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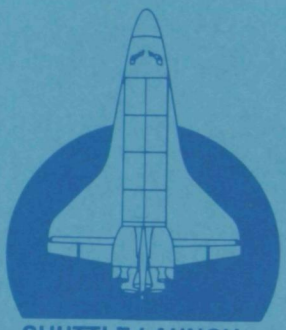
Aeronautical Engineering
A Continuing Bibliography with Indexes

NASA SP-7037(134)
April 1981



National Aeronautics and Space Administration

Aeronautical Engineering

ACCESSION NUMBER RANGES

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

STAR (N-10000 Series)	N81-13914 – N81-15967
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NASA SP–7037(134)

AERONAUTICAL ENGINEERING

A Continuing Bibliography

Supplement 134

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 March 1981 in

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

NASA Scientific and Technical Information Branch 1981
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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 387 reports, journal articles, and other documents originally announced in March 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.

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All publications abstracted in this bibliography are available to the public through the sources as indicated in the *STAR Entries* and *IAA Entries* sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover.

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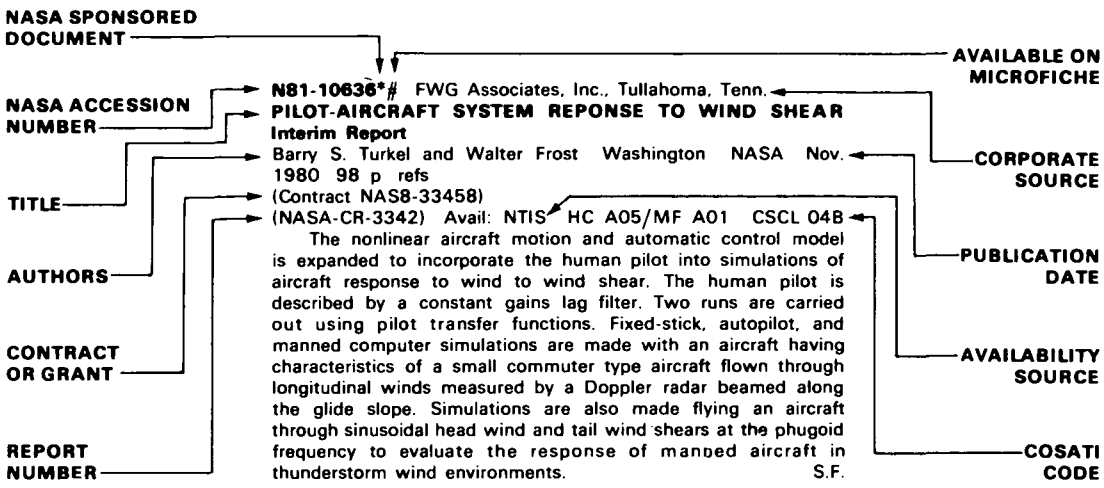

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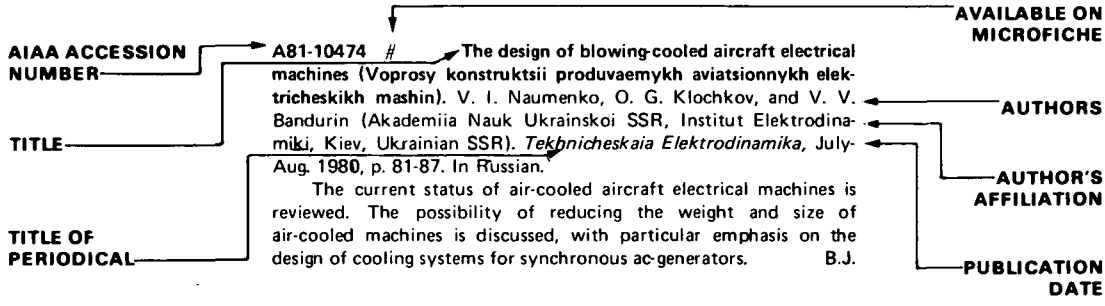

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 134)

APRIL 1981

IAA ENTRIES

A81-16551 # **Steady flow past a rectangular wing with circulation that is variable along the span (Statsionarnoe obtekanie priamougol'nogo kryla s tsirkuliatsiei peremennoi po razmakhu).** N. N. Poliakhov and Z. N. Shesternina. *Leningradskii Universitet, Vestnik, Matematika, Mekhanika, Astronomiia,* July 1980, p. 85-92. In Russian.

