsystems as well as the cockpit instrumentation of the Agusta A 129 attack helicopter The system will utilize redundant data bus communication, multimode cockpit displays, digital flight control with backup fly by-wire, and armament management, all controlled through a central processor system These integration measures are expected to increase pilot effectiveness in giving him better controls and displays with more usable information and increase aircraft performance, survivability, and reliability V L

A81-40132 The digital core avionics system S D Roy (Westland Helicopters, Ltd , Yeovil, Somerset, England) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 10 p

The paper examines the concept of digital core avionics which involves the creation of a basic system common to a fleet of helicopters and economically adaptable to meeting different mission or role requirements The core system is a distributed system architecture using microprocessors in the interface units for general purpose computing and a standard multiplex data bus to inter connect core system components The purpose of the core system is to perform the processing, control, and display of the functions associated with basic vehicle operations V L

A81-40133 Avionics system design requirements for the United States Coast Guard HH-65A Dolphin D A Young (U S Coast Guard, Aircraft Program Office, Grand Prairie, TX) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 10 p

The avionics system requirements for a Short Range Recovery HH-65A helicopter are discussed, emphasizing the system's architecture, capabilities, reliability, and adaptability to a wide variety of military and commercial purposes Specifications of the avionics system are aimed to relegate routine functions of flight control, navigation, and power train management to an automatic mode The Flight Management System (FMS) constitutes the heart of the system operation, taking part in navigation sensory, communications, flight guidance, radar and air data sensory A multiplex data bus system is essential to the lightweight and efficient operation of the FMS An Automatic Flight Control System (AFCS) provides hands off attitude and heading retention, stability/command augmentation for manual flight, automatic trim in all axes, and full coupling to the navigation systems through the flight director The Flight Director System is used to provide flight guidance information to the AFCS, computing pitch roll, and collective steering commands The Transition to Hover mode of this system enables the pilot to fly an entire maneuver automatically The HH-65A will also incorporate an Engine Condition Monitoring System, a Horizontal Situation and Video Display, and a Forward Looking Infrared video J F

A81-40134 Optimal higher harmonic blade pitch control for minimum vibration of a hinged rotor L Beiner (Negev, University, Beersheba, Israel) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16 19, 1980, Conference Papers Part 2 Bristol, University of Bristol, 1980 21 p 7 refs

A simple rotor model is used to obtain closed form expressions for the optimal b/rev blade pitch required to suppress the b/rev hub axial force of a b-bladed hinged rotor Explicit control laws are obtained for b = 2, 3, and 4 As a predominant influence, the required b/rev blade pitch amplitude is shown to increase with airspeed as mu to the 6th For flight conditions and rotor characteristics in the range of usual applications, the optimal pitch amplitude does not exceed values in the range 0 04 deg for b = 4 to 1 5 deg for B = 2 The results are shown to be in satisfactory agreement with wind-tunnel test data for a 2- and 4-bladed hingeless rotor V L

A81-40135 Gust response of rotary wing and its alleviation S Saito, A Azuma (Tokyo, University, Tokyo, Japan), and M Nagao (Olympus Optical Co , Ltd , Tokyo, Japan) In European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers Part 2

Bristol, University of Bristol, 1980 15 p 11 refs

A feed back system is proposed for alleviating the gust response of the helicopter rotor The system employs sensors which detect the flapping motion of the respective blade and actuators which control the pitch angle of the blade in accordance with the signal received The validity of the system is demonstrated by theoretical calculations based on the local momentum theory for the gust responses of the complete dynamic system of a helicopter in sinusoidal and step gusts V L

A81-40137 * # Computerized three-dimensional aerodynamic design of a lifting rotor blade M E Tauber and R M Hicks (NASA, Ames Research Center, Moffett Field, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 12 p 12 refs (AHS 80-2)

A three-dimensional, inviscid, full-potential lifting rotor code was used to demonstrate that pressure distributions on both advancing and retreating blades could be significantly improved by perturbing local airfoil sections The perturbations were described by simple geometric shape functions To illustrate the procedure, an example calculation was made at a forward flight speed of 85 m/sec (165 knots) and an advance ratio of 0 385 It was found that a minimum of three shape functions was required to improve the pressures without producing undesirable secondary effects in high speed forward flight on a hypothetical modern rotor blade initially having an NLR-1 supercritical airfoil Reductions in the shock strength on the advancing blade could be achieved, while simultaneously lessening leading-edge pressure gradients on the retreating blade The major blade section modifications required were blunting of the upper surface leading edge and some reshaping of the blade's upper surface resulting in moderately thicker airfoils (Author)

A81-40138 Hover performance methodology at Bell Helicopter Textron J D Kocurek, L F Berkowitz, and F D Harris (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 36th Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 48 p 17 refs (AHS 80-3)

During the past year a new hover performance methodology has become the standard for production design use at an American aerospace company The methodology is centered around a lifting surface analysis of the isolated main and tail rotors The analysis features an improved calculation of induced torque, a refined treatment of three dimensional compressibility, and a circulation coupled prescribed wake that permits application to a wide variety of rotors With this basic methodology, total aircraft performance is built up by considering airframe downloading, anti-torque and accessory power requirements, and power transmission efficiencies The considered Hover Performance Methodology establishes a structured, documented procedure and a data base from which further refinements can be made with continuity and clear recognition of technical position G R

A81-40139 The experimental and analytical definition of helicopter modeling effects A H Logan (Hughes Helicopters, Culver City, CA), D R Clark (Analytical Methods, Inc , Bellevue, WA), A Phelps (U S Army, Structures Laboratory, Hampton, VA), F D Raitch, and D Hollenbaugh (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 13 p 8 refs (AHS 80 4)

This paper describes the results of an analytical and experimental investigation into helicopter model configuration effects In this effort, a single helicopter model was analyzed and tested at two different scales to determine the effects of full and partial fuselage representation, full and partial main rotor wake representation, hub rotational advance ratio, and engine air flow/exhaust simulation The helicopter model used was the YAH-64 The analysis was conducted using program DRAG which is a fully interactive viscous wing/body computer code The testing was conducted at the NASA/Langley V/STOL tunnel and the data recorded include surface pressure data as well as forces and moments for the isolated main rotor hub, pylon and fuselage The data presented and discussed indicate that a larger than predicted tunnel correction should be applied to the large scale model Using this correction, the analysis, small scale, and large scale surface pressure data correlate well In addition, the data indicate a model scale Reynolds number of 300,000 is needed to measure full-scale forces accurately Also, model airflow simulation significantly influences model forces and should be included The effects of main rotor wake and hub rotation are also discussed (Author)

A81-40141 The development of a twin-turbofan V/STOL aircraft M V Ciminera (Grumman Aerospace Corp , Bethpage, NY) In American Helicopter Society, Annual Forum 36th Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 16 p (AHS 80-8)

Grumman has been developing a V/STOL turbofan aircraft with vanes in the fan stream for zero speed control The twin tilting nacelles contain all of the VTOL functions (thrust, thrust modulation, and control), the wing is sized to house an embedded radar for AEW functions Over 4 years of development testing has been completed on this concept which is designated Design 698 It has been used in US Navy studies culminating in a full-scale (TF34 engine) model test at NASA Ames Using Design 698 as the baseline vehicle concept, the areas discussed are design evolution, small-through full-scale tests of the control vanes, the effects of major technologies on aircraft size, unique model test setups, and development of the propulsion and flight control systems (Author)

A81-40143 Preliminary evaluation of RSRA data comparing pure helicopter, auxiliary propulsion and compound helicopter flight characteristics P J Arcidiacono, G deSimone, and J Occhiato (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings

Washington, DC, American Helicopter Society, 1980 17 p 7 refs (AHS 80-10)

The unique measurement capabilities of the RSRA are illustrated by examining representative technical topics of interest to the designer/analyst relative to the three basic aircraft configurations tested during the course of the qualification testing The three configurations tested include an aircraft whose lift and propulsive force are provided by the main rotor, an aircraft whose lift is provided by the main rotor, but whose propulsive force is provided in some measure by an auxiliary propulsion unit, and an aircraft whose lift and propulsive force are provided in some measure by auxiliary wing and propulsion units The primary purpose of the tests was to expand the flight envelope and structurally qualify the aircraft Attention is given to general aircraft description, aircraft operating attitudes, lift and drag comparisons, flight mechanics, and dynamics load and vibration G R

A81-40144 Mission potential of derivatives of the XV-15 tilt rotor research aircraft R K Wernicke, K G Wernicke (Bell Helicopter Textron, Fort Worth, TX), and D C Borgman (US Army, Aviation Research and Development Command, St Louis, MO) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 13 p (AHS 80-11)

The considered aircraft is currently demonstrating the capability of the tilt rotor concept The Army/NASA Tilt Rotor Research Program was initiated in 1972 to provide proof of concept for operational evaluation of the tilt rotor concept Evaluated were the potential for missions related to offshore oil exploration, search and rescue, and anti-helicopter operations It could be shown that in an offshore transport configuration the XV-15 would provide faster services over longer ranges at a lower passenger-mile cost than available helicopters As a search and rescue aircraft, the XV 15 possesses a unique combination of rotary wing and fixed wing attributes which make it the most mission-effective rescue aircraft type In the armed anti-helicopter role, it promises to revolutionize tactics developed for the helicopter G R

A81-40145 ABC development status and design considerations for several military applications D H Halley and L G Knapp (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 20 p (AHS 80-12)

The Advancing Blade Concept (ABC) is the product of a 15-year research and development program, the last seven years of which have included the successful flight test program of the XH-59A Demonstrator Design studies addressing specific missions indicate that ABC designs are attractive for missions requiring good hover and loiter efficiencies, shipboard or restricted area compatibility, low-speed maneuverability and one-engine-inoperative capability, low downwash velocities, compatibility with a variety of sensors and weapons, and speeds in the range of 200 to 300 knots (Author)

A81-40146 Achieving the full benefits of integrated multiplex in the 1980's D B Kanaly (Harris Corp , Government Information Systems Div , Melbourne, FL) In American Helicopter Society, Annual Forum, 36th Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 12 p (AHS 80 15)

Integrated Multiplex is a system design technique utilizing recent advances in digital electronics to implement subsystems aboard a vehicle with substantially less equipment Benefits of Integrated Multiplex are related to reduction in circuitry and other hardware, greater reliability, and enhanced survivability due to the redundant architecture employed All new military helicopter designs now assume the use of Integrated Multiplex However, it is currently only practical to integrate half of what functionally should be integrated If ways could be found to make it practical to integrate the other half, the benefits can be more than doubled The practical constraints which prevent this doubling of benefits are examined and approaches are discussed for overcoming the constraints G R

A81-40147 * # Navigation errors encountered using weather-mapping radar for helicopter IFR guidance to oil rigs J D Phillips, J S Bull, D M Hegarty, and D C Dugan (NASA, Ames Research Center, Moffett Field, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 10 p 5 refs (AHS 80 16)

In 1978 a joint NASA FAA helicopter flight test was conducted to examine the use of weather mapping radar for IFR guidance during landing approaches to oil rig helipads The following navigation errors were measured total system error, radar-range error, radar-bearing error, and flight technical error Three problem areas were identified (1) operational problems leading to pilot blunders, (2) poor navigation to the downwind final approach point, and (3) pure homing on final approach Analysis of these problem areas suggests improvement in the radar equipment, approach procedure, and pilot training, and gives valuable insight into the development of future navigation aids to serve the off shore oil industry (Author)

A81-40148 Subsystem status monitor J P McGee (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 10 p (AHS 80-17)

The reduction of the crew workload is an important factor for the improvement of helicopter mission effectiveness The past and predicted growth in the number and complexity of subsystems in US Army helicopters has made subsystem monitoring a prime candidate for design efforts aimed at the reduction of this workload A Subsystem Status Monitor study was conducted to explain suitable approaches for subsystem monitoring Conclusions of this study are discussed Properly human engineered in terms of display logic, formats, and contents, the use of on-board computers and multi function electronic displays can be effectively applied to the conversion of instrument panel space, improvement of out of cockpit visibility, and reduction of in-cockpit eye-time and workload during the monitoring of helicopter subsystems Computerized voice warning and voice recognition technologies should be considered for application to subsystem status monitoring G R

A81-40149 # Summary of interface testing of the digital AN/ASN-123 tactical navigation avionic system in the SH-3H helicopter R S Blevins (US Navy, Naval Air Test Center, Patuxent River, MD) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 6 p (AHS 80-18)

Installation of the digital computerized AN/ASN 123 TACNAV system in the SH 3H helicopter enhances the Anti Submarine Warfare (ASW) capability and reduces cockpit workload by computing and providing a visual display of the tactical horizontal situation A description is presented of the interface problems encountered and the testing performed to find the inaccuracies and errors created by combining a new avionics system and an aged helicopter with 'old' sensors Attention is given to system interface/navigation tests, environmental interface tests, sensor accuracy, system/aircraft interfaces, the man/machine interface, and growth provisions G R

A81-40150 Microprocessor control of lamps MK III /Seahawk/ helicopter sonobuoy launcher system F J Silverio and D Anttila (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 10 p (AHS 80-20)

The application of microprocessor technology makes it possible to implement functions and safeguards in helicopter weapon systems not previously practical in conventional analog design The LAMPS Mk III sonobuoy launcher system is an example of this technology The launcher system is an aircraft weapon subsystem which provides for the carrying and launching of 25 sonobuoys in response to the processor/controller determination that the selection logic and safety interlocks have been satisfied in the required sequence for normal launch or emergency jettison mode (Author)

A81-40151 Coupled rotor/airframe vibration analysis by a combined harmonic-balance, impedance-matching method T -K Hsu and D A Peters (Washington University, St Louis, MO) In

American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. Washington, DC, American Helicopter Society, 1980 13 p Grant No DAAG29-77 G-0103 (AHS 80-21)

A coupled rotor/airframe vibration analysis is performed by the matching of rotor and fuselage impedances The rotor impedance for the blades is calculated from the periodic-coefficient equations of a single blade in forward flight Three flapping modes are included, and the equation is solved by harmonic balance The fuselage impedance, including structural damping, is calculated for three rigid-body and three elastic modes in plunge, roll, and pitch The results show that the effect of hub motions on rotor loads is greatest for relatively stiff rotors, and is not well approximated by lumped-mass or purely inertial rotor models (Author)

A81-40152 LIVE - Liquid inertia vibration eliminator D R Halwes (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, *American Helicopter Society, 1980* 6 p (AHS 80-22)

Anti resonant isolation concepts utilizing a spring, which were developed to isolate the fuselage from the helicopter's main rotor oscillatory forces, were found to have certain drawbacks In 1972, research started using a hydraulic fluid in cylinders with different areas to amplify the motion of a tungsten piston as a tuning weight This concept progressed to a very compact system that was first tested in 1978 using a high density low-viscosity liquid (mercury) as both the 'hydraulic fluid' and the tuning weight The action of this Liquid Inertia Vibration Eliminator unit is discussed Attention is given to hydraulic nodalization, research hardware development, and 206B/LIVE configuration and flight test It is pointed out that the LIVE concept provides isolation performance equal to a conventional mechanical anti resonant isolator with significant savings in weight, cost and maintenance G R

A81 40153 Wind tunnel evaluation of aeroelastically conformable rotors R H Blackwell, R J Murrill (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT), W T Yeager, Jr (U S Army, Structures Laboratory, Hampton, VA), and P H Mirick (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 17 p 7 refs (AHS 80-23)

Recent years have seen both theoretical and experimental research into the concept of the rotor as a conformable object The general object of the described investigation was to further the understanding of blade torsional response and its role in the blade design process The specific objectives were to evaluate the conformable rotor concept by substantiating performance and rotor load benefits predicted by the analysis, to assess the adequacy of current analytic methods and to provide a data base to guide future design work The approach adopted was to utilize a state of the art aeroelastic response analysis to select principal blade parameters and rotor attributes for study and then to build and test model rotors which provided systematic variations in the key parameters The test program was conducted in the Langley Research Center Transonic Dynamics Tunnel G R

A81-40154 Aeroelastic stability analysis of hingeless rotor helicopters in forward flight using blade and airframe normal modes R T Lytwyn (Boeing Vertol Co , Philadelphia, PA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 11 p 10 refs (AHS 80 24)

A mathematical computer model for evaluating aeroelastic stability of single rotor helicopters, in which blade and elastic fuselage motions are defined by means of appropriate normal modes, is described and evaluated against experimental data for aeroelastic stability in hover and in forward flight. The model utilizes a discrete representation of elastic blade modes for the definition of aeroelastic stability equations of the entire coupled rotor and fuselage system, and applies Floquet analysis for stability definition of the complete aeroelastically coupled rotor and helicopter fuselage system in forward flight. The paper describes the mathematical model structure, the analytical formulation, and a systematic damping correlation with experimental results for aeroelastic stability from model testing, full scale whirl tower studies, and Bearingless Main Rotor (BMR) flight evaluations (Author)

A81-40155 # An experimental investigation of the effects of aeroelastic couplings on aeromechanical stability of a hingeless rotor helicopter W G Bousman (U S Army, Aeromechanics Laboratory, Moffett Field, CA) In *American Helicopter Society, Annual Forum*, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 14 p 9 refs (AHS 80-25)

A 1 62-m diameter rotor model was used to investigate aeromechanical stability, and the results were compared to theory Configurations tested included (1) a non matched stiffness rotor as a baseline, (2) the baseline rotor with negative pitch-lag coupling, (3) the combination of negative pitch lag coupling and structural flap-lag coupling on the baseline rotor, (4) a matched stiffness rotor, and (5) a matched stiffness rotor with negative pitch lag coupling The measured lead-lag regressing mode damping of the five configurations agreed well with theory, but only the matched stiffness case with negative pitch-lag coupling was able to stabilize the air resonance mode Comparison of theory and experiment for the damping of the body modes showed significant differences that may be related to rotor inflow dynamics (Author)

A81-40156 # Effects of rotor-body coupling in a linear rotorcraft vibration model D L Kunz (U S Army, Aeromechanics Laboratory, Moffett Field, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. Washington, DC, American Helicopter Society, 1980 16 p 16 refs (AHS 80-26)

A full coupled, linear rotorcraft vibration analysis using a harmonic balance solution is used to examine the effect of rotor-body coupling on helicopter vibration response Hub pitching-moment results for both hub-fixed and fully coupled systems are presented for a range of blade stiffnesses and uncoupled body frequencies These results show significant effects due to intermodal coupling and interharmonic coupling, as well as those due to the coupling between the rotor and the body For an approximation to where the vibratory responses will be large, coupled system eigenvalues can be used, however, they will not give any indication of the magnitude of the response It is also shown that hub moments calculated with the hub fixed do not adequately approximate the coupled moments and, therefore, will not be suitable for an accurate predictive analysis (Author)

A81-40157 X-wing stability and control development and wind tunnel demonstration tests - Helicopter, conversion, and fixed wing flight A J Potthast (Lockheed-California Co , Burbank, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 13 p 12 refs (AHS 80-27)

The X-wing aircraft combines the characteristics and attributes of a helicopter with those of a high aspect ratio transonic aircraft. A single wing/rotor lift and control system is combined with a conventional aircraft fuselage and tail The proposed stability and control concept uses cyclic and collective modulation of rotor/wing circulation control air with hub moment feedback and conventional augmentation The concept utilizes rotor/wing circulation control technology A 25-foot diameter rotor/wing and breadboard control system model, for a potential X wing demonstrator aircraft, was fabricated and tested in the NASA/Ames 40 x 80 foot wind tunnel The tests were completed in May, 1979 A brief description of the X-wing aircraft, aerodynamic lift, and control concept which makes possible continuous lift and control during rotary, conversion between rotary and fixed, and fixed wing modes of flight is provided Analytic methods used to predict control and stability characteristics are briefly described Test results are compared with predictions, and conclusions are drawn relative to a control configuration for a flight aircraft. (Author)

A81-40158 # Results of a simulator investigation of control system and display variations for an attack helicopter mission E W Aiken and R K Merrill (U S Army, Aeromechanics Laboratory, Moffett Field, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings

Washington, DC, American Helicopter Society, 1980 25 p 7 refs (AHS 80-28)

A piloted simulator experiment designed to assess the effects on overall system performance and pilot workload of variations in control system characteristics and display format and logic for a nighttime attack helicopter mission is described The simulation facility provided a representation of a helmet mounted display image consisting of flight-control and fire-control symbology superimposed on the background video from a simulated forward looking infrared sensor Control systems ranging from the baseline stability and control augmentation system to various hover augmentation schemes were investigated together with variations in the format and logic of the superimposed symbology Selected control system and display failures were also simulated The results of the experiment indicate that the baseline control/display system is unsatisfactory without improvement for the evaluation task which included a hovering target search and acquisition Significant improvements in pilot rating were achieved by both control system and display variations (Author)

A81-40159 Flight test results for task oriented flying qualities evaluation H J Pausder and B L Gmelin (Deutsche Forschungs und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugmechanik, Braunschweig, West Germany) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 15 p 17 refs (AHS 80-29)

Attention is given to a technique which has been developed for establishing a data base and recommendations for mission oriented flying qualities The technique was conceived in connection with the objective to replace, in the evaluation of a specific helicopter system, pilot opinions by objective scales, which would make it possible to quantify the requirements for the aircraft, estimate the characteristics of a project at an early stage, and perform the evaluation of an aircraft with a minimum of tests Aspects of task definition are considered along with flight tests, data collection, pilot evaluation, data analysis, statistical parameters, parameters relevant to evaluation, and the interpretation of hovering tracking results G R

A81-40160 * # A piloted simulator investigation of static stability and stability/control augmentation effects on helicopter handling qualities for instrument approach J V Lebacqz (NASA, Ames Research Center, Moffett Field, CA) and R D Forrest (FAA, Moffett Field, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 23 p 15 refs (AHS 80-30)

A ground simulator experiment was conducted on the Flight Simulator for Advanced Aircraft at Ames Research Center to investigate the influence of several static stability and stability/control augmentation design parameters on helicopter flying qualities during terminal area operations in instrument conditions Effects of light turbulence were included Two levels of static stability in each rotational axis (pitch, roll, yaw) were examined for a hingeless rotor configuration The variations in pitch and roll were (1) stable and (2) neutral static stability, in yaw there were two stable levels Four types of stability/control augmentation were also examined for the lower level of static stability in each axis This latter investigation covered three helicopter rotor types hingeless, articulated, and teetering Four pilots performed a total of 105 evaluations of these parameters for a representative VOR instrument approach task Pilot rating results indicate the acceptability of neutral static stability longitudinally and laterally and the need for pitch roll attitude augmentation to achieve a satisfactory system (Author)

A81-40161 Helicopter gust alleviation - An optimal sampled-data approach P E Zwicke (United Technologies Research Center, East Hartford, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 13 p 7 refs (AHS 80-31)

Helicopter ride quality is largely determined by the vibration level in the fuselage and the sensitivity of the fuselage to gust disturbances Considerable progress has been made over the years in reducing gust sensitivity and vibration level through improved mechanical and aerodynamic design These approaches, however, are static in the sense that they cannot adapt to changing flight conditions An alternate means of achieving gust alleviation and vibration reduction is through active control of the helicopter rotor blade pitch Sikorsky Aircraft in conjunction with United Technologies Research Center, has investigated the application of modern control techniques to gust alleviation and vibration reduction This paper describes the design of the gust alleviation controller The control configuration consists of an optimal sampled data digital controller coupled with an optimal one step-ahead predictor A sampled-data approach for the control was chosen to facilitate future implementation with an on board digital computer The predictor permits an estimate of the unmeasured gust disturbance magnitude to minimize gust effects on the helicopter fuselage (Author)