A method is proposed for solving the problem of the steady flow past a plane rectangular wing at low angle of attack with an arbitrary distribution of circulation along the span. The spanwise distribution of density of attached vortices is prescribed in the form of a power series with indefinite coefficients; this makes it possible to carry out integration along the span in quadratures and to determine series coefficients from the condition that circulation at the ends of the wing is equal to zero. Series coefficients are solutions of a system of Fredholm equations of the second kind. B.J.

A81-16578 The implications of current flight control research and development. R. C. Ettinger (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 18-37.

The impact of current flight control research and development on present and future aircraft is considered. Attention is given to the development of such systems as fly-by-wire, tactical weapons delivery, DIGITAC, control configured vehicle, integrated flight fire control, mission adaptive wing, and wing-in-ground effect. B.J.

A81-16579 F/A-18 full scale development test. W. H. Brinks (McDonnell Douglas Corp., St. Louis, Mo.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 38-46.

The flight envelope of the F/A-18 in the fighter escort configuration (two AIM-7s, two AIM-9s, and a 20-mm gun) has been expanded to 1.9 Mach number in flutter testing, and to zero airspeed during high angle of attack maneuvers. Flutter testing has been completed for the fighter escort configuration with the required 15% or better flutter margin and damping at the most critical flight condition. During high angle of attack testing the aircraft has been flown in dynamic maneuvers to over 90-deg angle of attack and 35-deg of sideslip with no departure tendencies in the fighter escort configuration. The load factor envelope has been expanded to a negative 2.8 gs and a positive 7.6 gs at various speeds and altitudes. B.J.

A81-16580 Advanced Attack Helicopter /YAH-64/ - Status report. J. W. Groulx (Hughes Helicopters, Culver City, Calif.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 47-58.

The Advanced Attack Helicopter (YAH-64) is designed primarily as an antiarmor helicopter capable of operating day or night in the nap-of-the-earth environment. This paper provides an aircraft description, and gives attention to the status of test vehicles, flight test results, and ordnance testing. B.J.

A81-16581 * Shipboard trials of the Quiet Short-Haul Research Aircraft /QSRA/. J. L. Martin (NASA, Ames Research Center, Moffett Field, Calif.) and P. B. Strickland (U.S. Navy, Naval Air Test Center, Patuxent River, Md.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 59-74. 6 refs.

The feasibility of the application of advanced state-of-the-art high lift STOL aircraft in the aircraft carrier environment was evaluated using the NASA Quiet Short-Haul Research Aircraft (QSRA). The QSRA made repeated unarrested landings and free deck takeoffs from the USS Kitty Hawk while being flown by three pilots of significant different backgrounds. The exercise demonstrated that the USB propulsive lift technology presents no unusual problems in the aircraft carrier environment. Optimum parameters for landing the QSRA were determined from the shore-based program; these proved satisfactory during operations aboard ship. Correlation of shipboard experience with shore-based data indicates that both free deck takeoffs and unarrested landings could be conducted with zero to 35 knots of wind across the deck of an aircraft carrier the size of the USS Kitty Hawk. B.J.

A81-16582 Head-Up-Display flight tests. S. J. Monagan and R. E. Smith (Calspan Advanced Technology Center, Buffalo, N.Y.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 75-87.

HUD flight tests conducted for the United States Navy and Air Force by the Flight Research Branch of the Calspan Advanced Technology Center are described. The HUD flight test system includes the NT-33A variable fly-by-wire research aircraft, a programmable HUD, and a workload assessment device. The integration of the Display Evaluation Flight Test System and the workload assessment device with the NT-33 in-flight simulation aircraft has resulted in an advanced systems research aircraft for USAF and USN flight research. This aircraft has proved to be a powerful tool for investigating the relationships between displays, flying qualities, and pilot performance and workload. B.J.

A81-16583 Air traffic management enhancement through new avionics /4-D/. D. A. Moor (Lockheed Corp., Burbank, Calif.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 90-93.

The first phase of a NASA/Lockheed program for the 1980s is to expand the current L-1011 Flight Management System descent mode to include the fourth dimension, time. This would enable an

L-1011 to make a completely automatic descent (4-D) from cruise altitude to arrive at a metering fix within a few seconds of a time allocated by ATC. The initial 4-D descent flight tests of the prototype system were such that a 2sigma arrival time error disposition of 8 sec is believed to be an attainable goal. B.J.

A81-16584 757/767 design considerations for improved productivity. T. E. Twiggs (Boeing Commercial Airplane Co., Seattle, Wash.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 94-113. 7 refs.

In the fall of 1981 and the spring of 1982, flight testing is scheduled to begin on a new series of technology transports, the 757 and the 767. Productivity improvement will be extracted from various disciplines of the aircraft design; among the technologies contributing are weight savings, aerodynamic efficiency, digital electronic reliability and adaptability, and improved cockpit environment. These factors are reviewed along with pilot workload modification, descent strategies, and ATC compatibility. B.J.

A81-16585 A cockpit view of advanced airline avionics. R. F. Hanna (American Airlines, Inc., Dallas, Tex.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 114-134.

Several current and proposed future developments in advanced airline avionics are described. Particular consideration is given to the ARINC Communications Addressing and Reporting System, the Electronic Flight Instrument System, and the Engine Indicating and Crew Alerting System. It is suggested that advanced airline avionics will provide: (1) enhanced safety by reducing head downtime and by providing more timely crew alerting, (2) increased passenger comfort by providing better enroute weather update for optimum route selection, (3) better on-time performance through maintenance monitoring for corrective action and dispatch, and (4) improved fuel efficiency by displaying real-time performance and navigation data for more effective management. B.J.

A81-16586 The future ATC system as influenced by advanced avionics. S. I. Rothschild (FAA, Washington, D.C.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 135-145.

The paper describes current FAA activities underway to attempt to determine how the future ATC system should evolve and how the features provided by that future system should tie into near-term developments. Attention is given to activities dealing with national flow planning, the terminal area, navigation, air-ground communications, human factors, and weather. B.J.

A81-16587 Development and certification of the Gulfstream III. R. K. Smyth (Grumman Aerospace Corp., Bethpage, N.Y.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 155-167.

The paper discusses the development and certification testing of Grumman's new business jet, the Gulfstream III. The G-III represents an improved version over its predecessor, the G-II, with a longer fuselage, a modern recontoured nose, and a new wing to which has been added NASA winglets to control wing-tip airflow and reduce drag due to lift. These new features give the G-III a 4600 lb increase in fuel capacity and increase its range to 3600 nautical miles. During preliminary test flights a phenomenon known as 'aileron tug' occurred as a function of Mach number and lift coefficient causing the need for installation of a row of vortex generators forward of the ailerons. On its first transoceanic flight from Savannah to Hannover, the G-III exhibited no problems and in subsequent tests including minimum unstick speed and high speed upset maneuvers, met certification requirements. B.R.K.

A81-16588 * The XV-15 tilt rotor research aircraft. D. C. Dugan (NASA, Ames Research Center, Moffett Field, Calif.), R. G. Erhart (Bell Helicopter Textron, Fort Worth, Tex.), and L. G. Schroers (U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.). *(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 2, 1980, p. 168-185.

The XV-15 tilt rotor has shown good handling qualities in all modes of flight; in the helicopter mode it allows precision hover and agility with low pilot workload. Vibration and noise levels are low; the conversion procedure is easy, with satisfactory acceleration or deceleration. The XV-15 handling demonstrated its potential for many civil and military applications. A.T.

A81-16684 Sarsat - A rescue system for ships and aircraft (SARSAT - ein Rettungssystem für Schiffe und Flugzeuge). J. Nauck (Erno Raumfahrttechnik GmbH, Bremen, West Germany). *Nachrichten Elektronik,* vol. 34, Oct. 1980, p. 362-364. In German.

The Sarsat satellite is discussed along with alternative orbit plans for ocean and general emergence services. Emphasis is placed on designing an economical system. A system of satellites in geostationary orbit employs 3 satellites and covers 94% of the earth surface. A system of 8 satellites in polar orbits provides 100% coverage of the earth. A system of satellites in geostationary and polar orbits is also examined which overcomes the advantages of the individual system. A proposal using quasi-polar orbits recommended by IMCO (Intergovernmental Maritime Consultative Organization) is illustrated and compared to a plan with a 57 degree orbit. R.C.