A81-40162 'Load snubbing' - A solution to the problem of terrain flying with external cargo T S Garnett, Jr (Boeing Vertol Co, Philadelphia, PA) and T B Allardice (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 18 p 11 refs (AHS 80-32)

In order to survive the hostile enemy air defense threat existing on mid-intensity battlefields of the future, the CH-47 helicopter will engage in terrain flying while performing external cargo resupply missions A comprehensive flight simulation analysis was conducted recently for the Army, to define Chinook capabilities and limitations related to terrain flight with external payloads Load 'snubbing' was identified as the best approach for minimizing unfavorable load motion, stability, and masking problems typical of conventional sling suspension schemes Preliminary design development of the snubbing concept produced an External Cargo Handling System (ECHS), capable of transporting 8 x 8 x 20 foot MILVAN or Gondola containers The ECHS consists of an electrically powered self hoisting interface adapter framework, which rigidly snubs the MILVAN against the aircraft landing gear to prevent motion and provide vibration isolation Wind tunnel testing of the concept

A81-40163 Computerized gear grinding system development F A Marcenaro (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 5 p (AHS 80-48)

This paper describes extensive modifications made to current form wheel gear grinding equipment in order to create adequate interface with microcomputer control A new grinding cycle has been developed and full computer control has produced significant improvements in reliability, quality and cost of aerospace type gears Management information, made available through a central terminal, supplies a new insight towards a fully computerized shop management. (Author)

A81-40164 A hybrid composite horizontal stabilizer for the XH-2/CCR Flight Demonstrator Aircraft F B Clark (Kaman Aerospace Corp, Bloomfield, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 6 p (AHS 80-35)

A hybrid composite stabilizer, utilizing graphite and S glass epoxy laminae has been designed and fabricated The stabilizer will be flown on the Circulation Control Rotor Flight Demonstrator Aircraft for the XH 2/CCR This is a stiffer and lighter structure than the present component The unique feature of this design is the box beam hollow spar that tapers in two dimensions from mid-span to tip Details of design, fabrication and initial testing of the stabilizer are reported Primary emphasis is on the manufacturing process and method for making a hollow monolithic structure by utilizing expandable composite mandrels which, upon final assembly cure, become inner walls of the structure (Author)

A81-40165 Advancements in dimensional inspection of helicopter gearboxes and transmission cases E V Maier (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980,

Proceedings Washington, DC, American Helicopter Society, 1980 9 p (AHS 80-36)

Seeking an operationally simple alternative inspection method from the prior concept of expensive dedicated gages (composite gage systems built to inspect one specific part number), Bell Helicopter Textron purchased a computer assisted Zeiss UMM-800 Universal Measuring Machine This paper discusses the new concept and its immediate success with the tasks of intersection and alignment inspection of the Model 222 Transmission Cases and Gearboxes Included are discussions on accuracy, speed of inspection, versatility, simplicity of operation for both inspector and programmer, and the future possibility of a similar system as a true quantitative inspection technique for spiral bevel gear tooth forms (Author)

A81-40167 Development of small fuel efficient aircraft engines P E Beam, Jr (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, IN) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 13 p (AHS 80 38)

This paper discusses the development of small (1000 horsepower or less) fuel efficient turboshaft and turboprop engines Basic cycle requirements for improving the fuel efficiency of simple cycle, regenerative, intercooled, and intercooled/regenerative cycle engines are reviewed It is shown how these cycle requirements lead to the need for the technology advances associated with higher cycle pressure ratio and higher turbine temperatures These changes can result in far different, and in some cases more difficult problems in small engines than in larger engines Progress in developing components for small fuel efficient engines is illustrated by Detroit Diesel Allison's (DDA) development of higher pressure ratio centrifugal compressors, axial, and radial flow air cooled turbines and ceramic turbine components (Author)

A81-40168 Regenerative engine for helicopter application A E Easterling and P Chesser (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 5 p (AHS 80 39)

This paper presents a brief background of regenerative engine efforts and a comparison of three variations of gas turbine engine cycles for helicopter application Cycle parameters were varied systematically, and the resulting engine performance characteristics were then used as an input on a selected helicopter's performance and mission capability Specifically, a comparison is made between a regenerative engine with a variable power turbine nozzle and the T63 A 720 engine using an OH-58C helicopter in a scout mission to determine fuel utilization, and mission capability (Author)

A81-40169 A new approach to turboshaft engine growth M A Compagnon (General Electric Co , Lynn, MA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 7 p (AHS 80-41)

A new approach to increase the power output of an existing turboshaft engine is presented The approach, which consists of supercharging the gas generator by means of a booster stage, has recently been evaluated experimentally under a program sponsored by the U S Army The turboshaft booster stage and its integration with a T700 engine is described, and the results of the engine demonstration of this new growth concept are presented The results obtained show that the application of a booster stage to turboshaft engines is an effective way to increase the power output of turboshaft engines (Author)

A81-40170 The requirements for efficient small turbine engines taking up the challenge R S Taylor (Hughes Helicopters, Commercial Helicopter Div , Culver City, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 8 p (AHS 80-42)

Continued growth with respect to helicopter applications is limited only by the capability of the manufacturers to produce machines to meet the imaginative requirements of the operators An appeal is made to the engine manufacturers to develop engines for a large market segment which is, as yet, untouched A case is made for a 300 HP turbine engine which can be used in pairs to power an efficient 6 place twin engine machine or singly for a small trainer type helicopter Attention is given to the development of a commercial helicopter, the market, twin engine helicopters, and the characteristics of a custom helicopter for executive transport G R

A81-40171 NDEC - A control concept for helicopter gas turbines D J Hawes and R M Evans (Aviation Electric, Ltd , Montreal, Canada) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 17 p Department of Industry, Trade and Commerce of Canada Contract No 9ST79-00058 (AHS 80-44)

The 'NDEC' (Speed, N, based Digital Electronic Control) is a low-cost sophisticated electronic control, initially configured to control a twin Helicopter Gas Turbine installation, but capable of being adapted for small turbo-fan or turbo-prop use By balancing the requirements of the Gas Turbine engine, with the characteristics of the microprocessor, a fundamentally simple, but very flexible and cost effective control concept has been realized Basically, the system converts the control parameters into Gas Generator speed and acceleration demands, and compares them in 'Min Select' gates, so that the minimum Acceleration term is integrated and the resultant speed error signal used to modulate the fuel flow Attention is given to control functions, system software implementation, an evaluation of the control concept, and the results of a control concept simulation G R

A81-40172 # Advanced composite airframe program - Preliminary design phase L T Mazza (U S Army, Applied Technology Laboratory, Fort Eustis, VA) and R L Foye (U S Army, Research and Technology Laboratories, Moffett Field, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 10 p 25 refs (AHS 80-45)

The major technology void that remains concerning the utilization of composite materials for helicopter construction applications is related to an employment for the main cabin section and the integration of this major component into the remainder of the airframe In connection with efforts to eliminate this void, the Advanced Composite Airframe Program (ACAP) was initiated This program will demonstrate some methods for using advanced composites in the primary airframe structure of a military helicopter Exploratory research indicated that an advanced composite airframe on a utility helicopter can increase payload and productivity by as much as 70% Moreover, the ability of the aircraft to perform its military mission will be enhanced, it will have a reduced radar signature, and it will be considerably more maintainable and repairable ACAP is a three phased program for the design, fabrication, test, and flight demonstration of a helicopter in which composite materials and composite design concepts will be extensively used in the airframe structure G R

A81-40173 Composite flight service evaluation program for helicopters D J Baker (U S Army, Structures Laboratory, Hampton, VA) and A J Gustafson (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 9 p (AHS 80-46)

Composite materials offer important benefits to the helicopter manufacturer and operator However, these materials must be proven and accepted by the manufacturer, the operator, and the FAA prior to commitment to production Acceptance of these new materials is largely determined by initial cost and acceptable durability To determine the long-term durability of these materials in helicopter service, NASA and U S Army Research and Technology Laboratories have initiated two flight service programs. Existing metal components will be replaced by composite components on the Bell Model 206L and U S Army OH 58 helicopters for commercial and military service, respectively Performance of these components will be monitored during 10 years of actual flight service (Author)

A81-40174 All composite helicopter airframe roof structure M J Rich and B F Kay (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society,

Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings. Washington, DC, American Helicopter Society, 1980 6 p (AHS 80-47)

The considered investigation is concerned with the design, the fabrication, and the test of structural elements, taking into account skins, stringers, frames, and mechanical and bonded joints The elements were combined into the design and fabrication of a segment of the fuselage shell structure The 20% weight saving, which had been previously calculated, could be verified The studies also showed that the development of composite roof structures in the main transmission support region presented problems which heretofore have not been addressed The difficulty arises where shear and bending continuity is required in two directions at the intersection of major frames and beams supporting the transmission Designs for critical joints were developed, test specimens fabricated and successfully tested G R

A81-40175 Model 206L composite vertical fin R G Anderson and J H Harse (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 10 p (AHS 80-34)

This paper describes a program to design and manufacture a composite vertical fin for the Model 206L helicopter The composite vertical fin is of sandwich construction with precured facesheets of graphite/epoxy unidirectional tape adhesively bonded to Fibertruss core of varying density A layer of aluminum wire screen is adhesively bonded to the outer surface of each facesheet for lightning protection A separate precured leading edge of Kevlar 49 is bonded to the main fin structure A filament-wound, tapered S glass tail skid is mounted by two injection molded fittings bonded into a graphite/epoxy closure at the base of the fin A two-part closed cavity tool is used with each facesheet being laid up and cured on its half of the tool The leading edge and lower closure are cured on separate tools The entire assembly is bonded together in the cavity tool (Author)

A81-40178 The substantiation of the structural integrity of the YAH-64 control actuators with material variations W D Harris (Hughes Helicopters, Culver City, CA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 13 p 10 refs (AHS 80 51)

The structural substantiation program of the Army YAH-64 helicopter control actuators using either ESR 4340 or VAR 4340 and Air MELT 4340 as substitute materials is discussed Fatigue test specimens were made, with heat treatments yielding tensile strength ranging from 260-300 ksi The characteristics of the fatigue behavior and the different strength levels of the materials were analyzed, using the coupon test program The data show the superiority of the ESR over the VAR steel at the higher heat treat level, but proved to be of a somewhat lower fatigue strength The high strength VAR 4340 exhibited 80% of the endurance limit of the high strength ESR 4340 S-N curves established for control system actuators reflect the different materials tested They are combined with measured flight loads and the flight spectrum to determine the respective actuator and actuator piston lives for each of the materials E B

A81-40180 * # NASA/FAA flight-test investigation of helicopter microwave landing system approaches I L Peach, Jr, J S Bull, D J Anderson, D C Dugan, V L Ross (NASA, Ames Research Center, Moffett Field, CA), A W Hunting, D P Pate, and J C Savage (FAA, Flight Standards National Field Office, Oklahoma City, OK) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings
Washington, DC, American Helicopter Society, 1980 22 p (AHS 80-55)

The helicopter Microwave Landing System flight test investigations, conducted by a joint NASA/FAA effort in order to gather statistical data for establishing terminal instrument procedures criteria, and to provide a performance data base for developing advanced MLS guidance concepts, are presented The specific flight test objectives were to (1) develop acceptable angle-only MLS approach profiles, (2) determine tracking errors, (3) determine altitude loss during missed approach, (4) evaluate guidance display sensitivities, and (5) evaluate pilot acceptability Fourteen pilots flew 140 manual (without stability augmentation) dual pilot simulated instrument approaches in a UH 1H helicopter The flight profiles flown included 3, 6, and 9 degree glideslope, centerline approaches to decision heights of 50, 100, and 150 ft, respectively The angular guidance display sensitivities and the data acquisition system are also described Eight major conclusions are made, and include the following (1) the use of pitch attitude to control airspeed and collective to control glideslope was the preferred pilot technique for the steep glideslope approaches, and (2) angular guidance deviation indicator sensitivity requirements for helicopter MLS approaches to STOLports and heliports have been found to be significantly different from standard ILS sensitivities K S

A81-40181 Design and development of the Model 412 helicopter W L Cresap and A W Myers (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 12 p 6 refs (AHS 80-56)

Using multibladed rotor technology developed with the Model 654 rotor, a four bladed, soft-inplane rotor system has been developed for the Model 212 helicopter The new rotor was designed to permit an increase in the allowable gross weight of the 212 and to eliminate airspeed restrictions caused by vibrations and rotor loads The four bladed system was chosen in lieu of a new two-bladed rotor/nodal beam combination because fewer fuselage modifications were required and retrofit was easier In eight months of developmental flying, the Model 412, as the new configuration is designated, has accumulated over 200 flight hours, including high altitude and cold weather tests Measurements during the preliminary flight load survey to speeds of 162 knots and maneuvers to 2 3 g indicate the design objectives have been achieved Predicted weight and performance improvements have been verified, and the helicopter is ready for FAA certification testing (Author)

A81-40182 Advancing blade concept /ABC/ high speed development A J Ruddell (United Technologies Corp, Sikorsky Aircraft Div, Stratford, CT) and J A Macrino (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 14 p 7 refs

Developmental phases of the advancing blade concept (ABC) are analyzed and the results of a flight program with the XH 59A demonstrator aircraft are presented Performance results agree well with predictions, rotor blade stresses are fully controllable, and control loads remain low The ABC high lift capability independent of airspeed was demonstrated above 235 knots and the forward flight/lift/drag ratio was verified as predicted As test results indicate, the performance stability and control power characteristics of the ABC rotor system provide the XH-59A with excellent agility characteristics, and the following features are reported a 2 g rotor load capacity through 200 knots and zero g through 180 knots, 5000 fpm rates of climb and descent, seven second 360 degree turns at hover, and excellent aircraft responses with precise control E B

A81-40183 Reducing the cost impact of helicopter internal noise control L S Levine (United Technologies Corp, Sikorsky Aircraft Div, Stratford, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 10 p 10 refs (AHS 80-59)

The economic impact of new design strategies used to improve the weight efficiency of soundproofing for helicopters is discussed A commercial helicopter configuration is evaluated over a gross weight range of 10,000 to 50,000 lb Major internal noise sources are analyzed and soundproofing options are investigated The decrease in productivity (ton-miles/hr) due to soundproofing weight ranged from 14 21% as compared to an untreated configuration, and the direct operating cost increased from 4 to 18% In all cases the economic impact increases with the increase of gross weight and it is concluded that the reduction of noise levels through internal noise control techniques will greatly reduce the operating cost by maintaining weight efficiency and productivity E B

A81-40184 * **Trailing edge noise from hovering rotors** Y N Kim and A R George (Cornell University, Ithaca, NY) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 14 p 29 refs Army-NASA-supported research (AHS 80-60)

A method has been developed to predict the high frequency broadband noise due to the interaction of convecting turbulent eddies with the trailing edges of a hovering rotor The trailing edge noise from each blade was modeled as point dipole noise with spanwise loading corrections This point dipole approximation was checked by applying the concept to a stationary airfoil in a moving medium with excellent results In order to estimate the strength of the point dipole, the trailing edge noise theory of Amiet was used The method was applied specifically to blade boundary layer turbulence and compared to incident atmospheric turbulence noise The results indicate that the relative importance of these two mechanisms is related to the magnitudes of the intensity and of the length scales of the inflow and boundary layer turbulence The results tend to fall below some available experimental data indicating that in those experiments other broadband noise sources were stronger than boundary layer trailing edge noise The approach which was developed is also applicable to other blade-turbulence interaction mechanisms such as local stall and tip noise (Author)

A81-40185 Helicopter model scale results of blade-vortex interaction impulsive noise as affected by tip modification D R Hoad (U S Army, Structures Laboratory, Hampton, VA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 14 p 26 refs (AHS 80-62)

An experimental investigation of the effect of tip shape modification on blade vortex interaction induced helicopter blade slap noise has been conducted The general rotor model system (GRMS) with a 3 148 m (10 33 ft) diameter, four bladed fully articulated rotor was installed in the Langley Research Center V/STOL tunnel Tests were conducted over a range of simulated flight and descent velocities which have been shown to produce blade slap Aerodynamic performance parameters of the rotor system were monitored to ensure properly matched flight conditions among the tip shapes The tunnel was operated in the open-throat configuration with treatment to improve the acoustic characteristics of the test chamber Four promising tips (based on previous investigations) were used (ogee, subwing, 60 deg swept tapered, and end plate) along with a standard square tip as a baseline configuration This investigation provided a detailed acoustic evaluation on the same rotor system of the relative applicability of the various tip configurations for blade-slap noise reduction The microphone data were also used to compute the location in the rotor disk where the blade vortex interaction noise was generated These were compared with probable locations calculated by an existing rotor wake analysis model, thus vortex age and orientation could be proposed (Author)

A81-40186 Acoustic shock waves generated by a transonic helicopter blade M P Isom (New York, Polytechnic Institute, Brooklyn, NY) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 17 p 8 refs Grant No DAAG29-76-G-0035 (AHS 80-63)

Recent experimental data show the importance of nonlinear effects in the propagation of sound by high-speed main rotor blades Progressive distortion of a wave and the appearance of a shock in the far field wave form are effects that cannot be accounted for by linear acoustic theory Calculations presented here are based on the usual linear monopole term that is modified by a variable local speed of sound in the rotor far field The method, called nonlinearization, is similar to the technique used in sonic boom theory Numerical results show that the rotor acoustic wave form becomes progressively more distorted with distance from the blade tip, and that the wave will steepen so that an acoustic shock forms. Calculations are given for a hovering rotor and compared with model data taken in an anechoic facility (Author)

A81-40187 A study of the economic impact of noise limits on new design and current production helicopters R H Spencer (Boeing Vertol Co , Philadelphia, PA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. Washington, DC, American Helicopter Society, 1980 15 p 13 refs (AHS 80-64)

The impact of exterior noise constraints on the direct operating cost and selling price of four helicopters (BO-105, Boeing Vertol 179, CH-47, and Model 301 Heavy Lift Helicopter) is studied, the aircraft having been originally designed with noise as a secondary consideration, and representing a wide range of flyover noise levels, from 7 EPNdB above the proposed noise limits to 9 EPNdB below those standards Noise sources are determined by analysis of measured data and by predictions for each of the source components, and design changes are identified to reduce the noise level The costs of reducing exterior noise are estimated in order to arrive at a selling price for each modification The selling price is used along with other information to derive revised direct operating costs The modifications that are presented are relative to the baseline helicopter, the CH-47C Military Chinook Requirements to reduce helicopter noise have resulted in main and tail rotors which operate at lower tip speeds than their predecessors K S

A81-40188 Active control of the helicopter rotor for vibration reduction J Shaw and N Albion (Boeing Vertol Co , Philadelphia, PA) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13 15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 13 p 10 refs (AHS 80-68)

Analytical design studies, simulation, and a series of wind tunnel tests have led to the demonstration of a closed-loop vibration suppression system in a V/STOL wind tunnel Using small amounts of oscillatory swashplate motion, this active control system simultaneously suppressed up to 90% of the four-per rev vertical force, pitching moment, and rolling moment of a 3 05-m (10-foot) diameter, four bladed hingeless rotor The system operated successfully in a large number of flight conditions including transition and autorotation Response time to cancel sudden changes of vibration level was very short, about 1 25 rotor revolutions Thus the system will be able to suppress vibration of a flight vehicle during maneuvers and gusty conditions The system, although demonstrated on a hingeless rotor, is also applicable to articulated single and tandem rotor configurations The wind tunnel testing included measurement of rotor fatigue loads, control loads, and performance Based on the data, active control appears to be a practical approach to vibration suppression The technology is now ready for full development. (Author)

A81-40189 * **An active control system for helicopter vibration reduction by higher harmonic pitch** R B Taylor, F A Farrar (United Technologies Research Center, East Hartford, CT), and W Miao (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings Washington, DC, American Helicopter Society, 1980 12 p 11 refs Contract No NAS2-101211 (AHS 80-71)

An analytical study defining the basic configuration of an active control system to reduce helicopter vibrations is presented Theoretical results for a nonlinear four-bladed single rotor helicopter simulation are discussed, showing that vibration reductions on the order of 80-90% for airspeeds up to 150 kn can be expected when using a higher harmonic pitch in an active feedback control system The rotor performance penalty associated with this level of vibration reduction is about 1 3% and the increase in rotor blade stresses is considered to be low The location of sensor accelerometers proved to be significant for vibration reductions, and it is noted that the RTSA controller is tolerant of sensor signal noise E B

A81-40324 # **The evolution of a strategic bomber** R A Hibma and E D Wegner (Rockwell International Corp , North American Aircraft Div , Los Angeles, CA) *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, CA, May 12-14, 1981, Paper 81-0919* 11 p Contract No F33657-70-C-800

This paper discusses the evolution of a strategic bomber from conceptual formulation studies to flight-test demonstration The B-1 bomber is used as a specific example of this process Subjects addressed include formulation of operational and design requirements, design philosophy, design features, interesting design problems encountered, and the resulting air vehicle capability Also addressed is the B 1 derivative, a multirole bomber, an adaptation to satisfy the versatility of current Department of Defense (DOD) requirement for a Long-Range Combat Aircraft (LRCA) (Author)

A81-40442 # **The calculation of lift and drag characteristics of subsonic wings with winglets** R Zhou (Nanjing Aeronautical Engineering College, Nanjing, Communist China) *Acta Aeronautica et Astronautica Sinica,* vol 2, June 1981, p 18 25 In Chinese, with abstract in English

The lift of rectangular wings with different winglets are calculated for subsonic speeds using the finite element method to divide the spanwise lattice and determine spanwise locations of control points with a constant roll angle method A combined flowfield method is also used to calculate the induced drags Parameters affecting the lift and drag characteristics of wings with winglets are given and the aerodynamic mechanism of winglets is discussed D H K

A81-40448 # **Aiming computation for fighter weapon aiming system** S Zhang (Optic-Machinery Research Institute, Communist China) *Acta Aeronautica et Astronautica Sinica,* vol 2, June 1981, p 85 92 In Chinese, with abstract in English

Derivations are presented of the aiming equations for the computer system of air to-air gunsights and head-up display systems Four cases are considered (1) a target moving in a straight line at a constant speed, (2) a maneuvering target for which the computer must make corrections, (3) a maneuvering target and the fighter's own roll for which the computer must make aiming corrections, and (4) during attack on a maneuvering target when the tracer line and a damped tracer are computationally matched for air to-air gunfire D H K

A81-40449 # **The optimum design of non-moment laminated composite plate - According to static failure strength condition** Z Ma (Northwestern Polytechnical University, Xian, Shaanxi, Communist China) *Acta Aeronautica et Astronautica Sinica,* vol 2, June 1981, p 93 102 In Chinese, with abstract in English

When the upper and/or lower panels of the loading box of an aircraft wing or tail are made of fiber-reinforced composite laminates, they can be represented as nonmoment plates The paper introduces a procedure for the minimum weight design of plate laminates according to the static failure strength condition The procedure is based on the Lagrangian multiplier method, with the Hill Tsai or Norris criteria adopted as the static failure strength condition Optimum design formulas are derived and adapted to be convenient for computer manipulation, and means for establishing the ultimate strength of laminates are discussed The solution procedure and the selection of the optimal laminate design are illustrated It is noted that the procedure can be considered as an engineering method for the optimal design for laminated composite loading panels operating in tension or compression in the absence of buckling failure S C S

A81-40455 **Boeing plays safe** J P Geddes and C Bulloch *Interavia,* vol 36, June 1981, p 538 540

Design features of the Boeing 737-300 are discussed and compared with those of the B 737 200, with which it has 80% commonality The B 737-300 is expected to be produced in two versions, one of which will permit an extra 2,500 kg of takeoff weight The aircraft is expected to demonstrate a pronounced improvement in fuel efficiency over the B 737 200 An outline of the preliminary production schedule is provided C K D

A81-40456 **The ATR 42 - Progress report on a new aircraft** M Grangier *Interavia,* vol 36, June 1981, p 543, 544

A status report on the development of the Aeritalia/Aerospatiale ATR 42 regional transport aircraft is presented Special attention is given to design implications of the decision to increase passenger capacity to between 40 and 50 The allocation of responsibilities for design and development is discussed, and the major characteristics of the aircraft are described The ATR 42, which will probably be powered by Pratt and Whitney PW 117-2R engines, is expected to begin flight tests in 1983 C K D

A81-40457 **Battle of the 15 tonne fans** D Wood and P Maurice *Interavia,* vol 36, June 1981, p 561-563

A description of corporate aggressive marketing for development and sale of 30,000 to 34,000 lb thrust turbofan engines earmarked initially for 1984 service on the Boeing 757 is presented Pratt and Whitney, Rolls Royce, and General Electric competed for various airlines contracts with favorable projections of fuel economy, ability to design or redesign, and offers of free retrofits after interim use of existing engines, with the airlines managing to gain significant contractual guarantees for committing themselves Pratt and Whitney will have to deliver an engine that exceeds the Rolls E4 in fuel efficiency by 8%, with its hopes resting on new features comprising active clearance control, advanced combustion liner and fuel injector, single crystal turbine blades, ceramic turbine seals, and electronic engine control The Rolls E4 has a wide chord fan and high pressure module, with a common nozzle exhaust, offering an 11% efficiency gain over previous models Future competitions are announced D H K

A81-40458 **Fire-proof fuel** P Maurice *Interavia,* vol 36, June 1981, p 585

Development of FM 9, a flight fuel additive designed to prevent crash induced instantly explosive air suspensions, is reviewed FM 9 (FM stands for fuel modifier) is a brittle, solid copolymer which is ground into a fine powder and comprises long twisted molecular chains capable of suppressing fuel misting This feature can also lower engine power, so a mechanism for violent churning before burning is under development to break the chains The additive will be injected in slurry form into the fuel tanks to enhance mixing, a 0 3% concentration is projected to eliminate explosive combustion in a crash at 125 knots Actual crash tests with remotely piloted vehicles will be performed by NASA in 1983 and 1984 Current efforts of the joint U S -British effort are concentrating on the degrader process, breaking the chains before burning, which now consumes 75 kWs/liter D H K

A81-40459 **Propfan progress** B Gunston *Interavia,* vol 36, June 1981, p 586, 587

The progress of propfan development toward higher Mach numbers using thin profile swept back blades is described NASA and Hamilton Standard began a project in 1974 with the goal of keeping propeller economy and jet speed for the Aircraft Energy Efficiency Program The reintroduction of gearboxes is considered of negligible impact because of the presence of gearboxes on some existing turbofans Models are increasingly of 10 blade design, carbon and boron composite, are 2 ft in diameter and run at 800 ft/s (cruise conditions) It is noted that cabin soundproofing is needed, and various structural and component placement methods are offered Efficiency increases of 27 to 33% over turbofans are projected for propfan use, with full scale, 9 8 ft diameter blades to be produced for testing in 1983 D H K

A81-40460 **The survivable, affordable fighter - The Aeritalia-Macchi-Embraer AM-X** M Lambert *Interavia,* vol 36, June 1981, p 588, 589

A proposed AM X fighter plane to be developed jointly by Brazil and Italy is described The design calls for a 10,500 kg weight with internal reconnaissance, full internal fuel, and the ability to taxi on grass or summarily repaired runways It will use a Rolls Royce Spey 107 engine with 11,030 lb thrust and a power weight ratio of 2 09 1, with a range of 180 n mi for the Italian version and longer for the Brazilian Intended as a stand-off weapon, the AM X will include an integrated digital system, head up display, and range only radar First flight is scheduled for 1983 with a capability of 95 Mach at low altitude The flight control system features triple redundancy, with final mechanical control if all electronics fail D H K

A81-40471 # **Some experimental study on parachute dynamics by utilizing a deceleration system simulator** M Hinada, H Matsuo, S Tsukamoto, and J Kawaguchi *Tokyo, University, Institute of Space and Aeronautical Science, Bulletin*, vol 17, Mar 1981, p 223-239 In Japanese, with abstract in English

A deceleration system simulator has been developed in order to investigate the aerodynamic characteristics of a parachute in the air-stream of the 2 m-phi low speed wind tunnel of the Institute of Space and Aeronautical Science at the University of Tokyo, and also to simulate a controlled parachute system in which the model parachute is controlled by extending and/or retracting 8 suspension lines independently, according to respective control signals The performance of the simulator has been examined preliminarily in the low speed wind tunnel by using small model parachutes of 30-60 cm in deployed cross-sectional diameter, and it has been found that the simulator functions satisfactorily Some experiments of parachute deployment have been conducted and the results of opening load behavior have been compared with the numerical results obtained

A81-40503 **Design and concepts of composite structures** S J Dastin (Grumman Aerospace Corp , Bethpage, NY) In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26 29, 1980 Volume 1 Oxford, Pergamon Press, 1980, p 49 68 12 refs

Advanced composite concepts and designs are presented for aerospace and commercial structural elements and components Structures designed for low weight, low cost and a balance of weight/cost are reviewed along with service experiences Design configurations of early composite structures are described and compared to current components Specialty composite structures utilized for spacecraft and sports equipment are discussed highlighting the concepts possible with composite materials Finally, trends for future composite designs and concepts are summarized

(Author)

A81-40521 **Stability and ultimate strength of carbon fiber reinforced plastic panels** L A Samuelson (Institutet for Metallforskning, Stockholm, Sweden), P Vestergren, L Knutsson, V Gamziukas (Flygtekniska Forsoksanstalten, Stockholm, Sweden), and K G Wangberg (Saab Scania AB, Linkoping, Sweden) In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26-29, 1980 Volume 1 Oxford, Pergamon Press, 1980, p 327 341 25 refs Research supported by the Forsvarets Materielverk

The buckling and post buckling behavior of thin walled plate structures under in plane shear and compressive loads is demonstrated, and use is made of existing theories in order to analyze the stability behavior and ultimate load It is shown that thin-walled plane panels may exhibit considerable post-buckling strength For stiffened panels or sandwich plates, the buckling load is often close to the ultimate load The shear stiffness of the core of sandwich panels is shown to have a marked influence on the stability characteristics It is also found that the scatter in the ultimate load is of the same order as that usually obtained in testing composite materials Theoretical methods for buckling analysis of plate structures show good agreement with experiments with respect to the bifurcation load and the post buckling behavior The bifurcation load is shown to give a reasonable estimate of the failure load of practical panels C R

A81-40581 **A fatigue study and an investigation on mechanically fastened joints for the development of a flap** P Minderhoud In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26-29, 1980 Volume 2 Oxford, Pergamon Press, 1980, p 1264-1279 9 refs Research sponsored by the Nederlands Instituut voor Vliegtuigontwikkeling en Ruimtevaart

A study has been carried out in support of the development of a flap to investigate the fatigue behavior of carbon/epoxy laminates consisting of plies in the 0, 45, and 90 deg directions and to evaluate several types of mechanical fasteners It is found that cyclic uniaxial tensile loading of a crossply results in matrix cracks in the plies perpendicular to the load direction if the RFM due to loading equals 1 6 (number of cycles 500,000) Thus, in the analysis of the flap no reduction factors have to be introduced for strength and stiffness if RFM is equal to or greater than 1 6 at daily load Results of lap joint tests indicate that flush head rivets can be used in those areas where load per rivet is not in excess of 2000 N at daily load V L

A81-40585 **Development, production, calculation and testing of a carbon/Kevlar fibre reinforced flap** L Machielse, D Slager, and C Vernooy (Fokker-VFW, Amsterdam, Netherlands) In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26-29, 1980 Volume 2 Oxford, Pergamon Press, 1980, p 1408-1423 Research sponsored by the Nederlands Instituut voor Vliegtuigontwikkeling en Ruimtevaart

A trailing edge flap has been designed and constructed which consists of fiber reinforced epoxy sandwich panels and solid laminate parts The suspensions and hinge brackets are full carbon/epoxy components Assembly is carried out by bonding, with the exception of the brackets and the bottom panel The tab hinge brackets and flap support brackets are installed by means of bolts, the lower skin is connected to the box by means of blind rivets and bolts In static testing, the test component failed at 1 28 of the limit load V L

A81-40586 **Application of BFRP Crack Patching to Mirage III aircraft** A A Baker, R J Callinan, M J Davis, R Jones, and J G Williams (Australian Defence Scientific Service, Aeronautical Research Laboratories, Melbourne, Australia) In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26-29, 1980 Volume 2 Oxford, Pergamon Press, 1980, p 1424-1438 10 refs

This paper describes some work leading to the recent application of BFRP Crack-Patching to the field repair of fatigue-cracks in the aluminium alloy wing-skins of Mirage III aircraft Aspects covered include finite-element design procedures, fatigue-crack propagation studies on patched panels, simulating the cracked and repaired area, materials and process selection, and the development of a Crack-Patching Field-support Unit Repairs are currently being carried out by specially trained RAAF personnel during routine maintenance of the aircraft. (Author)

A81-40588 **Composite helicopter rotor blades - Design, development, and operational performance (Les pales d'hélicoptères en composites - Conception, réalisation et comportement en opération)** M Torres (Societe Nationale Industrielle Aerospatiale, Department Recherches, Marignane, Bouches-du-Rhône, France) In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26-29, 1980 Volume 2 Oxford, Pergamon Press, 1980, p 1465-1482 In French

The development and testing of composite rotor blades at Aerospatiale are described The computer aided design of blades is discussed with attention given to shape definition, dynamic studies, resistance calculations, and material studies The fabrication, quality control, and fatigue testing of blades are also discussed Finally, the operational performance of blades is considered with emphasis on corrosion resistance, impact resistance, maintenance, and direct utilization costs B J

A81-40595 **Advanced composite structure repair** C E Beck (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26-29, 1980 Volume 2 Oxford, Pergamon Press, 1980, p 1580-1584

The development of techniques for advanced composite structures are discussed A review of repair techniques developed over the past 20 years for different types of damages and materials is presented, and emphasis is given to repair configurations of five test programs which included honeycomb sandwich repair from different sides, and fifty-ply laminate partial thickness repair Results show that it is possible to restore a badly damaged mechanically attached graphite structure to its original strength Bonded cocured scarf repairs with no size limit imposed have been shown to be permanent and durable E B

A81-40602 **Post-buckling and membrane structural capability of composite shell structures** J E Rhodes (Lockheed-California Co , Burbank, CA) In Advances in composite materials, Proceedings of the Third International Conference on Composite Materials, Paris, France, August 26-29, 1980 Volume 2
Oxford, Pergamon Press, 1980, p 1707-1720

Aluminum shell structures exploit post-buckling and membrane strength to achieve minimum weight The application of fibrous composites to these structures offers significant weight savings, provided post-buckling and membrane deformations can also be permitted This paper discusses the physics involved in shear and compression post-buckling and membrane pressure pillowing, and compares their forced displacement forms The objective is to contribute to a fundamental understanding of postbuckling behavior which will help establish practical design limits It is shown that the interlaminar and substructure separation forces can be assessed, with reasonable accuracy, once the displacement shapes are established
(Author)

A81-40616 # **High-temperature strength of alloys for gas turbine engines (Zharoprochnost' splavov dlia gazoturbinnykh dvigatelei)** R E Shalin, I P Bulygin, and E R Golubovskii Moscow, Izdatel'stvo Metallurgiia, 1981 120 p 86 refs In Russian

Methods are presented for probabilistic estimation and extrapolation of the mean and minimum values of the long-term strength, plasticity, and creep of alloy grades used for gas turbine engines The proposed methods use equations of temperature and temporal dependences of these parameters and their dispersion characteristics Experimental data and calculated characteristics are presented for several commercial alloys used for the manufacture of gas turbine disks and blades V L

A81-40621 # **Principles of the reliability of gas turbine engines (Osnovy nadezhnosti gazoturbinnykh dvigatelei)** V M Akimov Moscow, Izdatel'stvo Mashinostroenie, 1981 208 p 73 refs In Russian

The subject of turbine reliability is seen as having two aspects, one comprising the principles governing reliability, the other means used by engineers to ensure satisfactory operation In addition, reliability is considered to cover not only operation but also such characteristics as endurance, repairability, and shelf life Determining the reliability characteristics of gas turbines through testing and use is discussed, as is ensuring reliability in design and manufacture Attention is also given to methods of maintaining reliability during use C R

A81-40687 **Fatigue life evaluation of helicopter rotor heads** *Aircraft Engineering*, vol 53, June 1981, p 6-11, 13

Helicopter rotating systems are subject to large dynamic loads due to the centrifugal forces from each blade, the lift force, and flapping and drag moments The fatigue life of a Lynx rotor head is tested by measuring the total loading system with strain gages, the signals of which are analyzed by computer A preliminary life is calculated for each component from the flight spectrum defined for the role of the aircraft, and bending moments are derived The test objectives are to calculate fatigue life by accepted S-N curves and Goodman diagrams from component tests and load distributions, and to observe failures and failure effects The bending moment obtained through testing proved correct only at one specific point, and testing was broken down into smaller load component studies a torque to the barrel region, centrifugal forces to the four arms of hub center forging, and loads to the inboard and outboard ends of the lag element A universal rotor heat test facility was constructed with a subsurface framework, capable of accepting any rotor load with any number of blades It consisted of hydraulic servo system with separate flap and lag capabilities and a 16 channel computer based demand and monitoring system J F

A81-40750 **Airports and earthquakes - An important subject often ignored** D A Howells *Airport Forum*, vol 11, June 1981, p 49-53 17 refs

The paper covers airport damage by earthquakes, and suggests design and construction features to avoid this damage Economic considerations are discussed, and some case histories are presented including Alaska, March 27, 1964, Niigata, June 16, 1964, San Fernando, February 9, 1971, and several earthquakes of Haneda, Tokyo Consideration is given to general site levels of coastal airports chosen to avoid tsunamis, natural ground behavior beneath runways, and the flexibility of welded steel pipes used to distribute fuel Airport building terminals and hangars usually falling under the regulations of conventional buildings, may require tie beams at the bases of their structures due to their large plan dimensions Air traffic control and communications equipment should be well fixed to avoid overturning, but if placed at the top of the tower could be subjected to high accelerations due to oscillation of the tower Also considered is the installation of standby generating equipment due to the failure of public electricity supplies D L G

STAR ENTRIES

N81-26035# RAND Corp Santa Monica Calif
A METHOD FOR ESTIMATING THE COST OF AIRCRAFT STRUCTURAL MODIFICATION **Interim Report**
J L Birkler and J P Large Mar 1981 156 p
(Contract F49620-77-C-0023)
(AD-A099327 RAND/R-2565-AF) Avail NTIS HC A08/MF A01 CSCL 05/1

Research into the cost of aircraft structural modifications is described Detailed cost and man hour data supplied by the airframe industry permitted derivation of estimating tools for major aircraft components Separate equations were derived for engineering tooling manufacturing and material cost The major explanatory variable was always weight It was hypothesized that structural modification cost could be estimated on the basis of the weight of material added Estimates of the cost of modification for the B-52 C-141 C-5 and EF-111 were compared with cost data from industry Considerable informed judgment is required as is a knowledge of such program-specific facts as whether the original production tooling still exists Rather than a mathematical model the study describes the kinds of information needed suggests guidelines and presents estimating equations for airframe systems and subassemblies These contribute to an understanding of the estimating problem but do not constitute a general solution Author (GRA)

N81-26047# Grumman Aerospace Corp Bethpage N Y
TURBULENT INTERACTIONS ON AIRFOILS AT TRANSONIC SPEEDS RECENT DEVELOPMENTS
R E Melnik *In* AGARD Computation of Viscous-Inviscid Interactions Feb 1981 34 p refs

Avail NTIS HC A22/MF A01

Developments in theoretical concepts for the analysis of viscid inviscid interactions on airfoils at transonic speeds are discussed The overall weak interaction between the boundary layer wake and outer inviscid flow are considered as well as the strong local interaction at shock waves and trailing edges Efforts to incorporate important wake displacement and wake curvature effects into an interacting boundary layer formulation are discussed Progress in the development of local large Reynolds number asymptotic solutions for turbulent shock wave boundary layer and trailing edge interaction are described and related to Lighthill s two layer model of strong interactions Reasons for the difference between laminar and turbulent strong interaction theories are discussed Techniques are described for incorporating the local trailing edge solution into an interacting boundary layer formulation which includes a complete treatment of the wake Theoretical predictions obtained with this formulation are compared with wind tunnel data to illustrate the accuracy that can be achieved with an interacting boundary layer formulation when the wake and trailing edge interaction effects are included in the theoretical model R C T

N81-26072*# Stanford Univ Calif
STRAKE/DELTA WING INTERACTIONS AT HIGH ANGLES OF ATTACK
M I G Bloor and R A Evans Apr 1980 36 p refs
(Contract NCC2-55)
(NASA-CR-166183 SU-JIAA-TR-30) Avail NTIS HC A03/MF A01 CSCL 01A

The method of vortex discretization is used to analyze the interaction of the vorticity generated by a strake with the flow over a delta wing The validity of the approach is first established by making comparisons with established methods for dealing with delta wings after which compound delta planforms are discussed An understanding of the favorable interference effects normally associated with this type of configuration is obtained and results are presented to quantify the expected lift increments resulting from the strake interaction Author

N81-26075*# Vought Corp Dallas Tex
ADDITIONAL TESTING OF THE INLETS DESIGNED FOR A TANDEM FAN V/STOL NACELLE
Andres H Ybarra Jun 1981 148 p refs
(Contract NAS3-21468)
(NASA-CR-165310 TR-2-53020/IR-52726) Avail NTIS HC A07/MF A01 CSCL 01A

The wind tunnel testing of a scale model of a tandem fan nacelle designed for a type (subsonic cruise) V/STOL aircraft configuration is discussed The performance for the isolated front inlet and for the combined front and aft inlets is reported Model variables include front and aft inlets with aft inlet variations of short and long aft inlet cowls with a shaft simulator and diffuser vortex generators cowl lip fillets and nacelle strakes Inlet pressure recovery distortion and inlet angle-to-attack separation limits were evaluated at tunnel velocity from 0 to 240 knots angles-of-attack from -10 to +40 degrees and inlet flow rates corresponding to throat Mach number from 0 0 to 0 6 Combined nacelle pitch and yaw runs up to 30 deg were also made M G

N81-26076*# De Havilland Aircraft Co of Canada Ltd Downsview (Ontario)
PHASE 2 AND 3 WIND TUNNEL TESTS OF THE J-97 POWERED, EXTERNAL AUGMENTOR V/STOL MODEL
D B Garland Oct 1980 148 p
(Contract NASw-2797)
(NASA-CR-152380 DHC-DND-80-1) Avail NTIS HC A08/MF A01 CSCL 01A

Modifications were made to the model to improve longitudinal acceleration capability during transition from hovering to wing borne flight A rearward deflection of the fuselage augmentor thrust vector is shown to be beneficial in this regard Other augmentor modifications were tested notably the removal of both endplates which improved acceleration performance at the higher transition speeds The model tests again demonstrated minimal interference of the fuselage augmentor on aerodynamic lift A flapped canard surface also shows negligible influence on the performance of the wing and of the fuselage augmentor T M

N81-26078*# National Aeronautics and Space Administration Langley Research Center Hampton Va
A PROCEDURE FOR DESIGNING FOREBODIES WITH CONSTRAINTS ON CROSS-SECTION SHAPE AND AXIAL AREA DISTRIBUTION
Raymond L Barger Jul 1981 14 p refs
(NASA-TP-1881 L-14516) Avail NTIS HC A02/MF A01 CSCL 01A

A method is described for designing a forebody with cross sections which vary smoothly from an initial prescribed nose shape to a different prescribed base shape in such a way that the cross-section areas conform to a preassigned axial area distribution It is shown that these conditions can be satisfied with a remaining degree of freedom which can be used to accomplish a modest amount of geometric or pressure tailoring of the forebody An example is provided which involves modifying the pressure distribution along a given meridian line of the forebody Author

N81-26082# Boeing Military Airplane Development Seattle Wash
AERODYNAMIC ANALYSIS OF A FIGHTER AIRCRAFT WITH A HIGHER ORDER PANELING METHOD **Final Report, Sep 1978 - Jan 1981**
A R Dusto Wright-Patterson AFB Ohio AFWAL Nov 1980 627 p refs
(Contract F33615-77-C-3051 AF Proj 2404)
(AD-A099404 AFWAL-TR-80-3115) Avail NTIS HC A99/MF A01 CSCL 20/4

Results from analyses of steady and unsteady flows about several configurations involving the wing of the F-5 fighter airplane are presented The analyses were performed using higher order panel methods and the configurations analyzed included the following the clean wing (both in an unbounded and in a wind tunnel wall bounded atmosphere) the wing with an external missile store mounted at the wing tip and the wing with an external missile store mounted on a pylon at the lower surface of the wing The flow mach number ranged from 0 6 to 1 35 in steady flow and from 0 6 to 0 95 in unsteady flow Each steady flow case is analyzed at three angles of attack (0 5 deg, 0 0 deg 0 5 deg) while each unsteady flow case consisted of unsteady pitch oscillation about zero angle of attack The reduced frequency of the oscillation was in the range from 0 2498 to 0 3955 GRA

N81-26083*# National Aeronautics and Space Administration Langley Research Center, Hampton Va

A LEARNING GUIDE FOR THE TERMINAL CONFIGURED VEHICLE ELECTRONIC HORIZONTAL SITUATION INDICATOR

Athena T Markos Jun 1981 36 p

(NASA-TM-83128) Avail NTIS HC A03/MF A01 CSCL 01C

The electronic horizontal situation indicator (EHSI) course one of four courses comprising the TCV crew-training curriculum is designed to prepare pilots to effectively interpret and control the EHSI display and mode control panel on the TCV research simulator Prerequisities for the course and a suggested learning approach are discussed The course is available in manual form as well as a PLATO system The manual contents and format are described as well as the learning activities, time-to-complete, and assessment system for student evaluation for the computer-based lessons A R H

N81-26084# National Transportation Safety Board Washington D C Bureau of Technology

SAFETY REPORT THE STATUS OF GENERAL AVIATION AIRCRAFT CRASHWORTHINESS

17 Dec 1980 67 p refs

(PB81-160798 NTSB-SR-80-2) Avail NTIS HC A04/MF A01 CSCL 01B

Improvements in the crashworthiness of automobiles during the past decade has been documented through a reduction of the fatality-to-injury ratios Such improvement in general aviation aircraft crashworthiness has been sought by the National Transportation Safety Board the Civil Aeronautics Board and others for more than 35 years Past accident investigations regulatory developments and crashworthiness research activities were reviewed and the adequacy of current general aviation crashworthiness requirements was assessed GRA

N81-26086# Naval Ocean Systems Center San Diego Calif Tactical Sensors and Electronic Warfare Div

NAVTOLAND MICROWAVE SCANNING BEAM TESTS AT NOSC THREE LANDING GUIDANCE SYSTEMS TESTED IN A SPECULAR MULTIPATH ENVIRONMENT Interim Report, Nov 1980 - Jan 1981