A81-16688 A new system for the study of visual information presentation in aeronautics - GIBI (Un nouveau système d'étude de la présentation d'informations visuelles en aéronautique - Le GIBI). J. P. Menu, G. F. Santucci, and C. L. Valot. *Médecine Aéronautique et Spatiale, Médecine Subaquatique et Hyperbare,* vol. 19, 3rd Quarter, 1980, p. 185-187. In French.

The GIBI (French acronym for interactive binary image generator) system to be used in the development of electronic cockpit displays as well as in fundamental research on visual perception is presented. The system makes use of cathode ray tube images generated by a calculator-based information system operating in real time through either a shadow mask or a penetration rider scanning graphics processor, and is capable of reacting to subject responses. It may be used in flight simulations to determine the essential parameters for piloting at each stage of the flight and a useful symbology in which this information may appear. A.L.W.

A81-16689 Helicopter alarms - The use of ALAT incident and accident record cards (Les alarmes en helicoptère - Exploitation des fiches d'incidents et d'accidents de l'A.L.A.T.). J. P. Papin and B. Gangloff. *Médecine Aéronautique et Spatiale, Médecine Subaquatique et Hyperbare,* vol. 19, 3rd Quarter, 1980, p. 188-190. In French.

Records of helicopter accidents and incidents kept by ALAT are analyzed in order to determine the roles played by on-board alarms. The causes, diagnostic procedures, and crew reactions to 262 incidents on various types of helicopters over several years are examined. It is pointed out that diagnosis is more often immediate when the cause is mechanical and when an alarm is functioning, and that when the diagnosis is immediate, the action taken is most often adequate. It is concluded that an improvement in the presentation of alarms may increase flight safety, particularly as regards the determination of the cause of the situation and the utilization of signals. A.L.W.

A81-16712 Sound radiation from a finite length unflanged circular duct with uniform axial flow. I - Theoretical analysis. II - Computed radiation characteristics. G. W. Johnston and K. Ogimoto (Toronto, University, Toronto, Canada). *Acoustical Society of America, Journal,* vol. 68, Dec. 1980, p. 1858-1883. 23 refs. Natural

Sciences and Engineering Research Council of Canada Grant No. A-7945.

An analysis of sound radiation from a finite length, unflanged, hard wall circular duct with uniform axial flow using the Wiener-Hopf method is presented. The acoustic model simulates the noise radiation from a turbojet aircraft engine in flight at low and medium thrust levels as in landing or steady cruise flights. It includes the diffraction of sound at both ends and its mean convection by the duct and external flow fields; the refraction effects resulting from nonuniform exterior flow fields at the inlet and exhaust under high thrust conditions are not included. The finite duct effects are quantitatively presented for the case of plane-excitation; the finite duct radiation has length resonance which produces standing waves on either side of the source plane. The diffracted sound waves interfere in the farfield resulting in a modified radiation directivity relative to the semi-infinite duct radiation. A.T.

A81-16717 # **A case study in aircraft design: The de Havilland family of STOL commuter aircraft.** R. D. Hiscocks. New York, American Institute of Aeronautics and Astronautics, Inc., 1980. 129 p. 19 refs. $15.

The development of de Havilland STOL commuter aircraft from DHC-1 Chipmunk through the DHC-6 Twin Otter is described. Special attention is then given to the development of the DHC-7; preliminary design considerations, aircraft weight, noise, structural philosophy, construction materials, qualification testing, the powerplant, engine mounts, propulsion control, and lateral control, are described. Finally, attention is given to the current market for STOL commuter aircraft, and to plans for the DHC-8. B.J.

A81-16718 # **Concorde aerodynamics and associated systems development.** J. Rech (Société Nationale Industrielle Aérospatiale, Toulouse, France) and C. S. Leyman (British Aerospace, Bristol, England). New York, American Institute of Aeronautics and Astronautics, Inc., 1980. 104 p. $15.

A case study on the innovative aspects of Concorde aerodynamics is presented. Attention is given to design objectives, aircraft aerodynamic layout, flying qualities, performance and noise, and powerplant aerodynamics. B.J.