F E Morris Feb 1981 123 p

(AD-A099298 NOSC/TR-646) Avail NTIS HC A06/MF A01 CSCL 17/7

Results of testing Ku-band pulse-coded microwave scanning guidance system concepts are reported Three different systems were tested under conditions of severe specular multipath It is concluded that Ku-Band antennas with elevation and azimuth scanning beamwidths as wide as 4 and 6 deg respectively are adequate for shipboard landing guidance systems and that circular polarization and an elevation scan technique at low-angle-beam cutoff and mathematical beamfitting are effective solutions to multipath problems expected for a Navy shipboard system Additionally 1- and 2-microsec/deg coding was tested No difference in accuracy was found Author (GRA)

N81-26088# Federal Aviation Administration Atlantic City N J Technical Center

DISCRETE ADDRESS BEACON SYSTEM (DABS) COMPUTER PERFORMANCE/TEST AND EVALUATION Interim Report, Dec 1979 - Sep 1980

Donald Fisher Joseph Pino and Daniel Fox Apr 1981 58 p refs

(AD-A099326 FAA-CT-81-7 FAA-RD-81-12) Avail NTIS HC A04/MF A01 CSCL 17/7

This document describes tests conducted on the Discrete Address Beacon System (DABS) engineering model sensor with the release 6 4 software package to measure the performance characteristics of the computer subsystem distributive architecture Tests were conducted for various aircraft load conditions in three specific areas system data bus contention global memory address space utilization and processor utilization Both the methods of conducting these tests and the results obtained are described It was concluded that system data bus contention is not a problem with the distributive architecture used Release 6 4 of the DABS software uses less than 20 480 words of the available 24 576 global memory address space in 24 of the 29 active processors This leads to the conclusion that no problem should be experienced in expanding the size of the processor local memories from 8 192 words to 12 288 words Additionally, an expansion of the local memories to 16 384 words appears feasible with minor software changes The expansion of local memory will enable each processor to perform more functions This will reduce the total number of processors required and lead to less complexity and a smaller overall volume for DABS Author (GRA)

N81-26090# Federal Aviation Administration Atlantic City N J Technical Center

ANALYTICAL INVESTIGATION OF TIME CORRECTION IN ALPHA-BETA TRACKING FILTERS WITH APPLICATION TO EN ROUTE TRACKING Final Report, Mar 1979 - Mar 1980

Robert E Lefferts Apr 1981 47 p refs

(AD-A099218 FAA-CT-80-47) Avail NTIS HC A03/MF A01 CSCL 17/1

In the analysis of the alpha-beta tracking filter it is normally assumed that the tracking filter and data source operate in synchronism at a constant data rate An analytical solution is obtained for the case in which the tracking filter and data source operate asynchronously thus violating the standard assumptions To compensate for the asynchronous operation of the filter the technique of time correction is used to adjust the measured data point via the estimated velocity which approximates the synchronous operation of the filter and data source The tracking filter performance in the steady-state case where time correction is used is better than that obtained from a fixed-parameter tracking filter in which the actual random time intervals between measurements are used as the temporal basis of filter operation To ensure no degradation in system performance for purposes of air traffic control a system timing accuracy on the order of 0 05 second is required to preserve the position measurement accuracy rather than the presently used technique which yields a timing accuracy on the order of 0 8 second If the specified level of timing accuracy is not achieved then it is postulated that significant errors will be introduced in the predicted position for maneuvering targets System timing errors are presently the limiting factor in providing accurate position measurements for en route purposes and will partially nullify the data accuracy which will be available in the future Author (GRA)

N81-26091# Advisory Group for Aerospace Research and Development Neuilly-Sur-Seine (France)

PRECISION POSITIONING AND INERTIAL GUIDANCE SENSORS TECHNOLOGY AND OPERATIONAL ASPECTS

Mar 1981 370 p refs In ENGLISH partly in FRENCH Symp held at London 14-17 Oct 1980

(AGARD-CP-298 ISBN-92-835-0287-6) Avail NTIS HC A16/MF A01

Inertial sensors and systems technology, development and status of positioning systems and evaluation methods and results are discussed Other topics include filtering and estimate fault tolerance design and redundancy techniques and systems requirements and applications

N81-26092# Air Force Systems Command Wright-Patterson AFB Ohio

INVESTIGATION OF A STRAPDOWN ATTITUDE AND HEADING REFERENCE SYSTEM UTILIZING RING LASER GYROS

George M Siouris *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 14 p

Avail NTIS HC A16/MF A01

The potential benefits of utilizing ring laser gyro technology in a strapdown attitude and heading reference system configuration for rotary and fixed wing aircraft are assessed The ring laser gyro has demonstrated highly acceptable performance with the promise of even better results and greater design margins to enhance the low cost goals System performance is evaluated using a strapdown covariance error analysis simulation The covariance matrix represents the standard deviations of the errors in the system at any point in time of the trajectory or mission Coupled with a transition matrix that propagates the covariance matrix forward along the route the errors along the entire route can be computed E D K

N81-26100# Air Force Space Div Los Angeles Calif

NAVSTAR FIELD TEST RESULTS

Robert L Peterson *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 7 p

Avail NTIS HC A16/MF A01

The most significant user equipment tests conducted during the concept validation phase of the Navstar Global Positioning System are described These tests demonstrated that a 10 to 20 meter accuracy is achievable and a very precise navigation capability has a wide range of military applications E D K

N81-26102# Centre d Essais en Vol Bretigny-sur-Orge (France)
EVALUATION OF A HYBRID NAVIGATION SYSTEM WITH LASER GYROSCOPES SEXTAN [EVALUATION D'UN SYSTEME DE NAVIGATION HYBRIDE A GYROLASERS SEXTAN]
D Regnault, J Leclerc (Crouzet Aerospace and Systems) B deSalaberry (Societe Francais d'Equipment pour la Navigation Aerienne Velizy Villacoublay France) and J P Pradoux (Societe Francais d Equipment pour la Navigation Aerienne Boulogne France) *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 20 p In FRENCH

Avail NTIS HC A16/MF A01

The program SEXTAN was designed for low flying military helicopters The design considerations included cost reduction as a major factor in order to comply to the European economic markets and military needs Major components of the system include three laser gyroscopes three accelerometers, an on-board computer Doppler radar and a control terminal that utilizes computer graphics for visual presentation of flight control data Transl by T M

N81-26103# Naval Air Development Center Warminster Pa Communication Navigation Technology Directorate
FLIGHT TEST RESULTS OF AN ADVANCED DEVELOPMENT MODEL RING LASER GYRO NAVIGATOR (RLGN)
Kenton L Bachman *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 9 p ref

Avail NTIS HC A16/MF A01

The requirements leading to the formulation of an advanced development program for the RLGN are addressed The functional description of the RLGN including key hardware and software design features are described Particular emphasis is given to a discussion of the flight test program in an A-7E and P-3C aircraft and the resultant navigation and reliability performance Effects of high latitude on system alignment and navigation is also discussed The proposed follow on full scale development of a second generation carrier aircraft inertial navigation system (CAINS-II) applicable to all Navy carrier aircraft is given R C T

N81-26107# Naval Air Development Center Warminster Pa
RAPID ALIGNMENT OF AIRCRAFT STRAPDOWN INERTIAL NAVIGATION SYSTEMS USING NAVSTAR GLOBAL POSITIONING SYSTEM (GPS)
Robert W Tafel Jr and David Krasnjanski *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 20 p refs
Avail NTIS HC A16/MF A01

The use of the GPS navigation satellite system as a reference for the in air alignment of a strapdown inertial navigation system (INS) was investigated A Kalman filter covariance simulation program was used to determine the optimal alignment performance which can be achieved with a hybrid INS/GPS configuration The sensitivity of in air alignment to reset interval and choice of observable was examined The impact of various flight profiles upon the effectiveness of the alignment mechanism was evaluated The alignment sensitivities determined in the optimal study were then used to develop a suboptimal alignment filter suitable for mechanization in an airborne computer The trade off between filter size and alignment speed and accuracy was determined The recommended filter was compared to the optimal filter over a range of alignment conditions in order to demonstrate its effectiveness R C T

N81-26108# Naval Air Development Center Warminster Pa
NEW NAVY PROGRAMS FOR DEVELOPMENT OF INTEGRATED INERTIAL SENSORS
Charles R Abrams and Robert J Skoyles *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 14 p refs

Concepts in sensor redundancy and subsystem integration are described for navigation/flight control functions and other using subsystems The major emphasis is on a reduction in the number of required sensors by the use of skewed configurations and functional integration Substantial improvements in reliability and maintainability are anticipated from both the reduction in sensor complement and the introduction of ring laser gyros Survivability is enhanced by the dispersion of redundant units The data management software for skewed rate sensors and accelerometers that were developed validated in the laboratory and verified in flight tests are discussed Status of planned system hardware software and flight testing for an advanced development model of an integrated inertial sensor assembly to supply inertial data for flight control weapon delivery and navigation are also presented R C T

N81-26109*# Draper (Charles Stark) Lab Inc Cambridge Mass Control and Flight Dynamics Div
F-8 DIGITAL FLY-BY-WIRE AIRCRAFT ANALYTIC REDUNDANCY MANAGEMENT FLIGHT TEST EXPERIENCE
James C Deckert *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 11 p refs

(Contract NAS4-2675)
Avail NTIS HC A16/MF A01 CSCL 17G

The formulation and flight test results of an algorithm to detect and isolate the first failure of any one of twelve duplex control sensors being monitored are described The technique uses like sensor output differences for fault detection while relying upon analytic redundancy relationships among unlike quantities to isolate the faulty sensor The fault isolation logic utilizes the modified sequential probability ratio test, which explicitly accommodates the inevitable irreducible low frequency errors present in the analytic redundancy residuals In addition the algorithm uses sensor output selftest which takes advantage of the duplex sensor structure by immediately removing a highly erratic sensor from control calculations and analytic redundancy relationships while awaiting a definitive fault isolation decision via analytic redundancy R C T

N81-26111# Magnavox Co Torrance Calif Advanced Products and Systems
NAVSTAR GPS RECEIVER FOR SATELLITE APPLICATIONS
R Thorensen K M Joseph J J Winterhalter and J R Champion (APL Laurel Md) *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar 1981 21 p refs

Avail NTIS HC A16/MF A01

A GPS navigation receiver/processor and ancillary units which combined constitute a spaceborne GPS Navigator (GPSPAC) are described This navigator is intended for use on low altitude satellite host vehicles i e LANDSAT D The GPSPAC provides highly accurate three dimensional position and velocity of the host vehicle together with precision time determination using signals from NAVSTAR/GPS constellation of navigation development satellites The GPSPAC system architecture and design are described functional and operational characteristics discussed as well as principal hardware software and navigation features A description of test support equipment test methods and test results is presented R C T

N81-26114* National Aeronautics and Space Administration Langley Research Center Hampton Va
COOLING SYSTEM FOR HIGH SPEED AIRCRAFT Patent
Pierce L Lawing (McDonnel Aircraft Co St Louis) and LaVerne L Pagel inventors (to NASA) (McDonnell Aircraft Co St Louis) Issued 16 Jun 1981 8 p Filed 31 Jan 1979 Supersedes N79-24980 (17 - 16 p 2073) Sponsored by NASA
(NASA-Case-LAR-12406-1 US-Patent-4 273 304
US-Patent-Appl-SN-008210 US-Patent-Class-244-117A
US-Patent-Class-60-730 US-Patent-Class-60-267
US-Patent-Class-60-259 US-Patent-Class-62-DIG 5
US-Patent-Class-165-104 14 US-Patent-Class-244-163) Avail US Patent and Trademark Office CSCL 01C

The system eliminates the necessity of shielding an aircraft airframe constructed of material such as aluminum Cooling is accomplished by passing a coolant through the aircraft airframe the coolant acting as a carrier to remove heat from the airframe The coolant is circulated through a heat pump and a

heat exchanger which together extract essentially all of the added heat from the coolant The heat is transferred to the aircraft fuel system via the heat exchanger and the heat pump The heat extracted from the coolant is utilized to power the heat pump The heat pump has associated therewith power turbine mechanism which is also driven by the extracted heat The power turbines are utilized to drive various aircraft subsystems the compressor of the heat pump and provide engine cooling

Official Gazette of the U S Patent and Trademark Office

N81-26115 Texas Univ at Arlington
THE CRITICALITY OF ENGINE EXHAUST SIMULATIONS ON VSTOL MODEL-MEASURED GROUND EFFECTS Ph D Thesis
James Royce Lummus 1980 219 p
Avail Univ Microfilms Order No 8111703

The effects of varying the nozzle exit turbulence total pressure distributions and nozzle pressure ratio on the net and component ground-induced forces for two-, three- and four-nozzle configurations with large blocking surfaces (as well as a smaller cruciform two-nozzle blocking surface more characteristic of a real aircraft planform) were studied Nozzle exit turbulent intensities and pressure distributions were determined by exit surveys with a Kulite subminiature pressure transducer and a total pressure probe Screens of varying grid size and plates with varying hole patterns were used to achieve variations in turbulent intensity and pressure distributions (respectively) that are characteristic of real aircraft turbojet and turbofan engines at representative nozzle pressure ratios ranging from 1j5 to 2 4 It was determined that turbulence can be changed by increasing the screen grid size varying the pressure distribution or decreasing the nozzle pressure ratio

Dissert Abstr

N81-26116*# Cincinnati Univ Ohio Dept of Aerospace Engineering and Applied Mechanics
FLAP-LAG-TORSIONAL DYNAMIC MODELLING OF ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT, INCLUDING THE EFFECT OF CUBIC NONLINEARITIES
M R M CrespoDaSilva Jul 1981 73 p refs
(Grant NAG2-38)
(NASA-CR-166194 ASD-81-6-1) Avail NTIS HC A04/MF A01 CSCL 01C

The differential equations of motion and boundary conditions describing the flap-lead/lag-torsional motion of a flexible rotor blade with a precone angle and a variable pitch angle which incorporates a pretwist, are derived via Hamilton s principle The meaning of inextensionality is discussed The equations are reduced to a set of three integro partial differential equations by elimination of the extension variable The generalized aerodynamic forces are modelled using Greenberg s extension of Theodorsen s strip theory The equations of motion are systematically expanded into polynomial nonlinearities with the objective of retaining all terms up to third degree The blade is modeled as a long, slender, of isotropic Hookean materials Offsets from the blade s elastic axis through its shear center and the axes for the mass area and aerodynamic centers, radial nonuniformaties of the blade's stiffnesses and cross section properties are considered and the effect of warp of the cross section is included in the formulation E A K

N81-26117*# Cincinnati Univ Ohio Dept of Aerospace Engineering and Applied Mechanics
FLAG-LAG-TORSIONAL DYNAMICS OF EXTENSIONAL AND INEXTENSIONAL ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT Semiannual Progress Report, Jan. - Jun 1981
M R M CrespoDaSilva Jun 1981 3 p refs
(Grant NAG2-38)
(NASA-CR-164475) Avail NTIS HC A02/MF A01 CSCL 01C

The formulation of differential equations of motion for both extensional and inextensional rotor blades and the effect of cubic nonlinearities was examined The developed differential equations are reduced to a set of three integro partial differential equations for a hingeless blade by eliminating the extension variable Aerodynamic forces are modelled using Greenberg s extension of Theodorsen s strip theory Equations of motion are expanded into polynomial nonlinearities to evaluate the motion of the system E A K

N81-26118*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
FLIGHT TEST RESULTS OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM INSTALLED ON A REMOTELY PILOTED RESEARCH VEHICLE
John W Edwards May 1981 14 p refs Presented at the AIAA Struct Dyn Spec Meeting Atlanta 9-10 Apr 1981
(NASA-TM-83132) HC A02/MF A01 CSCL 01C

Flight flutter test results of the first aeroelastic research wing of NASA s drones for aerodynamic and structural testing (DAST) program are presented The implementation of the flutter suppression system and the flight test operation are described The conduct of the flutter testing and the near-real time damping estimation algorithm are also described in detail Flight data was obtained at Mach numbers up to 0 91 and was of high quality Response to fast frequency sweep excitation provided reliable damping estimates and the open-loop flutter boundary was well defined Evidence of angle-of-attack effects upon damping at high transonic Mach numbers is also presented While the flutter suppression system provided augmented damping at speeds below the flutter boundary an error in the implementation of the system gain caused the system to be less stable than predicted and the vehicle encountered system-on flutter on the third flight Author

N81-26119# Naval Air Development Center Warminster Pa Aircraft and Crew Systems Technology Directorate
VALIDATION STUDY OF THE V/STOL AERODYNAMICS AND STABILITY AND CONTROL MANUAL Final Report
M M Walters 31 Mar 1981 30 p refs
(WF41400000)
(AD-A099236, NADC-81051-60) Avail NTIS HC A03/MF A01 CSCL 20/4

The methods contained in the V/STOL Aerodynamics and Stability and Control Manual for the prediction of propulsion induced aerodynamics of V/STOL aircraft in the hover and transition flight regimes were validated against four different V/STOL aircraft configurations Manual prediction of the induced lift and pitching moment resulted in good correlation with test data for all configurations Author (GRA)

N81-26120*# Hughes Helicopters, Culver City Calif
PRELIMINARY DESIGN OF A TIP-JET-DRIVEN HEAVY LIFT HELICOPTER INCORPORATING CIRCULATION CONTROL
R E Head Bethesda, Md DTNSRDC Mar 1981 43 p refs
(Contract N00167-80-C-0066 WF41421091)
(AD-A099192 HH-80-466 DTNSRDC/ASED-81/07) Avail NTIS HC A03/MF A01 CSCL 01/3

This report describes a preliminary design study for a Very Heavy Lift Helicopter (VHLH) that is powered by jets at the blade tips and is controlled by circulation control applied to the main rotor blades The main thrust of the program was to integrate a tip-jet-powered helicopter design computer program developed by Hughes Helicopters Inc (HHI) with circulation control data generated by the David Taylor Naval Ship Research and Development Center (DTNSRDC) This work combined the computer program integration work with an air vehicle preliminary design study to size the helicopter and describe its features The result of this study is the sizing of a four-engined helicopter with a 185 foot diameter two-bladed main rotor that is designed to carry the XM-1 Main Battle Tank 100 nautical miles in a ship-to-shore Marine Corps assault mission GRA

N81-26121# Textron Bell Helicopter, Fort Worth, Tex
FLIGHT TEST EVALUATION OF A NONLINEAR HUB SPRING ON A UH-1H HELICOPTER Final Report
P J Hollifield L W Dooley J R VanGaasbeek J D Honaker and J Carr Apr 1981 159 p refs
(Contract DAAJ02-77-C-0064 DA Proj 1L2-62209-A-H-76)
(AD-A098794, AVRADCOM-TR-80-D-27) Avail NTIS HC A08/MF A01 CSCL 01/3

A nonlinear hub spring design and results of the subsequent flight testing as a concept to provide increased mast bumping safety margin for the UH-1H helicopter are presented Although there is a need for additional testing, the hub spring is shown to provide an increased margin of safety by reducing main rotor flapping in all conditions tested As a part of this effort a hybrid computer program was verified as able to predict mast loads due to flapping stop contact Using this program a parametric study of mast loads as a function of rotor flapping was performed in order to develop a design criteria to ensure that mast loads can be sustained during in-flight flapping stop contact In addition a comparison of the main rotor flapping predicted by the hybrid

computer and the digital computer C81 program using elastic blades is shown Also an evaluation of U S Army helicopter tactics to determine which NOE maneuvers are susceptible to high main rotor flapping is presented Author (GRA)

N81-26122# Queen Mary Coll London (England) Dept of Aeronautical Engineering
AN INTRODUCTION TO THE AERODYNAMICS OF SPOILERS
S R Siddalingappa and G J Hancock Aug 1980 35 p refs
(PB81-166183 QMC/EP-1034) Avail NTIS HC A03/MF A01 CSCL 01C

Some of the main features discussed include two dimensional spoiler/airfoil combinations with and without flaps three dimensional spoiler/wing combinations with comparison of aileron/wing combinations over a range of incidence and Mach as reflected in the lift, rolling moment, yawing moment and pitching moment characteristics No attempt is made to compare the full set of data available in the literature to some extent configurations tested are so diverse and test conditions unknown that comparisons are not realistic A bibliography of the literature is also included GRA

N81-26123# Queen Mary Coll London (England) Dept of Aeronautical Engineering
APPLICATION OF VORTEX LATTICE METHODS TO CALCULATE Lv (ROLLING MOMENT DUE TO SIDESLIP)
M A Javed and G J Hancock Aug 1980 31 p refs
(PB81-166167 QMC/EP-1038) Avail NTIS HC A03/MF A01

Four differing models of vortex lattice patterns are formulated to predict the loads on a finite wing in sideslip It was demonstrated that to obtain acceptable results for the rolling moment it is necessary to incorporate some representation of the zero loading condition on the downstream wing tip although the detailed modeling in this region does not appear to be important Theoretical results for the spanwise loading distribution derived from recommended vortex lattice models compare closely with some experimental data GRA

N81-26124# Queen Mary Coll London (England) Dept of Aeronautical Engineering
SOME QUALITATIVE EXPERIMENTS ON THE LOCAL FLOW ABOUT SPOILERS IN UNSTEADY MOTION AT LOW SPEEDS
S R Siddalingappa and G J Hancock Aug 1980 50 p refs
(PB81-166159 QMC/EP-1035) Avail NTIS HC A03/MF A01 CSCL 01C

The local flow was examined when there is reattachment of the flow downstream of the spoiler All unsteady measurements pose practical difficulties and uncertainties it is thought that the qualitative trends indicated are reasonable although the quantitative numbers should be treated with caution GRA

N81-26125# General Accounting Office Washington D C
OPERATIONAL AND SUPPORT COSTS OF THE NAVY'S F/A-18 CAN BE SUBSTANTIALLY REDUCED Report to the Congress
6 Jun 1980 69 p ref
(PB81-160814 LCD-80-65) Avail NTIS HC A04/MF A01 CSCL 01C

Cost reduction methods include the use of multiport avionics test equipment the consolidation of avionics repair facilities the buying of initial spares concurrently with aircraft installed units and a more effective use of pilot simulators The consolidation of F/A-18 squadrons into larger size units is discussed A reliability centered maintenance concept is presented that would determine the need for depot maintenance and pipeline aircraft T M

N81-26126# Advisory Group for Aerospace Research and Development Neuilly-Sur-Seine (France)
HELICOPTER FATIGUE LIFE ASSESSMENT
Mar 1981 261 p refs Partly in ENGLISH and FRENCH Proc of 51st meeting held in Axi-en-Provence France, 14-19 Sep 1980
(AGARD-CP-297 ISBN-92-835-0289-2) Avail NTIS HC A12/MF A01

The substantiation of the fatigue life of civil and military helicopters is considered with emphasis on comparisons with operational experience, the development of new technologies and the advent of new concepts Topics covered include current procedures damage tolerance and fail safe concepts service experience with existing procedures testing techniques and *methodology constant amplitude spectrum loading*

N81-26127# National Aerospace Lab , Emmeloord (Netherlands)
STATE OF THE ART AND STATISTICAL ASPECTS OF HELICOPTER FATIGUE SUBSTANTIATION PROCEDURES
R Noback *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 22 p refs

Avail NTIS HC A12/MF A01

The recipe that is used to calculate safe fatigue life for helicopter components is described Basic ingredients are flight loadspectrum, derived from measured flightloads and mission profile, a reduced S-N curve based on statistically treated coupon and specimen test results and a damage hypothesis These ingredients are generally used, but many different ways of handling especially statistically, exist and these may lead to a great variety of calculated safe fatigue lives An example is used to illustrate the influence of various ways of handling on the end result An attempt is made to bring together alternative statistical opinions Author

N81-26128# Royal Aircraft Establishment Farnborough (England) Structures Dept
FATIGUE ASSESSMENT OF UK MILITARY AEROPLANES
J L M Forsyth *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 6 p
Avail NTIS HC A12/MF A01