A81-16719 # **A case study on the F-16 fly-by-wire flight control system.** C. S. Droste and J. E. Walker. New York, American Institute of Aeronautics and Astronautics, Inc., 1980. 120 p. $15.

The implementation of the F-16 fly-by-wire system is described with emphasis on the electrical-to-mechanical interface (i.e., the YF-16 control surface actuation system), redundancy, and lightning protection. The unique flight control system functional features are then discussed, with attention given to AOA/g limiting, high-AOA roll coordination, roll rate limiter, rudder fadeout, yaw rate limiter, and manual pitch override. B.J.

A81-16720 # **The Grumman Aerospace and Gulfstream American Gulfstream III case study in aircraft design.** L. M. Mead (Grumman Aerospace Corp., Bethpage, N.Y.), Ch. Coppi (Gulfstream American Corp., Van Nuys, Calif.), and J. Strakosch (Grumman Aerospace Corp., Bethpage, N.Y.). New York, American Institute of Aeronautics and Astronautics, Inc., 1980. 115 p. $15.

A design evaluation of the Gulfstream III executive jet is presented. Attention is given to the ancestry of Gulfstream III and requirements definition, preliminary design studies and the evolution of the Gulfstream III design, and a design description and the development program of Gulfstream III. B.J.

A81-16721 # **The Gossamer Condor and Albatross: A case study in aircraft design.** J. D. Burke (AeroVironment, Inc., Pasadena, Calif.). New York, American Institute of Aeronautics and Astronautics, Inc., 1980. 66 p. 20 refs. (AV-R-80/540) $15.

The design and testing of the Gossamer Condor and the Gossamer Albatross, the first human-powered aircraft to complete the figure-eight course required for the Kremer prize and to cross the English Channel, respectively, are discussed as an example of an individual entrepreneurial approach to aircraft design. The objectives and guiding principles of the design program are outlined, and the sequence of project events is traced from the time of the first conception of a low-velocity man-powered aircraft in 1976 to the cross-channel flight of the Gossamer Albatross in June, 1979. Aircraft performance and aerodynamic design are examined, with attention given to the available and required power, and the evolution of aircraft stability and control. Aircraft structures and instrumentation are discussed, and the way in which all the necessary developments came together in the successful flight of the Gossamer Albatross despite turbulence and headwinds is related. A.L.W.

A81-16939 # **Renewal function for any arbitrary period - A Bayesian way.** D. D. Bhattacharya (Ministry of Defence, Directorate of Scientific Evaluation, New Delhi, India). *Defence Science Journal*, vol. 30, Jan. 1980, p. 17-20. 6 refs.

The usual format on which the consumption data and activity for spare parts of a system are available, makes it difficult for the evaluation of the renewal function on the procedure as laid down by Cox (1967). The author has, therefore, discussed in this paper a model through Bayesian Approach as to how in such cases the renewal function could be obtained for any period of activity, provided the past experiences are available in the form of a sample information. For a Beta-Prior density for the mean demand rate of the Poisson demand distribution, the renewal function in its analytical and asymptotic forms are obtained. (Author)

A81-16968 # **Inverse problems of controlled flight dynamics - Longitudinal motion (Obratnye zadachi dinamiki upravliaemogo poleta - Prodol'noe dvizhenie).** B. N. Petrov and P. D. Krut'ko (Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 255, no. 1, 1980, p. 43-47. In Russian.

The paper deals with the development of a new approach to the construction of aircraft control algorithms. The approach is based essentially on the concept of inverse problems of dynamics, introduced by Petrov, Krut'ko, and Popov (1979). The basic aspects of automatic aircraft control are analyzed on the basis of a nonlinear mathematical model whose equations are written in a system of velocity coordinates. V.P.

A81-16969 # **The method of superelements in the dynamics of complex structures (Metod superelementov v dinamike slozhnykh struktur).** I. F. Obraztsov, A. S. Vol'mir, and V. N. Terskikh (Voenno-Vozdushnaia Inzhenernaia Akademiia, Moscow, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 255, no. 1, 1980, p. 59-61. In Russian.

The paper deals with the superelement method, as an extension of the finite element method, capable of treating complex systems with very high computer speed and memory requirements. The coupling of superelements of different orders is demonstrated, using a delta wing configuration as an example. The normal mode vibration frequencies of the fuselage and four wing sections are plotted and compared with the experiment. V.P.

A81-17044 # **Airline flight departure procedures - Choosing between noise abatement, minimum fuel consumption and minimum cost.** R. E. Jones. *Canadian Aeronautics and Space Journal*, vol. 26, 3rd Quarter, 1980, p. 181-199. 13 refs.

A performance computer program was developed to analyze reduced noise takeoff procedures for the B-737 and B-747 aircraft. The IATA procedure was quieter by 5 dB within 10 nm of the airport (where noise levels are highest) than the more fuel efficient ATA method which uses 80 lb less of fuel in a B-737 and 450 lb less in the B-747. The operational cost of a B-747 using the ATA method for full-power takeoff is higher because of greater maintenance charges; a decision basis is proposed for the B-747 which uses IATA procedures for heavyweight takeoffs and ATA recommendations for lightweight takeoffs. A.T.

A81-17045 # **Productivity - The challenge of aircraft and engine maintenance.** P. E. Benham (CP Air, Richmond, British Columbia, Canada). *(Canadian Aeronautics and Space Institute, Annual General Meeting, Vancouver, Canada, May 13, 1980.) Canadian Aeronautics and Space Journal*, vol. 26, 3rd Quarter, 1980, p. 201-208. 7 refs.

Several methods of improving maintenance in aircraft operations which should produce the most reliable components at lowest costs are explored. The aims of aircraft maintenance include serviceable equipment, on-time flight departures, and higher scheduled aircraft utilization; these goals are limited by high maintenance costs, requirements for low fuel consumption, and limited ground support capital investment. A successful productivity manufacturing contract negotiated by Canadair and the Internal Association of Machinists and Aerospace Workers was based on relating work compensation and bonuses to schedule improvements and production planning; this method is difficult to apply in airline maintenance because of unexpected failures and nonroutine types of repair. A computer system for engine planning was developed which comprises a file of component specifications, an on-line video terminal which displays all repairs required, and a computer terminal which reviews the schedule and priorities. A.T.

A81-17046 # **Today and the future in aircraft wheel and brake development.** J. P. Ruppe (Bendix Corp., Aircraft Brake and Strut Div., South Bend, Ind.). *(Canadian Aeronautics and Space Institute, Annual General Meeting, Vancouver, Canada, May 13, 1980.) Canadian Aeronautics and Space Journal*, vol. 26, 3rd Quarter, 1980, p. 209-216.

A review of developments in aircraft wheel and brake design for commercial aviation which emphasizes low weight, longer life, and safety is presented. Modern wheels designed by computer models which simulate stresses from tire contact forces, deflections, and strains are discussed, along with thermal analyses of the wheel and brake assemblies. Wheel materials are usually 2014-T6 or T61 forged aluminum, but Ti, composites, and powder metallurgy Al alloys are being considered as alternates. An aircraft brake was also designed by computer simulation to produce a lightweight failure-resistant component; the most significant advance in brake design was application of steel/ceramet antifriction compositions with increased brake life. It is concluded that future aircraft brakes will be made of carbon composites of greater wear resistance, high heat storage capacity, and strength maintained at elevated temperatures. A.T.

A81-17047 # **Optimum selection of main parameters for the reverse design of a supersonic military aircraft.** T. S. Patel (Indian Institute of Technology, Bombay, India) and C. S. Dixit (Air India, Bombay, India). *Canadian Aeronautics and Space Journal*, vol. 26, 3rd Quarter, 1980, p. 218-229. 8 refs.

Reverse design problem of developing supersonic military aircraft around a given engine has been dealt with in the present paper. Optimum selection of the main parameters has been carried out for the airplane performing specified mission requirements. Two variants are worked out using two different criteria of evaluation: (1) minimum fuel requirements; and (2) maximum payload capacity. The feasible direction method of M. J. Box for nonlinear constrained optimization has been used in preparing computer software. The program developed can be easily modified to incorporate changes in constraints, addition of constraints or changes in objective function. The final results obtained are compared with the geometry of a typical military airplane of the same type and power plant. (Author)

A81-17048 # **Transonic axisymmetric bodies with minimal wave drag.** Y. Y. Chan, D. J. Jones (National Research Council, High Speed Aerodynamics Laboratory, Ottawa, Canada), and D. L. Mundie. *Canadian Aeronautics and Space Journal*, vol. 26, 3rd Quarter, 1980, p. 231-234. 10 refs.