Fatigue assessment procedures used in the United Kingdom at all stages from the initial specification of the mission profile to the monitoring of Service use of military aircraft are described The present thinking on fatigue assessment procedures for fiber reinforced plastic and damage tolerant structures as well as the latest work on loads measurement and in service monitoring is indicated A R H

N81-26129# Army Aviation Research and Development Command St Louis Mo Structures and Aeromechanics Div
SYNOPSIS OF SPECIALISTS' MEETING ON HELICOPTER FATIGUE METHODOLOGY
Dean C Borgman and Daniel P Schrage *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 10 p refs Also presented at the Am Helicopter Soc Spec Meeting, St Louis 25-27 Mar 1980
Avail NTIS HC A12/MF A01

The principal results from the American Helicopter Society (AHS) Specialists Meeting on Helicopter Fatigue Methodology held in St Louis Mo on March 25-27 1980 are summarized The four essential elements of fagigue methodology usage spectrum flight loadings, component testing and life calculations were considered as well as the feasibility of standardization of helicopter fatigue methodology The manufacturers fatigue methodology based on a calculated fatigue life of a hypothetical helicopter component was presented A R H

N81-26130# Messerschmitt-Boelkow-Blohm G m b H Munich (West Germany)
APPLICATION OF DAMAGE TOLERANCE CONCEPTS FOR THE HELICOPTERS
M V Tapavicza and F Och *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 8 p refs

Avail NTIS HC A12/MF A01

The more and more pronounced tendency of modern helicopters towards higher efficiency and reliability requires materials and structural designs possessing high strength and good damage tolerance behavior The damage tolerance methodology used for helicopters of the BO 105 family as well as for the BK 117 is outlined One example of each type of damage tolerant design realized in or developed for MBB helicopters is discussed and the design criteria for the other vital components are summarized It is shown that only a few vital components are designed according to the safe life philosophy A R H

N81-26131# Societe Nationale Industrielle Aerospatiale Marignane (France) Div Helicopters

FATIGUE ANALYSIS OF COMPOSITE MATERIALS USING THE FAIL-SAFE CONCEPT [JUSTIFICATION EN FATIGUE DE PIECES EN MATERIAU COMPOSITE BENEFICIANT DU CONCEPT FAIL SAFE]

G Stievenard *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 5 p In FRENCH

Avail NTIS HC A12/MF A01

A regulation established jointly between SNIAS and the Official French Service requires failure probability for any individual helicopter part below or equal to 10 to the minus 6th power This demands knowledge of (1) the fatigue properties of the material (2) the probability of onset of cracking in the component, and (3) the component crack propagation rate if the load spectrum is applied Composite materials developed at Aerospatiale and used for rotors have a good fatigue life with evident fail/safe character (delayed start of delamination and slow rate of propagation) The method used at SNAIS to calculate the global risk of rupture is described A R H

N81-26132# Army Aviation Research and Development Command Fort Eustis Va Applied Technology Lab

COMBAT DAMAGE ASSESSMENT

Clarence H Carper Jr *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 20 p refs

Avail NTIS HC A12/MF A01

Ballistic damage to helicopters is discussed with primary attention given to the airframe structure A synopsis is provided of the air defense threat systems and nature of combat damage received by Army helicopters in South Vietnam versus the threat and nature of ballistic damage anticipated in today s environment New materials, structural concepts, and other vulnerability reduction measures presently being employed on Army helicopters and promising concepts currently under development are addressed An overview of the combat threats anticipated for the helicopter in the near future is included A R H

N81-26133# Royal Aircraft Establishment Farnborough (England) Structures Dept

AN EVALUATION OF FATIGUE PROCEDURES FOR UK MILITARY HELICOPTERS

R Cansdale *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 5 p

Avail NTIS HC A12/MF A01

In many areas the formal UK requirements concerning fatigue strength of military helicopters set out in MOD Aviation Publication 970, Volume 3 are known to be deficient more stringent clearance procedures stated in the Specifications against which new helicopters are procured Current UK procedures for the fatigue substantiation of military helicopters are reviewed in the light of practical experience of testing and of service usage The problems of demonstrating both safe lives and damage tolerance are examined The philosophy and problems of clearing composite components are mentioned A R H

N81-26134# Civil Aviation Authority Redhill (England) Airworthiness Div

HELICOPTER FATIGUE A CIVIL VIEW

H E LeSueur *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 4 p refs

Avail NTIS HC A12/MF A01

The majority of catastrophic accidents to helicopters involving structure were due to fatigue of some kind and in comparison with civil jet aircraft the accident rate for helicopters appears to be worse by a factor of at least two Methods currently available to reduce the number of accidents due to structural failures are described It is suggested that some benefits should be obtained by the introduction of damage tolerant materials the incorporation of multipath loads and the use of vibration monitoring A R H

N81-26135# Textron Bell Helicopter Fort Worth Tex Structures Technology

HELICOPTER COMPONENT FATIGUE LIFE DETERMINATION

M J McGuigan *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 10 p refs

Avail NTIS HC A12/MF A01

The fatigue evaluation program for helicopter components is reviewed and some of the uncertainties that can be encountered in each stage of the program are discussed in some detail These include the fatigue test and the flight loads measurement phases Also considered is the frequency of occurrence spectrum and the effects of changes in operational usage as well as possible solutions to the problem of the resulting changes in load spectrums Variables in the final fatigue life calculations are discussed and some different approaches to setting component retirement time are discussed In view of the existing uncertainties involved in the safe life determination process the fail safe approach is considered and some examples are discussed of damage tolerance testing for both metal and composite main rotor blades Author

N81-26136# Societe Nationale Industrielle Aerospatiale Marignane (France)

FATIGUE TESTS ON THE TOTAL STRUCTURE OF THE GAZELLE SA 341 HELICOPTER [ESSAI DE FATIGUE D'UNE STRUCTURE COMPLETE DE LHELICOPTERE SA 341 GAZELLE]

Philippe Petard and Jean-Pierre Lambert (Centre D Essais Aeronautique Toulouse) *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 22 p In FRENCH

Avail NTIS HC A12/MF A01

The Gazelle is a light single turbine 3-blade main rotor s aircraft whose structure combines metal assemblages and honeycomb structures A pecularity of the helicopter is a drift-fenestron (fan-in-fin) which replaces the classic anti-torque rotor This design especially at high speeds permits reduction of necessary force on the fenestron because of the aerodynamic action of the f drift and consequently increases the force available on the main rotor Transl by A R H

N81-26137# Sikorsky Aircraft Stratford Conn Transmission Systems Design and Development

HELICOPTER GEARBOX TESTING

Robert Zincone and Joseph H Mancini *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 10 p ref

Avail NTIS HC A12/MF A01

Helicopter gearboxes have benefited from improved materials and from design concepts However in the design arena exhaustive testing to verify that reliability maintainability and safety objectives achieved remains the key to a successful product Overstress testing and the methods used to design the gearboxes to meet these overstress test requirements are the key issues A gearbox designed for mission reliability will most likely have an unacceptably high risk of not passing an accelerated test The types of tests use to qualify gearboxes to provide reliability in the field are discussed Also discussed are the test approaches taken and the differences in acceptance criteria used by the various certifying agencies the ramifications of overstress testing and the reliability assessment used in the design of a modern helicopter gearbox Author

N81-26138# Westland Helicopters Ltd Yeovil (England)

FATIGUE TESTING OF HELICOPTER GEARBOXES

A H Baker *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 24 p

Avail NTIS HC A12/MF A01

The fatigue testing of helicopter gearboxes which covers not only the gears but the casings and shafts and other parts of the gearboxes is addressed Testing with the required factors for fatigue scatter and extrapolation leads to difficulties with the tooth meshing and premature tooth surface damage requiring modified tooth profiles and high pressure lubricants The principal test method has been on back to back rigs but for the future open loop testing is planned in order to give greater flexibility and versatility A comparison of service experience with test experience is of some value in assessing the merit of the test factors L F M

N81-26139# Hughes Helicopters Culver City Calif Structural Analysis Section

THE METHODOLOGY OF FATIGUE ANALYSIS AND TESTING MAIN ROTOR BLADES AND HUB, HUGHES YAH-64 ADVANCED ATTACK HELICOPTER

John M McDermott *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 17 p ref

Avail NTIS HC A12/MF A01

The fatigue methodology applied to the structural analysis and testing of the main rotor blade blade retention system and main rotor hub of the Hughes YAH-64 advanced attack helicopter are presented The basic structural concepts are described including provision of fail-safe redundant load paths and damage tolerance A description of the materials used for the various structural elements is given and the factors affecting their choice are discussed The strap retention system which incorporates both flapping and feathering motion is described with emphasis on its fail-safety The approach to fatigue testing of the main rotor elements is described Fatigue test results are presented, including failure modes and the ability of many components with large amounts of fatigue damage to sustain full loads A description is given of the fatigue testing of parts with ballistic damage and also of the crack propagation testing of parts with a fatigue crack already developed The analysis of failed parts to determine failure modes origins of crack inception and possible improvements to extend fatigue life is discussed L F M

N81-26140# Messerschmitt-Boelkow-Blohm G m b H Munich (West Germany)

FATIGUE TESTING OF COMPOSITE ROTOR BLADES

F Och *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 14 p refs

Avail NTIS HC A12/MF A01

Fatigue testing methodology for composite rotor blades established and proved during the last 20 year is based on nonlinear regression analysis An equation with four material-dependent parameters is used to derive mean and working S/N curves between static strength and endurance limit To calculate a scatter factor the fatigue failure load for a given number of cycles is chosen as statistical variable The fatigue testing program is comprised of testing coupons cut out of production blades to establish basic S/N curve shapes both for fiber and matrix failure Coupon testing includes temperature/humidity preconditioning effects and the effect of test temperature as well as service usage on the fatigue strength of unidirectional glass fiber composite It was found that the S/N curve shapes and scatter factors determined from coupon data could be applied to the full scale specimens A reduction in interlaminar shear fatigue strength was found with coupons after artificial environmental exposure With coupons no degradation could be found as it is with full scale specimens Composite rotor blades show excellent damage tolerance characteristics where damage will be indicated by changes in the eigenfrequencies due to decreasing stiffnesses long before the structural integrity will be questioned L F M

N81-26141# Royal Aircraft Establishment Farnborough (England)

DEVELOPMENT OF STANDARDISED FATIGUE TEST LOAD HISTORIES FOR HELICOPTER ROTORS BASIC CONSIDERATION AND DEFINITION OF HELIX AND FELIX

J Darts and D Schuetz (Fraunhofer-Inst fuer Betriebsfestigkeit) *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 42 p refs

Avail NTIS HC A12/MF A01

The development of two standard load histories for the fatigue evaluation of helicopter rotor materials and design details is described The loading environment experienced by helicopter rotor components is generally around the constant amplitude fatigue limit Realistic assessment of the fatigue performance of helicopter materials and design details by flight simulation loading therefore results in long testing times on electrohydraulic machines The adoption of a standard loading history for such assessments should reduce the amount of testing required and greatly increase the technical value of individual test results This is because with an agreed standard a wealth of relevant data accumulates quickly which may negate the need for some tests and gives extensive comparative data for others Large evaluation programs can therefore be more readily shared between different organizations and countries because the results of the program will be comparable with the organizations own standard data and the standard data previously accumulated L F M

N81-26142# Fraunhofer-Inst fuer Betriebsfestigkeit Darmstadt (West Germany)

FATIGUE TEST PROGRAM AND TEST RESULTS

D Schuetz H-G Koebler W Schuetz (Industrieanlagen-Betriebsgesellschaft) and M Hueck (Industrieanlagen Betriebsgesellschaft) *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 7 p

Avail NTIS HC A12/MF A01

The estimation of fatigue life of helicopter rotor parts is obtained by application of standarized load sequences where the service and standard load spectra are very similar Test results yield data of helicopter main rotor parts in the form of fatigue life curves L F M

N81-26143# Pisa Univ (Italy) Inst of Aeronautics

FATIGUE BEHAVIOR OF HELICOPTER DYNAMIC COMPONENTS UNDER CONSTANT AMPLITUDE AND SPECTRUM LOADING

G Cavallini A Lanciott G Aldinio (Costruzioni Aeronautiche G Agusta) and R Rovellotti (Costruzioni Aeronautiche G Agusta) *In* AGARD Helicopter Fatigue Life Assessment Mar 1981 14 p refs

Avail NTIS HC A12/MF A01

A number of results obtained in a research helicopter fatigue are given Various approaches to design for fatigue in helicopter components and subsequently an evaluation of improvement in this area were compared Current methodologies used in helicopter industries are considered, as well as nominal stress approach and advanced methods namely methods based on local stress-strain approaches Fatigue test constant amplitude and variable amplitude loading were carried out on typical dynamic component the tail rotor mast of A 109A helicopter Spectrum loading tests were performed using a sequence directly deduced from flight load survey Such experimental data and theoretical data from of all the methods considered are then compared Useful indications concerning fatigue evaluation methodolgies are given L F M

N81-26144*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center Edwards Calif

SUBSONIC TESTS OF AN ALL-FLUSH-PRESSURE-ORIFICE AIR DATA SYSTEM

Terry J Larson and Paul M Siemers III (NASA Langley Research Center) Jun 1981 50 p refs Presented at the 1980 Air Data Systems Conf Colorado Springs Colo May 1980

(NASA-TP-1871 H-1122) Avail NTIS HC A03/MF A01 CSCL 01D

The use of an all-flush-pressure-orifice array as a subsonic air data system was evaluated in flight and wind tunnel tests Two orifice configurations were investigated Both used orifices arranged in a cruciform pattern on the airplane nose One configuration also used orifices on the sides of the fuselage for a source of static pressure The all-nose-orifice configuration was similar to the shuttle entry air data system (SEADS) The flight data were obtained with a KC-135A airplane The wind tunnel data were acquired with a 0 035-scale model of the KC-135A airplane With proper calibration several orifices on the vertical centerline of the vehicle s nose were found to be satisfactory for the determination of total pressure and angle of attack Angle of sideslip could be accurately determined from pressure measurements made on the horizontal centerline of the aircraft Orifice pairs were also found that provided pressure ratio relationships suitable for the determination of Mach number The accuracy that can be expected for the air data determined with SEADS during subsonic orbiter flight is indicated A R H

N81-26145*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

TURBINE BYPASS ENGINE A NEW SUPERSONIC CRUISE PROPULSION CONCEPT

Leo C Franciscus 1981 15 p refs Presented at the 17th Joint Propulsion Conf Colorado Springs Colo 27-29 Jul 1981 sponsored by AIAA SAE and ASME

(NASA-TM-82608 E-855) Avail NTIS HC A02/MF A01 CSCL 21E

Engine performance and mission studies were carried out for a single-spool Turbine Bypass Engine concept Comparisons were made between the TBE a conventional single-spool turbojet, and the Pratt & Whitney Variable Stream Control Engine The airplane assumed for the study was a Mach 2 32 commercial supersonic transport The nominal mission was a 4000-nautical miles total range with a 300-nautical miles subsonic cruise leg The figure of merit was the minimum takeoff gross weight for the mission Comparisons of the three engines were also made for the 4000-nautical miles total range with longer subsonic cruise legs Author

N81-26146*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
SMALL GAS-TURBINE COMBUSTOR STUDY FUEL INJECTOR EVALUATION
Carl T Norgren and Stephen M Riddlebaugh 1981 20 p refs Presented at the Joint Propulsion Conf Colorado Springs Colo 27-29 Jul 1981 sponsored by AIAA SAE and ASME
(NASA-TM-82641 E-891) Avail NTIS HC A02/MF A01 CSCL 21E

As part of a continuing effort at the Lewis Research Center to improve performance emissions and reliability of turbine machinery an investigation of fuel injection technique and effect of fuel type on small gas turbine combustors was undertaken Performance and pollutant emission levels are documented over a range of simulated flight conditions for a reverse flow combustor configuration using simplex pressure-atomizing spill-flow return and splash cone airblast injectors A parametric evaluation of the effect of increased combustor loading with each of the fuel injector types was obtained Jet A and an experimental referee broad specification fuel were used to determine the effect of fuel type Author

N81-26148*# National Aeronautics and Space Administration Langley Research Center Hampton Va
SIMPLIFIED DESIGN POINT PERFORMANCE MODEL OF A DRY TURBOFAN ENGINE CYCLE
Frederick J Lallman May 1981 22 p
(NASA-TM-83112) HC A02/MF A01 CSCL 21E

The specific thrust and fuel-air ratios for the cycle were calculated over a range of altitudes and Mach numbers The engine has a fan pressure ratio of 2 9, compressor pressure ratio of 8 0 and bypass ratio of 0 6 A simplified model of the specific thrust and fuel-air ratio involving look-up tables and simple algebraic equations was empirically derived from the calculated data T M

N81-26149# Comptroller General of the United States Washington D C
A LOOK AT NASA'S AIRCRAFT ENERGY EFFICIENCY PROGRAM
28 Jul 1980 94 p refs
(PSAD-80-50) Avail NTIS HC A05/MF A01

The status of the program the coordination effectiveness between NASA and the Department of Defense the need for periodic reporting to the Congress on efforts such as ACEE and NASA s role in aeronautical research and development were examined Emphasis is placed on the development of technologies which would make future transport aircraft up to 50% more fuel efficient than current models T M

N81-26151# Naval Ship Research and Development Center Bethesda Md Dept of Aviation and Surface Effects
LIFT-PROPULSION SYSTEM WEIGHT VARIATION FOR VERY HEAVY LIFT HELICOPTERS
Peter S Montana Sep 1980 36 p refs
(ZF66412001)
(AD-A099169 DTNSRDC/ASED-80/25) Avail NTIS HC A03/MF A01 CSCL 21/5

The lift-propulsion system (LPS) weights of single and tandem rotor shaft-driven helicopters and single rotor tip-driven helicopters were estimated using weight trend equations for vehicle gross weights up to 250 000 lb (113 636 kg) The tip-driven helicopter configuration had the lowest LPS weight over the entire gross weight range and the greatest potential for achieving useful loads in excess of 60 000 lb (27 216 kg) Results of the sensitivity analysis indicate that disc loading number of blades and solidity of the main rotor are the most significant parameters affecting LPS weight The application of circulation control rotor technology to very large helicopters with tip-driven rotors can reduce LPS weight by as much as 19 percent Author (GRA)

N81-26152* National Aeronautics and Space Administration Langley Research Center Hampton Va
PITCH ATTITUDE STABILIZATION SYSTEM UTILIZING ENGINE PRESSURE RATIO FEEDBACK SIGNALS Patent
Wendell W Kelley inventor (to NASA) Issued 12 May 1981 7 p Filed 28 Feb 1979 Supersedes N79-20135 (17 - 11 p 1394)
(NASA-Case-LAR-12562-1 US-Patent-4 266 743 US-Patent-Appl-SN-015995 US-Patent-Class-244-182 US-Patent-Class-244-181) Avail US Patent and Trademark Office CSCL 01C

The changes in the engine pressure ratio signals which result from thrust changes are used to generate a pitch stabilization signal The signal is combined with other pitch control signals to automatically counteract pitching moments resulting from the changes in engine thrust
Official Gazette of the U S Patent and Trademark Office

N81-26153 Virginia Polytechnic Inst and State Univ Blacksburg
A STUDY OF THE EFFECTS OF STORE AERODYNAMIC ON WING/STORE FLUTTER Ph D Thesis
Charlie Daniel Turner 1980 83 p
Avail Univ Microfilms Order No 8110479

A large number of wing/store single carriage configurations parameters were included multivariate analysis techniques were used to analyze wing/store configuration modal data and flutter results The inclusion of both tip store and underwing store aerodynamics can cause large variations in the computed flutter speed when compared to results obtained when these effects are ignored In the majority of the configurations analyzed the flutter mechanism remained unchanged with the addition of the store aerodynamics which allowed for the use of multivariate analysis techniques The results of the factor analysis indicate that it may not be possible to develop general guidelines or to predict store aerodynamic effects that will apply to all aircraft and it is possible to develop specific guidelines or to predict store aerodynamic effects that will apply to given aircraft
Dissert Abstr

N81-26154*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center Edwards Calif
CORRELATION OF PREDICTED AND FLIGHT DERIVED STABILITY AND CONTROL DERIVATIVES WITH PARTICULAR APPLICATION TO TAILLESS DELTA WING CONFIGURATIONS
Joseph Weil Jul 1981 42 p refs
(NASA-TM-81361) Avail NTIS HC A03/MF A01 CSCL 01C

Flight derived longitudinal and lateral-directional stability and control derivatives were compared to wind-tunnel derived values As a result of these comparisons boundaries representing the uncertainties that could be expected from wind-tunnel predictions were established These boundaries provide a useful guide for control system sensitivity studies prior to flight The primary application for this data was the space shuttle and as a result the configurations included in the study were those most applicable to the space shuttle The configurations included conventional delta wing aircraft as well as the X-15 and lifting body vehicles Author

N81-26156*# National Aeronautics and Space Administration Wallops Flight Center Wallops Island, Va
DEVELOPMENT AND EVALUATION OF A PROTOTYPE IN-FLIGHT INSTRUMENT FLIGHT RULES (IFR) PROCEDURES TRAINER Final Report
Jennings B Aaron Jr and Gerald G Morris Jun 1981 34 p
(NASA-TM-73292) Avail NTIS HC A03/MF A01 CSCL 14B

An in-flight instrument flight rules (IFR) procedures trainer capable of providing simulated indications of instrument flight in a typical general aviation aircraft independent of ground based navigation aids was developed The IFR navaid related instruments and circuits from an ATC 610J table top simulator were installed in a Cessna 172 aircraft and connected to its electrical power and pitot static systems The benefits expected from this hybridization concept include increased safety by reducing the number of general aviation aircraft conducting IFR training flights in congested terminal areas and reduced fuel use and instruction costs by lessening the need to fly to and from navaid equipped airports and by increased efficiency of the required in-flight training Technical feasibility was demonstrated and the operational feasibility of the concept was evaluated Results indicated that the in-flight simulator is an effective training device for teaching IFR procedural skills E A K

N81-26158*# National Aeronautics and Space Administration Washington D C
MEASUREMENTS OF TEMPERATURE AND PRESSURE FLUCTUATIONS IN THE T PRIME 2 CRYOGENIC WIND TUNNEL
A Blanchard J B Dor and J F Breil Oct 1980 48 p

Transl into ENGLISH of Mesures des Fluctuations de Temperature et de Pression dans la Soufflerie Cryogenique T prime 2 (Toulouse) OA8/5007 and DERAT No 8 5007 DN Jan 1980 22 p Transl by Kanner (Leo) Associates Redwood City Calif Original doc prep by Centre d Etudes et de Recherches de Toulouse France
(Contract NASw-3199)
(NASA-TM-75408) Copyright Avail NTIS HC A03/MF A01 CSCL 14B

Cold wire measurement of temperature fluctuations were made in a DERAT T 2 induction powered cryogenic wind tunnel for 2 types of liquid nitrogen injectors Thermal turbulence measured in the tranquilization chamber depends to a great extent on the injector used for fine spray of nitrogen drops this level of turbulence seemed completely acceptable Fluctuations in static pressure taken from the walls of the vein by Kulite sensors showed that there was no increase in aerodynamic noise during cryogenic gusts Author

N81-26209# SRI International Corp Menlo Park Calif
ANALYSIS OF MIDDLE DISTILLATE FUELS BY FIELD IONIZATION MASS SPECTROMETRY Interim Technical Report, 7 Sep 1979 - 9 Sep 1980
S E Buttrill Jr Sep 1980 48 p
(Contract N00173-79-C-0462 SRI Proj PYU-8903)
(AD-A099407) Avail NTIS HC A03/MF A01 CSCL 21/4