An optimization technique was applied in the design of area distributions of transport aircraft with minimum wave drag at high transonic speeds. The minimal drag bodies were calculated for the Mach number range of 0.98-1.10. Below this range, the shock is too weak to affect the drag; at subsonic flows above this Mach range, the flow over a slender body is described up to the first order by the linear supersonic theory, achieving the minimal wave drag body of Sears-Haack. It was concluded that axisymmetric bodies with minimal wave drag at near-sonic speeds can be designed by numerical optimization techniques using a finite difference code for the flow field computation. At subsonic Mach numbers, the optimum body has a blunt nose and an almost shockless condition. A.T.

A81-17049 # **Application of fracture mechanics in designing lower wing skin of transport aircraft.** V. G. Nanduri (De Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada). *Canadian Aeronautics and Space Journal*, vol. 26, 3rd Quarter, 1980, p. 235-238.

An application finite element method of using fracture mechanics in the design of test panels similar to the lower surface of a transport aircraft wing is discussed. The cracked stiffened panel is assumed to be a composite material with the skin and stiffeners representing the matrix and fibers; an expression is derived for the net section stress to produce total panel failure. The expression is based on the law of mixtures equation, the notch strength analysis of Kuhn (1967), and the proportional limit of the stress-strain curve as the limiting stress for the stiffeners. Detail designs of a wing bottom surface and of the narrow 7- and 6-stringer panels are presented; the failure of a 7-stringer panel during a residual strength test is photographically depicted. A.T.

A81-17067 **Periodically stiffened fluid-loaded plates. I - Response to convected harmonic pressure and free wave propagation. II - Response to line and point forces.** B. R. Mace (Southampton, University, Southampton, England). *Journal of Sound and Vibration*, vol. 73, Dec. 22, 1980, p. 473-504. 17 refs. Research supported by the Ministry of Defence (Procurement Executive).

A formulation for the vibration and sound radiation of fluid-loaded plates periodically stiffened by line supports is presented for line and point force excitations. The response to a convected harmonic pressure is determined by Fourier transforms; at low frequencies, where the separation of the stiffeners is less than one-third of the plate wavelength, the stiffened plate behaves like an equivalent orthotropic plate. At higher frequencies, the input mobility shows peaks at specific frequencies which can be identified with the bounding frequencies of zero propagation zones, and standing waves can be set up on the plate. With further increases in frequency, the mobility approaches a value determined by the properties of the structure at the point of excitation. A.T.

A81-17143 # **Fuel conservation in the air transportation industry - General and operational aspects (Il contenimento del consumo di carburante nell'industria del trasporto aereo - Aspetti generali ed operativi).** A. Schiavo. *Ingegneria*, Sept.-Oct. 1980, p. 257-266. 8 refs. In Italian.

A81-17146 # **Aerodynamic design of a ducted propeller - Optimization of efficiency (Il progetto aerodinamico di un'elica intubata - Ottimizzazione del rendimento).** S. de Ponte and A. Baron (Milano, Politecnico, Milan, Italy). *Ingegneria*, Sept.-Oct. 1980, p. 273-278. In Italian.

A81-17166 # **Rolls-Royce engines status report.** *Aircraft Engineering*, vol. 52, Dec. 1980, p. 2-7.

The article presents a survey of various Rolls-Royce engines including RB211 Turbofan, Pegasus Vectored-Thrust Turbofan, Olympus 593 Turbojet, Dart Turboprop, RB 401 Demonstrator and Business Jet Engine, Viper Turbojet, Tyne Turboprop, Conway Turbofan, Gnome Turboshaft Engine, and Turmo III C4. All of the engines have undergone extensive testing and are reviewed for their individual features. The RB211 Turbofan models have a take-off thrust of about 50,000 lb and improved fuel consumption and have

been used in the Lockheed L.1011-1 Tristar, and the Boeing 747. The RB211-535, being developed for the new Boeing 757 twinjet airliner is discussed together with the Adour Turbofan model which powers the Anglo-French Jaguar supersonic strike/trainer aircraft. The latter has a take-off thrust of 5,115 lb. for the Adour Mk. 102 and of 5,700 lb for the Adour -56. The major feature of these engines is a significant increase in reheat thrust. The Olympus 593 Turbo-jet has a take-off thrust of 38,000 lb and is the most extensively tested commercial engine. The Dart Turboprop is a long-serving commercial gas turbine noted for its fuel economy and low noise levels. Finally the Gem Turboshaft Engine which powers the twin engine Westland Lynx helicopter has a fuel consumption significantly better than similar engines in service. B.R.K.