This interim technical report describes work completed during the first twelve months of a research program to develop field ionization mass spectrometry for quantitative analyses of middle distillate fuels The relative field ionization sensitivities were measured for 90 compounds from petroleum shale or coal The FIMS sensitivities for naphthalenes are from 2 to 3 times greater than for saturates an advantage for detecting these minor components Sensitivity was also high for nitrogen and sulfur containing compounds which will increase the level at which these materials may be detected in fuels Distillation of the fuel sample from a solids probe into the FIMS source was found to not provide sufficient separation of compounds such as naphthalenes and saturates These compounds will be separated using high resolution FIMS The precision of the proposed analysis method was evaluated with an authentic jet fuel sample and it was found that the coefficient of variation of minor components averaged 6 percent while that of larger components was 2 or 3 percent The use of high resolution FIMS together with a batch inlet system and computerized data collection and analysis system appears to be a highly promising technique for providing detailed quantitative data on the chemical composition of middle distillate fuels Author (GRA)

N81-26349# University of South Florida Tampa Dept of Electrical Engineering
INVESTIGATION OF LOW LEVEL AIRCRAFT NONAVIONIC NONLINEAR INTERFERENCE Phase Report, 1 Oct 1979 - 30 Sep 1980
J L Allen Griffiss AFB, N Y RADC Apr 1981 52 p refs
(Contract F30602-78-C-0120, AF Proj 2338)
(AD-A098784 RADC-TR-81-26) Avail NTIS HC A04/MF A01 CSCL 20/14

High transmitter power levels combined with increased receiver sensitivity in multi-channel communication systems have led to operational problems caused by passively generated intermodulation products (IM) This report summarizes the results of a literature survey on causes effects and reduction techniques for passively generated IM interference An extensive list of references is included Author (GRA)

N81-26394# Ohio Univ Athens Dept of Electrical Engineering
VLF P-STATIC NOISE REDUCTION IN AIRCRAFT VOLUME 2 RECOMMENDED ACTION Final Report, May 1979 - Aug 1980
Robert W Lilley Oct 1980 12 p refs 2 Vol
(Contract DOT-FA79WA-4320)
(AD-A099130 EER-48-2 FAA-RD-80-137-2) Avail NTIS HC A02/MF A01 CSCL 09/4

Recommendations for experimentation and action to reduce p-static effects on low-frequency navigation are presented with emphasis on awareness of p-static symptoms and cures by the aviation community Experimentation to verify effects of new mechanical and electrical technology on p-static reduction is proposed The potential for interference by related noise sources such as lightning discharges is noted Author (GRA)

N81-26496*# National Aeronautics and Space Administration Langley Research Center Hampton Va
QUALITATIVE COMPARISON OF CALCULATED TURBULENCE RESPONSES WITH WIND-TUNNEL MEASUREMENTS FOR A DC-10 DERIVATIVE WING WITH AN ACTIVE CONTROL SYSTEM
Boyd Perry III Jun 1981 13 p refs Presented at the AIAA Dyn Specialist Conf Atlanta 8-11 Apr 1981
(NASA-TM-83144 AIAA-81-0567) Avail NTIS HC A02/MF A01 CSCL 20K

Comparisons are presented analytically predicted and experimental turbulence responses of a wind tunnel model of a DC-10 derivative wing equipped with an active control system The active control system was designed for the purpose of flutter suppression, but it had additional benefit of alleviating gust loads (wing bending moment) by about 25% Comparisons of various wing responses are presented for variations in active control system parameters and tunnel speed The analytical turbulence responses were obtained using DYLOFLEX a computer program for dynamic loads analyses of flexible airplanes with active controls In general the analytical predictions agreed reasonably well with the experimental data E D K

N81-26497*# National Aeronautics and Space Administration Langley Research Center Hampton Va
STRUCTURES AND DYNAMICS DIVISION RESEARCH AND TECHNOLOGY PLANS, FISCAL YEAR, 1981
Kay S Bales Jun 1981 43 p refs
(NASA-TM-83137) Avail NTIS HC A03/MF A01 CSCL 20K

The objectives expected results approach and FY81 milestones for the Structures and Dynamics Division s research program are presented This information will be useful in program coordination with other government organizations in areas of mutual interest Author

N81-26643*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt, Md
LIGHTNING ELECTRIC FIELD MEASUREMENTS WHICH CORRELATE WITH STRIKES TO THE NASA F-106B AIRCRAFT, 22 JULY 1980
D M LeVine May 1981 28 p refs
(NASA-TM-82142) Avail NTIS HC A03/MF A01 CSCL 04B

Ground-based data collected on lightning monitoring equipment operated by Goddard Space Flight Center at Wallops Island, Virginia during a storm being monitored by NASA's F-106B are presented The slow electric field change data and RF radiation data were collected at the times the lightning monitoring equipment on the aircraft was triggered The timing of the ground-based events correlate well with events recorded on the aircraft and provide an indication of the type of flash with which the aircraft was involved J D H

N81-26845*# Massachusetts Inst of Tech Cambridge Dept of Aeronautics and Astronautics
NOISE AND PERFORMANCE OF PROPELLERS FOR LIGHT AIRCRAFT
G P Succi D H Munro J A Zimmer P D Dunbeck E E Larabee K U Ingard and J L Kerrebrock Jun 1981 26 p refs
(Contract NAS1-15154)
(NASA-CR-165732) Avail NTIS HC A03/MF A01 CSCL 20A

The aerodynamic and acoustics of lightly loaded propellers with subsonic tip speed were studied theoretically in order to gain insight into the sound generation of moving bodies The effect of variation of some parameters such as blade sweep radial load distribution and blade number on the nose characteristics of propeller models was also examined A linear acoustic formula of Succi for noise calculations was coded for a computer and the predicted noise spectra and signatures compared very well with the measured data for model propellers On the basis of theoretical analysis and model tests a two bladed fixed pitch propeller was designed for a single engine aircraft Some flight tests also were performed on this full scale propeller The peak sound level during a full power flyover at 305 m (1000 ft) altitude was 4 8 dBA lower A R H

N81-26846*# Wyle Labs Inc El Segundo Calif
STATIC TESTS OF EXCESS GROUND ATTENUATION AT

WALLOPS FLIGHT CENTER Final Report
Louis C Sutherland and Ron Brown Jun 1981 155 p refs (Contract NAS1-15845)
(NASA-CR-3435 WR-80-32) Avail NTIS HC A08/MF A01 CSCL 20A

An extensive experimental measurement program which evaluated the attenuation of sound for close to horizontal propagation over the ground was designed to replicate, under static conditions results of the flight measurements carried out earlier by NASA at the same site (Wallops Flight Center) The program consisted of a total of 41 measurement runs of attenuation in excess of spreading and air absorption losses for one third octave bands over a frequency range of 50 to 4000 Hz Each run consisted of measurements at 10 locations up to 675 m from a source located at nominal elevations of 2 5, or 10 m over either a grassy surface or an adjacent asphalt concrete runway surface The tests provided a total of over 8100 measurements of attenuation under conditions of low wind speed averaging about 1 m/s and for most of the tests, a slightly positive temperature gradient averaging about 0 3 C/m from 1 2 to 7 m The results of the measurements are expected to provide useful experimental background for the further development of prediction models of near grazing incidence sound propagation losses A R H

N81-26847# Douglas Aircraft Co Inc Long Beach Calif
YC-15 INTERIOR NOISE MEASUREMENTS TECHNICAL DISCUSSION Final Report, 8 May - 8 Dec. 1976
James L Warnix and D E Hines Mar 1981 123 p refs (Contract F33657-72-C-0833 AF Proj 1367)
(AD-A098788 MDC-J7191 AFFDL-TR-76-140) Avail NTIS HC A06/MF A01 CSCL 20/1

Tests were conducted to simultaneously measure exterior fuselage noise structural vibration and interior noise of a YC-15 Advanced Medium-Range Short-Takeoff and Landing Transport airplane that employs an under-the-wing externally-blown-flap powered lift system The data obtained are of high quality and constitute a comprehensive data base of static ground tests at various flap and engine settings and flight tests at typical STOL takeoff, taxi, cruise and landing GRA

N81-26849*# Boeing Commercial Airplane Co, Seattle Wash
YC-14 INTERIOR NOISE MEASUREMENTS PROGRAM Technical Report, Oct 1975 - Oct 1977
L M Butzel Mar 1981 149 p refs Sponsored in part by NASA
(Contract F33657-72-C-0829 AF Proj 2401 AF Proj 1471 AF Proj 1367)
(NASA-CR-164523 AD-A098799 D748-10113-4 AFFDL-TR-77-128) Avail NTIS HC A07/MF A01 CSCL 20A

A test and preliminary analysis program was conducted to develop a data base and initial understanding of the interior noise of a Upper Surface Blowing STOL airplane using the YC-14 as a test vehicle A data base has been secured consisting of concurrent cabin noise exterior fuselage fluctuating pressures, fuselage wall vibrations and associated aerodynamic propulsive and mechanical performance values covering the normal operating envelope of the airplane Results from preliminary analysis of data show orderly and intuitively reasonable trends The resultant data base is judged capable of supporting further detailed analysis GRA

N81-27042*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
FACTORS INFLUENCING THE PREDICTED PERFORMANCE OF ADVANCED PROPELLER DESIGNS
Lawrence J Bober and Li-Ko Chang (Purdue Univ Lafayette Ind) 1981 20 p refs Presented at the 17th Joint Propulsion Conf Colorado Springs Colo 27-29 Jul 1981 sponsored by AIAA SAE and ASME
(NASA-TM-82676 E-942 AIAA-Paper-81-1564) Avail NTIS HC A02/MF A01 CSCL 01A

The assumptions on which conventional propeller aerodynamic performance analyses are based can be seriously violated when advanced high speed propellers are analyzed Studies were performed using a lifting line representation for the propeller to determine the sensitivity of predicted propeller performance to various assumptions in the analysis Items studied include the method of determining blade section lift and the effects of blade section drag camber and blade sweep The effects of nonuniform flow into the propeller and compressibility were also studied Comparisons of analytical and experimental results are presented to demonstrate the overall validity of the results Author

N81-27046*# McDonnell-Douglas Corp Long Beach Calif
DESIGN AND WIND TUNNEL TESTS OF WINGLETS ON A DC-10 WING Final Report
R D Gilkey Washington NASA Apr 1979 52 p refs (Contract NAS1-14743)
(NASA-CR-3119) Avail NTIS HC A04/MF A01 CSCL 01A

Results are presented of a wind tunnel test utilizing a 4 7 percent scale semi-span model in the Langley Research Center 8-foot transonic pressure wind tunnel to establish the cruise drag improvement potential of winglets as applied to the DC-10 wide body transport aircraft Winglets were investigated on both the DC-10 Series 10 (domestic) and 30/40 (intercontinental) configurations and compared with the Series 30/40 configuration The results of the investigation confirm that for the DC-10 winglets provide approximately twice the cruise drag reduction of wing-tip extensions for about the same increase in bending moment at the wing fuselage juncture Furthermore the winglet configurations achieved drag improvements which were in close agreement to analytical estimates It was observed that relatively small changes in wing-winglet tailoring effected large improvements in drag and visual flow characteristics All final winglet configurations exhibited visual flow characteristics on the wing and winglets Author

N81-27051# Lockheed-Georgia Co Marietta
AERODYNAMIC INVESTIGATION OF C-141 LEADING EDGE MODIFICATIONS FOR CRUISE DRAG REDUCTION, TEST 2 Final Report, Oct 1978 - Aug 1980
Robert A Large and W T Blackerby Apr 1981 146 p refs (AF Proj 2404)
(AD-A099662 AFWAL-TR-81-3032) Avail NTIS HC A07/MF A01 CSCL 20/4

A wing leading edge modification for cruise drag reduction on the C-141 aircraft has been designed and wind tunnel tested The modification was designed using a CONMIN optimizer linked to a transonic airfoil code It was tested in the AEDC 16-Foot Transonic Facility using a 0 044 scale C-141B model to determine the effects of the modifications on C-141 cruise aerodynamic characteristics and wing chordwise pressure distributions Measured chordwise pressure distributions were used for correlations with transonic theory Force data results were analyzed to determine the effects on C-141 cruise drag drag rise and cruise performance A fuel savings evaluation was made based on measured cruise performance improvements The effects of Lockheed designed swept wing tip extensions and trailing edge anti-drag bodies were also investigated in combination with the wing leading edge modification Author (GRA)

N81-27060* National Aeronautics and Space Administration Washington D C
ENERGY ABSORPTION STUDIED TO REDUCE AIRCRAFT CRASH FORCES
20 Jul 1981 4 p
(NASA-News-Release-81-96 P81-10097) Avail NTIS Avail NASA Scientific and Technical Information Facility P O Box 8757 B W I Airport Md 21240 CSCL 01C

The NASA/FAA aircraft safety reseach programs for general aviation aircraft are discussed Energy absorption of aircraft subflooring and redesign of interior flooring are being studied The testing of energy absorbing configurations is described The three NASA advanced concepts performed at neary the maximum possible amount of energy absorption and one of two minimum modifications concepts performed well Planned full scale tests are described Airplane seat concepts are being considered J D H

N81-27061*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
ATC SIMULATION OF HELICOPTER IFR APPROACHES INTO MAJOR TERMINAL AREAS USING RNAV, MLS, AND CDTI
L Tobias H Q Lee L L Peach F M Willett, Jr (FAA Atlantic City) and P J OBrien (FAA Atlantic City) Apr 1981 55 p refs
(NASA-TM-81301 A-8606) Avail NTIS HC A04/MF A01 CSCL 01C

The introduction of independent helicopter IFR routes at hub airports was investigated in a real time air traffic control system simulation involving a piloted helicopter simulator computer generated air traffic and air traffic controllers The helicopter simulator was equipped to fly area navigation (RNAV) routes and microwave landing system approaches Problems studied included (1) pilot acceptance of the approach procedure and tracking accuracy (2) ATC procedures for handling a mix of helicopter and fixed wing traffic and (3) utility of the cockpit display of traffic information (CDTI) for the helicopter in the hub airport environment Results indicate that the helicopter routes were acceptable to the subject pilots and were noninterfering with fixed wing traffic Merging and spacing maneuvers using CDTI were successfully carried out by the pilots but controllers had some reservations concerning the acceptability of the CDTI procedures Author

N81-27062*# National Aeronautics and Space Administration Langley Research Center Hampton Va
THUNDERSTORM HAZARDS FLIGHT RESEARCH STORM HAZARDS 1980 OVERVIEW Technical Report, Jun - Oct 1980
Perry L Deal Gerald L Keyser Bruce D Fisher and Norman L Crabill Jun 1981 29 p refs
(NASA-TM-81974) Avail NTIS HC A03/MF A01 CSCL 01C

A highly instrumented NASA F-106B aircraft modified for the storm hazards mission and protected against direct lightning strikes was used in conjunction with various ground based radar and lightning measurement systems to collect data during thunderstorm penetration flights During 69 thunderstorm penetrations there were 10 direct lightning strikes to the aircraft No problems were encountered with any of the aircraft s systems as a result of the strikes and the research instrumentation performed as designed Electromagnetic characteristics of nine strikes were recorded and the results of other experiments confirm the theory that X-ray radiation and nitrous oxide gas are being produced by processes associated directly with thunderstorm electric fields and lightning discharges A better understanding of aircraft lightning attachment mechanisms and strike zones is being accomplished by careful inspection identification and documentation of lightning attachment points and swept stroke paths following each strike to the aircraft
A R H

N81-27063*# Battelle Columbus Labs Ohio
A STUDY OF ASRS REPORTS INVOLVING GENERAL AVIATION AND WEATHER ENCOUNTERS Interim Report
Thomas H Rockwell (Ohio State Univ) Darrell E Roach (Ohio State Univ) and Walter C Griffin (Ohio State Univ) 26 Jun 1981 57 p
(Contract NAS2-10060)
(NASA-CR-166212) Avail NTIS HC A04/MF A01 CSCL 01C

Consideration is given to the nature and characteristics of problems involving dissemination of weather information use of this information by pilots its adequacy for the purpose intended the ability of the air traffic control system to cope with weather related incidents and the various aspects of pilot behavior aircraft equipment, and NAVAIDS affecting flights in which weather figures It is concluded from the study that skill and training deficiencies of general aviation pilots are not major factors in weather related occurrences nor is lack of aircraft equipment Major problem causes are identified with timely and easily interpreted weather information judgement and attitude factors of pilots and the functioning of the air traffic control system
E D K

N81-27064# Federal Aviation Administration Washington D C Office of Aviation Safety
SPECIAL AVIATION FIRE AND EXPLOSION REDUCTION (SAFER) ADVISORY COMMITTEE, VOLUME 2B Final Report, 26 Jun 1978 - 26 Jun 1980
J H Enders and E C Wood 26 Jun 1980 194 p
(AD-A099176 FAA-ASF-80-4-Vol-2B) Avail NTIS HC A09/MF A01 CSCL 01/2

The factors affecting the ability of the aircraft cabin occupant to survive in the post crash fire environment and the range of solutions available are presented The proceedings of the SAFER Committee and the FAA s responses to the committee s recommendations are reported Information on crew protection and passenger evacuation is given T M

N81-27065# Federal Aviation Administration Washington D C Office of Aviation Safety
SPECIAL AVIATION FIRE AND EXPLOSION REDUCTION (SAFER) ADVISORY COMMITTEE, VOLUME 2A Final Report, 26 Jun 1978 - 26 Jun 1980
J H Enders and E C Wood 26 Jun 1980 304 p refs
(AD-A099147 FAA-ASF-80-4-Vol-2A) Avail NTIS HC A14/MF A01 CSCL 01/2

The Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee and its technical supporting groups spent nearly 13 months from May 1979 through June 1980 examining the factors affecting the ability of the aircraft cabin occupant to survive in the post-crash fire environment and the range of solutions available Presentations were made to the SAFER Committee by Committee members technical supporting groups the FAA citizens and private firms The broadly-constituted body of information developed and presented to the Committee formed the basis for Committee Findings and Recommendations This volume contains technical subcommittee submittal related to interior cabin materials flammability short term solutions to the fire hazard and recommendations on Post Crash Fire Reduction Author (GRA)

N81-27068# Transportation Research Board Washington D C
AVIATION FORECASTING AND SYSTEMS ANALYSES
R Wilson Kenneth E Geisinger John R G Brander Frank R Wilson Harold M Kohn Neil W Polhemus Scott D Nason Allen C Busch Brian Colamosca and J Stuart Hunter 1980 65 p refs
(PB81-174252 TRB/TRR-768 ISBN-0-309-03112-5 ISSN-0361-1981) Avail NTIS HC A04/MF A01 CSCL 01C

A method of allocating airport runway slots a method for forecasting general aviation activity and an air traffic control network-planning model based on second-order Markov chains are presented Other topics analyzing ticket-choice decisions of air travelers assessing the safety and risk of air traffic control systems risk estimation from rare events forecasts of aviation fuel consumption in Virginia estimating the market share of international air carriers forecasts of passenger and air-cargo activity at Logan International Airport and forecasting method for general aviation aircraft and their activity GRA

N81-27071# Federal Aviation Administration Washington D C Office of Systems Engineering Management
AN ANALYSIS OF THE REQUIREMENTS FOR AND THE COSTS AND BENEFITS OF THE NATIONAL MICROWAVE LANDING SYSTEM (MLS), VOLUME 1
William C Reddick, Seymour M Horowitz, Eugene S Rehrig and Gilbert P Christiana Jun 1980 345 p refs 2 Vol
(AD-A099632 FAA-EM-80-7-Vol-1) Avail NTIS HC A15/MF A01 CSCL 17/7

This report consist of three volumes (1) An Executive Summary (2) This Volume I comprising the detailed study analysis and (3) Volume II which contains reprints of important studies supporting the analysis included in the report The analysis assesses the comparative desirability of implementing the MLS equipment option in place of the currently installed ILS as the long term National standard for precision guidance service An evaluation period of 20 years to the year 2000 was used for this assessment An implementation strategy was assumed to achieve the estimated National requirement 1250 ground installations by the year 2000 and providing precision guidance service alternatively with the ILS or MLS equipment option The study s method was to examine the technical and performance specifications for the MLS and to estimate the dollar amounts of benefits resulting from the portion of these specifications which could be quantified The dollar amounts of comparative costs to the community of aviation users and to the FAA from the alternative use of MLS instead of ILS were likewise estimated The study results show that implementation of MLS can provide sizeable benefits in excess of costs in varying degrees to the different aviation user groups (i e air carriers commuter airlines general aviation and the military) Author (GRA)

N81-27072# Federal Aviation Administration Washington D C Office of Systems Engineering Management

AN ANALYSIS OF THE REQUIREMENTS FOR, AND THE BENEFITS AND COSTS OF THE NATIONAL MICROWAVE LANDING SYSTEM (MLS), VOLUME 2

William C Reddick Seymour M Horowitz Eugene S Rehrig and Gilbert P Christiana Jun 1980 242 p refs 2 Vol (AD-A100018 FAA-EM-80-7-Vol-2) Avail NTIS HC A11/MF A01 CSCL 17/7

The comparative desirability of implementing the MLS equipment option in place of the currently installed ILS as the long term national standard for precision guidance service was assessed An evaluation period of 20 years to the 2000 was used for this assessment Results show that implementation of MLS can provide sizeable benefits in excess of costs in varying degrees to the different aviation user groups TM

N81-27073# Federal Aviation Administration Atlantic City N J Technical Center

INVESTIGATION OF WILCOX MODEL 585B VERY HIGH FREQUENCY OMNIDIRECTIONAL RADIO RANGE SYSTEM, PART 2 Interim Report, May - Jun 1980

Wayne Bell and James Dong Apr 1981 14 p refs (AD-A099525 FAA-CT-80-45-Pt-2 FAA-RD-80-124-Pt-2) Avail NTIS HC A02/MF A01 CSCL 17/2

This report establishes a calibration procedure which employs a space modulation chart to adjust percent modulation for the Wilcox 585B very high frequency omnidirectional radio range (VOR) System This procedure is recommended for solid-state VOR designed systems in which the rotatable goniometer has been replaced by a solid-state unit Ground and airborne modulation tests were made using a spectrum analyzer for determining percent modulation Results of these measurements indicated 1 5 percent modulation be added to the normal 30 percent modulation adjustment when made with the detector at counterpoise edge to provide equality between near and far afield modulation measurements GRA

N81-27075*# National Aeronautics and Space Administration Washington D C

THE SUPERCRITICAL PROFILE OF THE SUPERCRITICAL WING

Otto Wagner Jul 1981 12 p refs Transl into ENGLISH from Luft- und Raumfahrt (West Germany) v 1 4th quarter 1980 p 105-106 108 109 Original language document was announced as A81-17522 Transl by Scientific Translation Service Santa Barbara Calif Original doc prep by Technical Univ Munich

(Contract NASw-3198)

(NASA-TM-76605) Avail NTIS HC A02/MF A01 CSCL 01C

The profile wing design for supercritical structures is discussed Emphasis is placed on the flow of air surrounding the wing and variations in flow fields are examined Modifications to the profile for flight below transonic level are presented that increase the uplift pressure and permit the achievement of critical Mach numbers on the order of 0 85 The uplift pressure along the upper side of the profile is compared for a classical and a Peaky profile A comparison of classical and supercritical wing cross sections indicates a flatter upper side a large nose radius and a thicker profile to the supercritical wing Author

N81-27076*# Textron Bell Helicopter Fort Worth Tex

TOTAL MAIN ROTOR ISOLATION SYSTEM ANALYSIS

Dennis R Halwes Jun 1981 142 p refs

(Contract NAS1-16211)

(NASA-CR-165667) Avail NTIS HC A07/MF A01 CSCL 01C

The requirements for a preliminary design study and verification procedure for a total main rotor isolation system at n/rev are established The system is developed and analyzed and predesign drawings are created for an isolation system that achieves over 95 percent isolation of all six degrees of freedom Author

N81-27077*# Douglas Aircraft Co Inc Long Beach Calif

MANUFACTURING DEVELOPMENT OF DC-10 ADVANCED RUDDER Final Report, 6 Dec 1976 - 1 Sep 1979

A Cominsky Aug 1979 230 p refs

(Contract NAS1-14724)

(NASA-CR-159060) Avail NTIS HC A11/MF A01 CSCL 01C

The design manufacture and ground test activities during development of production methods for an advanced composite rudder for the DC-10 transport aircraft are described The advanced composite aft rudder is satisfactory for airline service and a cost saving in a full production manufacturing mode is anticipated LFM

N81-27078*# North Carolina State Univ Raleigh

FLIGHT TEST EVALUATION OF PREDICTED LIGHT AIRCRAFT DRAG, PERFORMANCE, AND STABILITY

Frederick O Smetana and Stan R Fox May 1979 712 p refs

(Grant NsG-1077)

(NASA-CR-159062) Avail NTIS HC A99/MF A01 CSCL 01C

A technique was developed which permits simultaneous extraction of complete lift drag and thrust power curves from time histories of a single aircraft maneuver such as a pull up (from V max to V stall) and pushover (to V max for level flight) The technique which is an extension of nonlinear equations of motion of the parameter identification methods of Iliff and Taylor and includes provisions for internal data compatibility improvement as well was shown to be capable of correcting random errors in the most sensitive data channel and yielding highly accurate results Flow charts listings sample inputs and outputs for the relevant routines are provided as appendices This technique was applied to flight data taken on the ATLIT aircraft Lack of adequate knowledge of the correct full throttle thrust horsepower true airspeed variation and considerable internal data inconsistency made it impossible to apply the trajectory matching features of the technique A R H

N81-27079*# National Aeronautics and Space Administration Washington D C

PROTECTION AGAINST WING ICING FOR AIRBUS A300 AND A310

G Woelfer Jul 1981 30 p ref Transl into ENGLISH of Vereisungschultz fuer die Traglaechen des Airbus A300 and A310 Brunswick DGLR Paper 80-046 p 1-34 Presented at the 13th Deutsche Gesellschaft fuer Luft- und Raumfahrt Jahrestagung, Brunswick 28-30 May 1980 Translation was announced as A80-46296 Transl by Scientific Translation Service Santa Barbara Calif Original document prepared by Messerschmitt-Boelkow-Blohm GmbH

(Contract NASw-3198)

(NASA-TM-76584 HE242-311/80) Avail NTIS HC A03/MF A01 CSCL 01C

To improve economy of operantion it is now planned to modify the anti icing system used on the A300 Airbus wing Thus, for the A310 Airbus the deicing system will be applied to only half the wing length Other essential modifications are a substantial simplification of the warm-air system and discontinuation of the use of a double wall in slats Author

N81-27080# Nielsen Engineering and Research Inc Mountain View Calif

PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION VOLUME 2 USERS MANUAL FOR THE COMPUTER PROGRAM Final Report, Jun 1975 - Jan 1980

Joseph Mullen, Jr Frederick K Goodwin and Marnix F E Dillenius Wright-Patterson AFB Ohio AFWAL Nov 1980 247 p refs

(Contract F33615-76-C-3077 AF Proj 2403)

(AD-A099391 NEAR-TR-210-Vol-2

AFWAL-TR-80-3032-Vol-2) Avail NTIS HC A11/MF A01 CSCL 19/5

Detailed instructions are presented for using a computer program which calculates the six-degree-of-freedom trajectories of external stores which are separated from fighter-bomber type aircraft flying at supersonic speeds Multiple circular or elliptical store configurations may be handled Parent aircraft configurations may consist of a circular or arbitrary cross section fuselage with ramp external compression inlets and a wing pylon and rack The program uses linear potential-flow theory to model the wing and pylon loading and thickness Three-dimensional line sources and doublets are used to model circular fuselages and stores The noncircular fuselage and elliptic store surfaces are modeled with constant source panels Nonlinear corrections are made to the wing fuselage rack store and fuselage inlet models to simulate shocks The program also calculates the trajectory of the store

as it separates from the aircraft This report describes the program presents instructions for preparing input for the program describes the output from the program and presents a sample case The program represents an extension of an earlier program restricted to circular bodies at supersonic speeds written by the present authors and described in AFFDL-TR-76-41 This volume presents the instructions for preparing input for each of two programs a sample case for each and the descriptions of the output cases
Author (GRA)

N81-27081# Nielsen Engineering and Research, Inc Mountain View Calif
PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION VOLUME 1 THEORETICAL METHODS AND COMPARISONS WITH EXPERIMENT Final Report, Jun 1975 - Jan 1980
Frederick K Goodwin Marnix F E Dillenius and Joseph Mullen Jr Wright-Patterson AFB Ohio AFWAL Nov 1980 331 p refs 4 Vol
(Contract F33615-76-C-3077 AF Proj 2403)
(AD-A099330 NEAR-TR-210-Vol-1
AFWAL-TR-80-3032-Vol-1) Avail NTIS HC A15/MF A01 CSCL 20/4

The primary objective of this report is to describe an investigation conducted to develop a method for predicting the trajectory of a store separated from an aircraft flying at supersonic speeds The aircraft model can include a circular or noncircular fuselage engine inlets wing pylon ejector rack and circular and noncircular stores The linear potential flow methods used to model the aircraft components are described as are nonlinear corrections which are made to position shock waves more accurately The methods used to calculate the nonuniform flow field the store forces and moments and the store trajectory are presented Comparisons between theory and experiment for flow fields store loading distributions store forces and moments and store trajectories are shown and discussed Author (GRA)

N81-27082# Nielsen Engineering and Research Inc Mountain View Calif
PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION VOLUME 3 APPENDICES A AND B DETAILS OF PROGRAM 1 Final Report, Jun 1975 - Feb 1980
Joseph Mullen Jr Frederick K Goodwin and Marnix F E Dillenius Wright-Patterson AFB Ohio AFWAL Nov 1980 210 p refs 4 Vol
(Contract F33615-76-C-3077 AF Proj 2403)
(AD-A099331 NEAR-TR-210 Vol-3
AFWAL-TR-80-3032-Vol-3) Avail NTIS HC A10/MF A01 CSCL 20/4

A detailed description of the operations and flow of calculations of each of the individual routines in Program I is provided Included are a description of the flow of the calculations including flow charts of some routines, a description of any program arguments and a program listing All variables passed between routines in common blocks are also described A listing of each common block with a description of each variable array or index in the common is provided A special section is given for the multiple uses of blank common as well as a cross reference chart of routine versus common block usage R C T

N81-27083# Nielsen Engineering and Research Inc Mountain View Calif
PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS INCLUDING FUSELAGE AND STORES OF NONCIRCULAR CROSS SECTION VOLUME 4 APPENDICES C AND D DETAILS OF PROGRAM 2 Final Report, Jun 1975 - Feb 1980
Joseph Mullen Jr Frederick K Goodwin and Marnix F E Dillenius Wright-Patterson AFB Ohio AFWAL Nov 1980 330 p refs 4 Vol
(Contract F33615-76-C-3077 AF Proj 2403)
(AD-A099332 NEAR-TR-210-Vol-4
AFWAL-TR-80-3032-Vol-4) Avail NTIS HC A15/MF A01 CSCL 20/4

Detailed instructions are presented for using a computer program which calculates the six degree of freedom trajectories of external stores which are separated from fighter bomber type aircraft flying at supersonic speeds The program uses linear potential fow theory to model the wind and pylon loading and thickness Three dimensional line sources and doublets are used to model circular fuselages and stores The noncircular fuselage and elliptic store surfaces are modeled with contrast source panels Nonlinear corrections are made to the wing fuselage rack store and fuselage inlet models to simulate shocks The program also calculates the trajectories of the store as it separates from the aircraft R C T

N81-27084# Naval Research Lab Washington, D C Target Characteristics Branch
RESULTS OF A FEASIBILITY STUDY FOR DETERMINING THE YAW ANGLE OF A LANDING AIRCRAFT Final Report, Jan 1976 - Oct 1979
F Donald Queen and James J Alter 27 May 1981 19 p refs
(XF21232061)
(AD-A099765 NRL-8480) Avail NTIS HC A02/MF A01 CSCL 17/9

A study was conducted to determine a means of measuring the yaw angle (crab angle) of an aircraft landing in zero-zero visibility conditions The results of flight tests using the technique judged most promising are described This technique used the characteristics of the radar returns obtained when the beam aspects of the aircraft were illuminated with a high-range-resolution radar The range-time profiles of the sides of the aircraft were processed to determine the delay time between maximum correlation of the two waveforms This delay is shown to be directly related to the crab angle While success was achieved using manual data processing automatic data processing did not produce consistent results when the aircraft geometry was complex It was concluded that the profiles did not match because of differences in the radar characteristics A radar technique employing switched RF oscillators is recommended for further testing Author (GRA)

N81-27085# Messerschmitt-Boelkow-Blohm G m b H Ottobrunn (West Germany) Unternehmensbereich Flugzeuge
TORNADO FLIGHT CHARACTERISTICS AT HIGH ANGLES OF INCIDENCE [TORNADO-FLUGEIGENSCHAFTEN IM HOHEN ANSTELLWINKELBEREICH]
E P Hahn and E Zehner 13 Dec 1979 47 p refs In GERMAN Presented at DGLR Symp on the MRCA-Program TORNADO Neubiberg, West Germany 13 Dec 1979
(MBB/FE-127/S/PUB/23) Avail NTIS HC A03/MF A01

The flight characteristics of the MRCA TORNADO aircraft are assessed from wind tunnel simulations and partial flight test results The development of spin, spin departure and spin recovery capabilities are emphasized The effectiveness of the control surfaces individually and as a whole is discussed Longitudinal and lateral stability are then determined from simulator data Spin behavior and spin recovery are described The practicability of spin prevention maneuvers is analyzed Results show that the pilotage of the TORNADO at high incidence is possible and that spin recovery characteristics are good for this class of fighter aircraft Author (ESA)

N81-27086# National Aerospace Lab Amsterdam (Netherlands) Structures and Materials Div
LASTING FRIENDSHIP A REVIEW OF THE F-27 FATIGUE EVALUATION PROGRAM CARRIED OUT BY FOKKER-VFW
J B deJonge 27 Jun 1980 41 p
(Contract RB-RLD/78011)
(NLR-TR-78150-U) Avail NTIS HC A03/MF A01

A fatigue evaluation of the F-27 aircraft covering life up to 120 000 flights is described Included are a complete inventory of the configuration status of the F-27 fleet an inventory and evaluation of existing test experience and evaluation of service experience Analytical predictions of life and fail safe properties and additional fatigue tests are included Full scale fatigue and fail safe tests are described for fuselage and wing panel specimens Additional tests are described for outer wing lower skin panels and main landing gear drag strut brackets
Author (ESA)

N81-27087# National Aerospace Lab Amsterdam (Netherlands) Structures and Materials Div

STATE OF THE ART AND STATISTICAL ASPECTS OF HELICOPTER FATIGUE SUBSTANTIATION PROCEDURES

R Noback Aug 1980 24 p refs Presented at AGARD Specialist Meeting on Helicopter Fatigue Life Assessment Aix-en-Provence France 14-19 Sep 1980 Sponsored in part by Sci Res Branch Air Mater Directorate

(NLR-MP-80025-U) Avail NTIS HC A02/MF A01

The methods used to calculate the safe fatigue life of helicopter components are described Flight loads are determined for the flight conditions and maneuvers of the mission profiles The application of the Palmgren-Miner rule and mean load reduction techniques is described Reduced S-N curve methods in which constant amplitude tests are carried out at various load levels until failure are presented together with the corresponding error analysis Alternative statistical analyses are compared Many different ways are available to calculate safe fatigue lives but there is general agreement on the results obtained An expression is derived for the reduction factor for the S-N curves Author (ESA)

N81-27089*# General Electric Co Cincinnati Ohio Aircraft Engine Business Group

BLADE LOSS TRANSIENT DYNAMICS ANALYSIS, VOLUME 1 TASK 1 SURVEY AND PERSPECTIVE Final Report

V C Gallardo E F Gaffney L J Bach and M J Stallone Jun 1981 22 p refs 3 Vol

(Contract NAS3-22053)

(NASA-CR-165373-Vol-1 R81AEG381-Vol-1) Avail NTIS HC A02/MF A01 CSCL 21E

An analytical technique was developed to predict the behavior of a rotor system subjected to sudden unbalance The technique is implemented in the Turbine Engine Transient Rotor Analysis (TETRA) computer program using the component element method The analysis was particularly aimed toward blade-loss phenomena in gas turbine engines A dual-rotor casing and pylon structure can be modeled by the computer program Blade tip rubs Coriolis forces and mechanical clearances are included The analytical system was verified by modeling and simulating actual test conditions for a rig test as well as a full-engine blade-release demonstration Author

N81-27090*# General Electric Co Cincinnati Ohio Aircraft Engine Business Group

BLADE LOSS TRANSIENT DYNAMICS ANALYSIS, VOLUME 2 TASK 2 THEORETICAL AND ANALYTICAL DEVELOPMENT TASK 3 EXPERIMENTAL VERIFICATION Final Report

V C Gallardo A S Storace E F Gaffney L J Bach and M J Stallone Jun 1981 250 p refs 3 Vol

(Contract NAS3-22053)

(NASA-CR-165373-Vol-2 R81AEG381-Vol-2) Avail NTIS HC A11/MF A01 CSCL 21E

The component element method was used to develop a transient dynamic analysis computer program which is essentially based on modal synthesis combined with a central finite difference numerical integration scheme The methodology leads to a modular or building-block technique that is amenable to computer programming To verify the analytical method turbine engine transient response analysis (TETRA) was applied to two blade-out test vehicles that had been previously instrumented and tested Comparison of the time dependent test data with those predicted by TETRA led to recommendations for refinement or extension of the analytical method to improve its accuracy and overcome its shortcomings The development of working equations their discretization numerical solution scheme the modular concept of engine modelling the program logical structure and some illustrated results are discussed The blade-loss test vehicles (rig full engine) the type of measured data and the engine structural model are described A R H

N81-27091*# General Electric Co Cincinnati Ohio Aircraft Engine Business Group

BLADE LOSS TRANSIENT DYNAMICS ANALYSIS VOLUME 3 USER'S MANUAL FOR TETRA PROGRAM Final Report

G R Black V C Gallardo A S Storace and F Sagendorph Jun 1981 239 p ref 3 Vol

(Contract NAS3-22053)

(NASA-CR-165373-Vol-3 R81AEG381-Vol-3) Avail NTIS HC A11/MF A01 CSCL 21E

The users manual for TETRA contains program logic flow charts error messages input sheets modeling instructions option descriptions input variable descriptions and demonstration problems The process of obtaining a NASTRAN 17 5 generated modal input file for TETRA is also described with a worked sample A R H

N81-27093*# Pratt and Whitney Aircraft Group East Hartford Conn

ENERGY EFFICIENT ENGINE, HIGH-PRESSURE TURBINE COOLING MODEL TECHNOLOGY REPORT

W B Gardner May 1981 37 p

(Contract NAS3-20646)

(NASA-CR-165374 PWA-5594-159) Avail NTIS HC A03/MF A01 CSCL 21E

Two dimensional flow visualization model tests were used to substantiate the flow stability benefits derived from the use of turning vanes in the root and tip turn flow areas Results indicate the need for corner fillets and flow injection into the acute corner formed by the intersection of the rib and simulated airfoil suction surface in order to minimize recirculation (stagnation) of flow in that region Three dimensional flow visualization model tests verified the actual blade coolant passage design R C T

N81-27094*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

THE SUPERSONIC FAN ENGINE AN ADVANCED CONCEPT IN SUPERSONIC CRUISE PROPULSION

Leo C Franciscus 1981 13 p refs Presented at the 17th Joint Propulsion Conf Colorado Springs Colo 27-29 Jul 1981 sponsored by AIAA SAE and ASME

(NASA-TM-82657 E-923) Avail NTIS HC A02/MF A01 CSCL 21E

Engine performance and mission studies were carried out for turbofan engines equipped with supersonic through-flow fans The mission was for a commercial supersonic transport with a Mach 2 32 capability The advantages of the supersonic fan engines are discussed in terms of mission range comparisons with other engine types The effects of fan efficiency inlet losses and engine weight on engine performance and mission range are shown The range of a supersonic transport with supersonic fan engines could be 10 to 20 percent better than with other types having the same technology core Author

N81-27095*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

MIXING EFFECTIVENESS TEST OF AN EXHAUST GAS MIXER IN A HIGH BYPASS TURBOFAN AT ALTITUDE

R R Cullom G A Bobula and L A Burkardt 1981 13 p refs Presented at the 17th Joint Propulsion Conf Colorado Springs Colo 27-29 Jul 1981 sponsored by AIAA SAE and ASME

(NASA-TM-82663 AVRADCOM-TR-81-C-24 E-938) Avail NTIS HC A02/MF A01 CSCL 21E

Thermal mixing effectiveness characteristics of an eighteen lobe scalloped and unscalloped partial forced mixer were measured in a high-bypass turbofan engine Data were also obtained without the mixer installed i e free mixing Tests were conducted at four combinations of simulated flight conditions from 0 3 to 0 8 Mach number and from 6 096 meters (20 000 ft) to 13 715 m (45 000 ft) altitude mixing chamber lengths of L/D = 0 52 and 0 65 were tested For this range of test conditions and mixer configurations the forced mixing effectiveness varied from 59 to 68 percent Values of mixing effectiveness and total pressure loss were calculated from temperature and pressure data obtained at the mixer inlet and exhaust nozzle exit Author

N81-27096*# National Aeronautics and Space Administration Langley Research Center Hampton Va

WINGTIP VORTEX TURBINE Patent Application

James C Patterson Jr inventor (to NASA) Filed 16 Mar 1981 14 p

(NASA-Case-LAR-12544-1 US-Patent-Appl-SN-243685) Avail NTIS HC A02/MF A01 CSCL 01C

Means of extracting rotational energy from the vortex created

at aircraft wing tips of a turbine with four blades which are located in the cross flow of the vortex and attached downstream of the wing tip are described The turbine blades are attached to a core When the aircraft is in motion the rotation of the core transmits energy to a centrally attached shaft The rotational energy thus generated is utlized within the airfoil or aircraft fuselage E A K

N81-27097*# General Electric Co Cincinnati Ohio Aircraft Engine Group
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE), ACOUSTIC PERFORMANCE OF A 50 8-cm (20 INCH) DIAMETER VARIABLE PITCH FAN AND INLET, TEST RESULTS AND ANALYSIS, VOLUME 1 Final Report
K R Bilwakesh A Clemons and D L Stimpert Apr 1979 306 p refs
(Contract NAS3-18021)
(NASA-CR-135117 R77AEG229-Vol-1) Avail NTIS HC A14/MF A01 CSCL 21E

Tests were run both in forward and in reverse thrust modes with a bellmouth inlet five accelerating inlets (one hard wall and four treated) with a design throat Mach number of 0 79 at the takeoff condition and four low Mach inlets (one hard wall and three treated) with a design throat Mach number of 0 6 at the takeoff condition Unsuppressed and suppressed inlet radiated noise levels were measured at conditions representative of QCSEE takeoff approach and reverse thrust operations Measured aerodynamic performance of the accelerating inlet is also included The test objectives facility configurations are described as well as the data analysis results and comparisons A R H

N81-27098*# AiResearch Mfg Co Phoenix Ariz
ABRADABLE COMPRESSOR AND TURBINE SEALS, VOLUME 2
D V Sundberg R E Dennis and L G Hurst Jul 1979 53 p 2 Vol
(Contract NAS3-20073)
(NASA-CR-159662 AiResearch-21-3213-2 PCRP-2) Avail NTIS HC A04/MF A01 CSCL 21E

The applications and advantages of abradable coatings as gas path seals in a general aviation turbofan engine were investigated Abradable materials were evaluated for the high pressure radial compressor and the axial high and low pressure turbine shrouds T M

N81-27100# Vought Corp Dallas Tex
POWER SYSTEM CONTROL STUDY PHASE 1 INTEGRATED CON ROL TECHNIQUES PHASE 2 DETAIL DESIGN AND SYSTEM MODELING Final Report, 15 Jun 1978 - 15 Sep 1980
D E Lautner A J Marek J R Perkins and D F Sellers Wright-Patterson AFB Ohio AFWAL Mar 1981 449 p refs
(Contract F33615-78-C-2018 AF Proj 3145)
(AD-A099894 AFWAL-TR-80-2129) Avail NTIS HC A19/MF A01 CSCL 10/2

This report documents the results of a two phase program which addresses the integration of advanced power system control technologies into a reliable and fault tolerant system The advanced control technologies integrated include electric engine start automatic load management microprocessor control implementations design techniques for providing no-gap power and an all solid state electric power distribution system Electric system performance requirements are established and preliminary designs of an integrated baseline control system for single and multi-engine aircraft for the 1990 operational time period are presented Finally a detail design was performed for a single and a multiple engine electric system Analytical models and computer programs were developed for the IDG and VSCF implemented electrical systems A users guide for each of the programs was prepared Simulation runs of typical electrical system operations were made on the computer graphics system and included in the final engineering report GRA

N81-27102# Annawerk Keramische Betriebe G m b H Roedental (West Germany) Geschaeftsbereich Ceranox
DEVELOPMENT OF HIGH STRENGTH SILICON CARBIDE MATERIALS FOR GAS TURBINE APPLICATIONS Final Report
Ernst Gugel and Gerhard Leimer Bonn Bundesministerium fuer Forschung und Technologie Jul 1980 77 p refs In GERMAN ENGLISH summary Sponsored by Bundesministerum fuer Forschung und Technologie
(BMFT-FB-T-80-025 ISSN-0340-7608
BMFT-01ZA005/NTS1003) Avail NTIS HC A05/MF A01

The processing of silicon carbides was undertaken in order to develop materials suitable for manufacturing gas turbine ceramic parts Dense SiC sintered without pressure SiC containing densified silicon and reaction bonded SiC were investigated Forming techniques appropriate to manufacturing gas turbine components were defined Turbine blades blade rims engine inlet nose cones combustors and turbine rotors were produced Mechanical properties were measured and component quality was determined experimentally Results confirm that these materials conform to gas turbine standards Author (ESA)

N81-27103# Advisory Group for Aerospace Research and Development Neuilly-Sur-Seine (France)
MICROCOMPUTER APPLICATIONS IN POWER AND PROPULSION SYSTEMS
Mar 1981 156 p refs Lecture Ser held in London 2-3 Apr 1981 Oberpfaffenhofen West Germany 6-7 Apr 1981 and Genoa 9-10 Apr 1981
(AGARD-LS-113 ISBN-92-835-1381-9) Avail NTIS HC A08/MF A01

Topics include microprocessor characteristics by manufacturer memory characteristics software HI and LO level language tradeoffs and sensor and actuator interfacing Control logic design methods redundancy management and a description of several current applications to engine control are also discussed For

N81-27104# Lucas Aerospace Ltd Birmingham (England)
MICROPROCESSOR CHARACTERISTICS AND COMPARATIVE FEATURES
R G Burrage *In* AGARD Microcomputer Appl in Power and Propulsion Systems Mar 1981 17 p
see
Avail NTIS HC A08/MF A01

A modern design of control for a gas turbine is used to introduce the concept of computer control This shows the function of the microprocessor which associated circuits are needed to complete the control and the features of the microprocessor that suit it to control tasks Many tasks other than control can be undertaken by microprocessors These are discussed to establish which general features are of importance to propulsion systems These features plus the normal criteria applied to the procurement of any component can be used as a guide to the selection of a microprocessor Comparisons are made of different manufacturer s product using this approach E D K

N81-27105# Naval Air Propulsion Test Center Trenton N J Advanced Development Div
THE PACKAGING OF ELECTRONIC ENGINE CONTROL UNITS AND RELATED SUBCOMPONENTS
R W Vizzini *In* AGARD Microcomputer Appl in Power and Propulsion Systems Mar 1981 34 p refs

Avail NTIS HC A08/MF A01

The data evaluated in this study leads to the engine mounted electronic control system with a choice between two versions air cooled and fuel cooled When maintainability reliability survivability vulnerability safety and life cycle cost are considered there is no clear choice between an air cooled engine mounted control and a fuel cooled engine mounted control The air cooled version could be selected based on the slight survivability/ vulnerability and safety benefits and the fuel cooled version on the basis of weight and cost benefits Clearly the two systems are both acceptable and the final decision on configuration must be considered a designers choice driven by the overriding selection criteria for the particular aircraft E D K

N81-27108# Smiths Industries Ltd Basingstoke (England) Aerospace and Defence Systems
MICROPROCESSOR SYSTEM TEST AND MONITORING
J F O Evans *In* AGARD Microcomputer Appl in Power and Propulsion Systems Mar 1981 8 p

Avail NTIS HC A08/MF A01

Digital control systems for aircraft jet engines require extensive and careful development testing if they are to meet the rigorous performance and safety requirements of the engine

and airframe manufacturers and air certification authorities In order to achieve the level of testing required whilst minimizing expensive engine running hours relatively sophisticated test procedures and equipment are required These tests need to cover the system hardware real time operating system software and control software The development of the required testing techniques and the current equipment and procedures are described E D K

N81-27109# Smiths Industries Ltd Basingstoke (England) Aerospace and Defence Systems
FAULT TREES AND SYSTEM RELIABILITY ANALYSIS WITH REFERENCE TO THE CONTROL OF AIRCRAFT ENGINES
J F O Evans *In* AGARD Microcomputer Appl in Power and Propulsion Systems Mar 1981 16 p refs

Avail NTIS HC A08/MF A01

Control systems for aircraft engines are very precisely and stringently specified with respect to performance and safety At the same time there is a real need to minimize cost and weight and to improve reliability These requirements may conflict unless the overall system organization is very carefully designed and proven It is not possible to prove that the safety requirements were met within the acceptable confidence level by testing alone Hence testing needs to be backed up by safety analysis Current engine control systems organizations the related analysis techniques such as fault trees and some of the special difficulties associated with analyzing systems which include multitask processors are discussed E D K

N81-27112# Naval Air Propulsion Test Center Trenton N J Advanced Development Div
FULL AUTHORITY DIGITAL ELECTRONIC CONTROL TURBOFAN ENGINE DEMONSTRATION
R W Vizzini T G Lenox (Pratt and Whitney Aircraft Group East Hartford Conn) and R J Miller (Pratt and Whitney Aircraft Group West Palm Beach Fla) *In* AGARD Microcomputer Appl in Power and Propulsion Systems Mar 1981 10 p

Avail NTIS HC A08/MF A01

The design demonstration and evaluation of a Full Authority Digital Electronic Control (FADEC) capable of controlling an advanced variable cycle gas turbine engine in an advanced supersonic Navy fighter aircraft application is described The FADEC design incorporates many advanced technology features including the latest microelectronics extensive fault tolerance capability and high speed digital communication using a fiber optic link The advanced technology FADEC system was successfully demonstrated in a comprehensive test program which included open loop environmental bench testing closed loop bench testing and testing on an F401 afterburning turbofan engine at sea level and at nine altitude conditions from 7000 to 50 000 ft and at Mach numbers from 0 3 to 1 6 Over 7000 hr of electronic control operation were achieved during this program Over 1100 hr of testing were achieved with the engine mounted control unit which included over 68 hr of engine testing without a hardware malfunction In addition to the advanced electronic circuitry employed in the FADEC the first demonstration of optic communication with engine mounted equipment was achieved E D K

N81-27113*# Systems Technology Inc Hawthorne Calif
ANALYSES OF SHUTTLE ORBITER APPROACH AND LANDING CONDITIONS Final Contractor Report
Gary L Teper Richard J Dimarco Irving L Ashkenas and Roger H Hoh Jul 1981 136 p refs
(Contract NAS4-2581)
(NASA-CR-163108 TR-1137-1) Avail NTIS HC A07/MF A01 CSCL 01C

A study of one shuttle orbiter approach and landing conditions are summarized Causes of observed PIO like flight deficiencies are identified and potential cures are examined Closed loop pilot/vehicle analyses are described and path/attitude stability boundaries defined The latter novel technique proved of great value in delineating and illustrating the basic causes of this multiloop pilot control problem The analytical results are shown to be consistent with flight test and fixed base simulation Conclusions are drawn relating to possible improvements of the shuttle orbiter/digital flight control system R C T

N81-27114*# Boeing Military Airplane Development Wichita Kans
FINAL DESIGN AND FABRICATION OF AN ACTIVE CONTROL SYSTEM FOR FLUTTER SUPPRESSION ON A SUPERCRITICAL AEROELASTIC RESEARCH WING
G E Hodges and C R McGehee Jun 1981 396 p refs
(Contract NAS1-14675)
(NASA-CR-165714 D3-11536 1) Avail NTIS HC A17/MF A01 CSCL 01C

The final design and hardware fabrication was completed for an active control system capable of the required flutter suppression compatible with and ready for installation in the NASA aeroelastic research wing number 1 (ARW-1) on Firebee II drone flight test vehicle The flutter suppression system uses vertical acceleration at win buttock line 1 930 (76) with fuselage vertical and roll accelerations subtracted out to drive wing outboard aileron control surfaces through appropriate symmetric and antisymmetric shaping filters The goal of providin an increase of 20 percent above the unaugmented vehicle flutter velocity but below the maximum operating condition at Mach 0 98 is exceeded by the final flutter suppression system Results indicate that the flutter suppression system mechanical and electronic components are ready for installation on the DAST ARW-1 wing and BQM-34E/F drone fuselage R C T

N81-27115*# National Aeronautics and Space Administration Langley Research Center Hampton Va
A DIGITAL PROGRAM FOR CALCULATING THE INTERACTION BETWEEN FLEXIBLE STRUCTURES, UNSTEADY AERODYNAMICS AND ACTIVE CONTROLS
Ellwood L Peele and William M Adams, Jr Jan 1979 57 p refs
(NASA-TM-80040) Avail NTIS HC A04/MF A01 CSCL 01C

A computer program ISAC is described which calculates the stability and response of a flexible airplane equipped with active controls The equations of motion relative to a fixed inertial coordinate system are formulated in terms of the airplane s rigid body motion and its unrestrained normal vibration modes Unsteady aerodynamic forces are derived from a doublet lattice lifting surface theory The theoretical basis for the program is briefly explained together with a description of input data and output results Author

N81-27116*# Boeing Commercial Airplane Co Seattle, Wash
THE 747 PRIMARY FLIGHT CONTROL SYSTEMS RELIABILITY AND MAINTENANCE STUDY Final Report, Aug 1977 - Jul 1978
Apr 1979 205 p refs
(Contract NAS1-14742)
(NASA-CR-159010 D6-46350) Avail NTIS HC A10/MF A01 CSCL 01C

The major operational characteristics of the 747 Primary Flight Control Systems (PFCS) are described Results of reliability analysis for separate control functions are presented The analysis makes use of a NASA computer program which calculates reliability of redundant systems Costs for maintaining the 747 PFCS in airline service are assessed The reliabilities and cost will provide a baseline for use in trade studies of future flight control system design Author

N81-27117# Systems Technology Inc Hawthorne Calif
DEVELOPMENT OF HANDLING QUALITY CRITERIA FOR AIRCRAFT WITH INDEPENDENT CONTROL OF SIX DEGREES OF FREEDOM Final Report, Oct 1978 - Jul 1980
Roger H Hoh Thomas T Myers Irving L Ashkenas Robert F Ringland and Samuel Craig Apr 1981 252 p refs
(Contract F33615-78-C-3616 AF Proj 2403)
(AD-A100045 STI-TR-1135-1 AFWAL-TR-81-3027) Avail NTIS HC A12/MF A01 CSCL 01/4

A tentative flying quality criterion has been developed for aircraft with direct force controls which allow independent control over the six inertial degrees of freedom The criterion is based on analysis of existing flight test and simulation data as well as the results of an abbreviated flight test conducted during the program Author (GRA)

N81-27118# National Aerospace Lab Amsterdam (Netherlands) Flight Div
DETERMINATION OF LOW-SPEED LONGITUDINAL MANEUVERING CRITERIA FOR TRANSPORT AIRCRAFT

WITH ADVANCED FLIGHT CONTROL SYSTEMS
H A Mooij W P deBoer and M F C Vangool 20 Dec 1979 157 p refs
(Contracts NIVR-1745 RB-RLD-1977 1 3 1 RB-RLD-77017 RB-RLD-77017/1 RB-RLD-1978 1 3 RB-RLD-78017 RB-RLD-78017/1)
(NLR-TR-79127-U) Avail NTIS HC A08/MF A01

The application of active control technology concepts and in particular the relaxed static stability principle to certain categories of transport aircraft is addressed Approach and landing flight simulation investigations were performed using a moving-base flight simulator with simulated outside view A jet transport conceptual aircraft developed around the relaxed static stability concept and equipped with a primary flight control system of the rate-command/attitude-hold type for pitch and roll control was simulated Boundaries for satisfactory handling qualities were established from pilot/aircraft performance pilot ratings and pilot commentaries for a number of handling quality criteria A criterion on closed loop resonance and pilot compensation (Neal-Smith criterion) related to the pitch attitude control loop is identified as the best format for short period pitch dynamics
Author (ESA)

N81-27200*# Clemson Univ S C
OPTIMIZATION OF FIBER REINFORCED STRUCTURES TO SATISFY AEROELASTIC REQUIREMENTS Final Technical Report
Carl S Rudisill [1981] 8 p ref
(Grant NsG-1411)
(NASA-CR-164536) Avail NTIS HC A02/MF A01 CSCL 11D

A numerical procedure was developed for minimizing the structural mass of an aircraft structure which must have a specified minimum flutter velocity or divergence velocity During the optimization process the arrangement of the structural members remains fixed while the stiffness parameters of the structure are varied
Author

N81-27206# Aeronautical Research Labs Melbourne (Australia)
ANALYSIS OF COMPOSITE LAMINATES AND FIBER COMPOSITE REPAIR SCHEMES
R Jones Oct 1980 17 p refs
(AD-A099629 ARL/STRUC-NOTE-465, AR-002-236) Avail NTIS HC A02/MF A01 CSCL 11/4

In recent years several advanced finite element methods have been developed for the analysis of laminated composites, these take into account the membrane bending, and interlaminar stresses Similarly finite element methods have also been developed for the analysis of structures repaired with a bonded overlay of fiber composite material The present paper discusses these methods and indicates how the finite element method developed for the analysis of structural repairs is connected to those methods specifically developed for the analysis of composite laminates
Author (GRA)

N81-27208# Messerschmitt-Boelkow-Blohm G m b H Hamburg (West Germany) Unternehmensbereich
DEVELOPMENT OF A CFC WINDOW FRAME, USING SHORT FIBER PRESSING TECHNOLOGY Final Report
Frank Heinze and Gerhard Stemmer Bonn Bundesministerium fuer Forschung und Technologie Dec 1980 123 p refs In GERMAN ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-032 ISSN-0170-1339) Avail NTIS HC A06/MF A01

The development of a carbon fiber composite (CFC) cabin window frame is discussed and a series of full scale tests including mechanical endurance tests thermal studies and environmental tests are described Its installation into a fuselage test panel (airbus structure) is described The problems which were encountered are listed The results show that the use of CFC in primary structures is technically feasible Endurance tests to date include 32 000 flights without any failures Preliminary work for continuing service trials in an aircraft is mentioned Author (ESA)

N81-27372# Transportation Systems Center Cambridge Mass
DETECTION PERFORMANCE EVALUATION OF THE ASDE-3 USING FIXED FREQUENCY AND FREQUENCY AGILE OPERATION Final Report, Jan - Apr 1980
P J Bloom G J Bishop and J E Kuhn Mar 1981 104 p
(AD-A099513 DOT-TSC-FAA-81-8 FAA-RD-81-41) Avail NTIS HC A06/MF A01 CSCL 17/9

The ASDE-3 (Airport Surface Detection Equipment) Radar design has many features to enhance operational usefulness The purpose of all these features is to provide a better airport surface surveillance display for the control power tower cab One of these features is the use of frequency agility the transmission at a different frequency within a frequency band during each radar transmit time The function of this feature is to improve the detection performance of the ASDE radar and thereby improve the quality of the information presented on the operational display The use of frequency agility reduces image breakup of aircraft on the display and in rainy weather allows the display of ground traffic during much heavier precipitation than achievable with fixed frequency operation This report discusses the role of the ASDE in airport surface traffic control and the theory of frequency agility benefits and gives the empirical results obtained during field experiments using the ASDE-3 engineering model test bed
GRA

N81-27548*# National Aeronautics and Space Administration Langley Research Center Hampton Va
WIND-TUNNEL EVALUATION OF NASA DEVELOPED CONTROL LAWS FOR FLUTTER SUPPRESSION ON A DC-10 DERIVATIVE WING
I Abel and Jerry R Newsom Jun 1981 14 p refs Presented at the AIAA Dyn Spec Conf Atlanta 8-11 Apr 1981
(NASA-TM-83143 AIAA-Paper-81-0639) Avail NTIS HC A02/MF A01 CSCL 20K

Two flutter suppression control laws were synthesized implemented and tested on a low speed aeroelastic wing model of a DC-10 derivative The methodology used to design the control laws is described Both control laws demonstrated increases in flutter speed in excess of 25 percent above the passive wing flutter speed The effect of variations in gain and phase on the closed loop performance was measured and compared with analytical predictions The analytical results are in good agreement with experimental data
Author

N81-27692*# National Aeronautics and Space Administration Washington D C
EFFECT OF AIRCRAFT NOISE ON THE EQUILIBRIUM OF AIRPORT RESIDENTS LONGITUDINAL STUDY AROUND ROISSY, PHASE 3
Jacques Francois May 1981 104 p refs Transl into ENGLISH of Les Repercussions du Bruit des Avions sur l Equilibre des Riverains des Aeroports Etude Longitudinale autour de Roissy Teme Phase Paris Sep 1979 p 1-73 Transl by Scientific Translation Service Santa Barbara Calif Original language doc prep by Inst Francais d Opinion Publique (IFOP) Paris (France)
(Contract NASw-3198)
(NASA-TM-75906) Avail NTIS HC A06/MF A01 CSCL 13B

The effects of airplane noise on the mental equilibrium of residents living near airports are discussed and based on population sample surveys involving health questionnaires and self-administered personality tests Progressive changes were observed on the part of residents living near a large airport S F

N81-27714# Environmental Monitoring and Support Lab Las Vegas Nev Advanced Monitoring Systems Div
DEVELOPMENT OF A HELICOPTER WATER QUALITY MONITORING/SAMPLING SYSTEM
H Michael Lowry Feb 1981 53 p refs
(PB81-168734 EPA-600/4-81-005) Avail NTIS HC A04/MF A01 CSCL 13B

The system was developed for use by the National Eutrophication Survey and subsequently used in support of other water quality projects The salient problems associated with the use of a helicopter as a sampling platform and the modifications made in the system to fulfill the needs are described
GRA

N81-27883*# National Aeronautics and Space Administration Washington D C

AVIATION NOISE OVERLOAD IN THE IMMEDIATE PROXIMITY OF THE WARSAW-OKECIE AIRPORT

Zbigniew Koszarny and Stefan Maziarka May 1981 14 p refs Transl into ENGLISH from Rocznik Panstwowego Zakladu Hyg (Poland) v 26 no 1 1975 p 1-10 Transl by Kanner (Leo) Associates, Redwood City Calif

(Contract NASw-3199)

(NASA-TM-75892) Avail NTIS HC A02/MF A01 CSCL 20A

The results are presented for investigations on noise overload around the Warszawa-Okecie airport on persons inhabiting the area where it exceeds 100 dB for a single aircraft flight Of 256 subjects 91 1 percent complained about aircraft noise overload In the population studied considerable differences were noted respecting the subjective sensitivity scale Statistical analysis showed numerous correlations between the individual noise sensitivity threshold and the subject s state of health age sex type of work etc At the same time investigations demonstrated various forms and levels of disturbance in the organism for individual subjects and groups The most frequent complaint was chronic fatigue (68 1 percent) followed by nervousness (36 6 percent) frequent headaches (36 2 percent) hearing disturbances (30 0 percent) and sleep disorders (23 9 percent)

Author

N81-27884*# Syracuse Univ N Y Dept of Mechanical and Aerospace Engineering

AEROACOUSTICS OF A POROUS PLUG JET NOISE SUPPRESSOR Semiannual Status Report, 1 Jan - 30 Jun 1981

D S Dosanjh Jul 1981 62 p refs

(Contract NAG1-129)

(NASA-CR-164549 SASR-1) Avail NTIS HC A04/MF A01 CSCL 20A

The aeroacoustics of a porous plug jet noise suppressor was investigated The predicted flow features of isentropic plug nozzles for different pressure ratios or exit flow Mach numbers, throat areas ratios of the plug to annular nozzle radii mass flow rates and the available run times possible with the existing compressed air supply system are compiled The dimensions and the coordinates of the contour of typical isentropic external expansion plugs with different exit flow Mach numbers are listed Design details of the experimental facility and the plug nozzle selected for experimental aeroacoustic studies are reported The analytical flow prediction by method of characteristics of a conical porous plug nozzles is initiated The role of the shape size and porosity of the plug surface in achieving over a perforated conical plug a nearly isentropic shockfree supersonic flow field which is closely similar to the flow field of a contoured isentropic plug nozzle is examined

E A K

N81-27886*# Georgia Inst of Tech Atlanta School of Aerospace Engineering

PREDICTION OF SOUND RADIATION FROM DIFFERENT PRACTICAL JET ENGINE INLETS Semiannual Status Report, 1 Dec 1980 - 30 May 1981

Ben T Zinn and William L Meyer 1981 128 p refs

(Grant NAG3-67)

(NASA-CR-164620) Avail NTIS HC A07/MF A01 CSCL 20A

Computer codes, capable of producing accurate results for nondimensional wave numbers (based on duct radius) of up to 20, were developed and used to generate results for various other inlet configurations Both reflection coefficients and radiation patterns were calculated by the integral solution procedure for the following five inlet configurations the NASA Langley Bellmouth the NASA Lewis JT-15D-1 ground test nacelle and three hyperbolic inlets of 50 70, and 90 degrees Results obtained are compared with results from other experimental and theoretical studies

A R H

N81-27889# Aerospace Medical Research Labs Wright-Patterson AFB Ohio

EFFECT OF PROPAGATION DISTANCE ON AIRCRAFT FLYOVER SOUND DURATION

Jerry D Speakman May 1981 20 p

(AF Proj 7231)

(AD-A099694 AFAMRL-TR-81-28) Avail NTIS HC A02/MF A01 CSCL 20/1

In the past NOISEMAP and other aircraft noise contouring programs incorporating single event time-integrated measures such as Sound Exposure Level (SEL) or Effective Perceived Noise Level (EPNL) assumed that the sound duration for flyovers doubled for each doubling of the distance between the source and a receiver This simplifying assumption considers only the losses due to the spherical divergence of a sound wave as it propagates over distance Mathematically this meant that in calculating SEL or EPNL versus distance functions a duration term was introduced that was proportional to multiplying the logarithm of the ratio in propagation distances between two points by a coefficient of 10 Controlled level flyover noise tests were conducted on A-10 C-135A C-141 E-3A F-5E F-15 and F-18 aircraft to directly measure sound duration as a function of propagation distance Data were also acquired during a dedicated series of C-130E actual takeoffs and landings Our findings show the duration coefficient varies between 5 and 7 for different aircraft types Clearly the old coefficient of 10 is wrong Data are included that also show that the sound attenuation mechanisms controlling this duration coefficient are basically independent of the frequency content of the aircraft noise

GRA

N81-27890# Human Engineering Labs Aberdeen Proving Ground Md

THE BACKGROUND AND BASES FOR THE PROPOSED MILITARY STANDARD ON ACOUSTICAL NOISE LIMITS IN HELICOPTERS Final Report

Georges R Garinther and David C Hodge Mar 1981 14 p refs

(AD-A099814 HEL-TM-5-81) Avail NTIS HC A02/MF A01 CSCL 01/3

A design standard for interior noise of helicopters has been prepared to provide the developer and user with realistic noise limits which consider hearing damage risk speech intelligibility mission profile state-of-the-art in noise reduction and helicopter weight The levels selected meet the current hearing conservation limits of the Department of Defense and permit electrically aided sentence intelligibility of 98% Helicopters below 20 000 pounds are treated separately from those above because of the strong positive relation between internal noise and vehicle gross weight This standard defines the locations and flight conditions under which noise measurements shall be made for compliance It also specifies the types of instrumentation and the test procedures to be used to collect interior noise level data This degree of specificity in the instrumentation and measurements area is intended to insure that data collected by different development and test agencies will be both accurate and consistent

Author (GRA)

N81-27893# European Space Agency Paris (France)

OPTIMIZATION OF BARRIERS

Dieter Lohmann H Kluge and K H Spiegel Mar 1981 56 p refs Transl into ENGLISH of Zur Optimierung von Schallschutzwaenden DFVLR Brunswick Report DFVLR-FB-79-29 Dec 1978

(ESA-TT-648 DFVLR-FB-79-29) Avail NTIS HC A04/MF A01

A scale model of a SF6 engine fan installed in an anechoic chamber was used to examine diffraction effects behind sound screens The screens were 22 mm thick covered with a 5 cm layer of mineral wool on the source side Test data were stored on a 14 track tape device and later displayed using a real time analyzer after averaging 32 spectra with an absolute bandwidth of 20 Hz and in the case of the double wall partially also as third octave spectra The sound screening effect is found to depend mainly on the directional characteristics of the fan due to the diffraction at the edges of the screen The sound screen should therefore be dimensioned and positioned so that its edges are not in the region of the maxima of the directional characteristics

Author (ESA)

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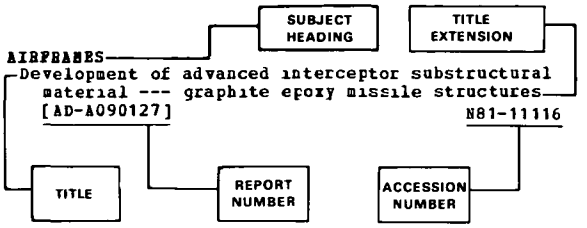

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A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

Q

R

S

T

U

V

W

X

Y

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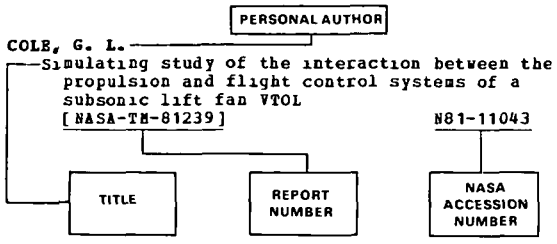

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A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

Z

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