A81-17167 # **Coatings in the aero gas turbine.** R. H. Wedge and A. V. Eaves (Rolls-Royce, Ltd., Aero Div., Bristol, England). *Aircraft Engineering,* vol. 52, Dec. 1980, p. 25-29.

The paper discusses sprayed coatings for gas turbine engines, the different problems associated with different parts of the engine, and future developments in the use of sprayed coatings and their likely impact on cost effectiveness within the gas turbine industry. The traditional metallic coatings such as 'hard' chrome to produce wear resistance, copper and tin as soft metals associated with bearings, cadmium plating for corrosion resistance, and silver plating for anti-seize/anti-fret application are supplemented by 'sprayed' coatings. The major problems which can arise in gas turbine engines are hammer wear (combatted by chromium plating or various plasma sprayed carbide coatings), fretting and rubbing wear (combatted by copper-nickel-indium, copper-nickel, aluminum bronze, and aluminum bronze-polyester), rotating seal problems (combatted by sprayed alumina), and high temperatures (combatted by various nickel-chromium alloy sprays). A table is given which shows the various sprayed coatings and their cost effectiveness. Future developments are anticipated in the method of application and components of the various sprayed coatings. B.R.K.

A81-17324 # **Turbopropeller engine PZL-10S.** W. Kordzinski. *Technika Lotnicza i Astronautyczna,* vol. 35, May 1980, p. 10, 11. In English and Polish.

The paper deals with the design, specifications, and performance of a version of the Soviet TWD-10 turboprop engine currently manufactured in Poland on the basis of a license agreement. The engine is intended for the An-28 STOL aircraft and the PZL Sokol helicopter. Modern time and labor saving methods used in the production of the engine are noted. V.P.

A81-17325 # **The PZL-Sokol - New Polish helicopter.** T. Chwalczyk. *Technika Lotnicza i Astronautyczna,* vol. 35, May 1980, p. 33-37. In English and Polish.

The medium-weight-class helicopter under consideration fits between the Soviet helicopters, Mi-2 and Mi-8, as a substitution of the Mi-4, whose production has been terminated. In the passenger version of the helicopter, 12 (removable) seats are arranged in a 1.4-m high 3.2 x 1.56 m cabin. The design characteristics and specifications of the helicopter are examined. V.P.

A81-17371 # **Comparative evaluation of the quality of jet fuels (Sravnitel'naia otsenka urovnia kachestva reaktivnykh topliv).** A. F. Gorenkov. *Khimiia i Tekhnologiia Topliv i Masel,* no. 12, 1980, p. 21-25. 5 refs. In Russian.

A methodology is presented for comprehensive evaluation of fuel products which involves (1) selection of the base values of quality indices, (2) determination of the relative values of quality indices by establishing a functional relationship between the actual and the base value of each index, (3) determination of the weights for each of the relative quality indices, and (4) calculation of the combined quality index. Evaluation results are given for several fuel grades. V.L.

A81-17372 # **Formation of solid phase during the heating of jet fuels (Osobennosti obrazovaniia tverdoi fazy pri nagreve reaktivnykh topliv).** V. V. Malyshev and V. A. Astaf'ev. *Khimiia i Tekhnologiia Topliv i Masel,* no. 12, 1980, p. 25-27. 10 refs. In Russian.

The mechanisms of tar and sludge formation during thermal oxidation of jet fuels have been investigated under static and dynamic conditions in the temperature range 120-200 C. It is found that tar deposits consist of high-molecular compounds whose solubility and adsorption properties change with increasing temperature by nonoxidation mechanisms. These compounds are thought to cause the coagulation of the solid phase. Under static conditions, sludge formation is largely determined by the surface oxidation of the fuel. V.L.

A81-17373 # **Composition of sludge formed in B-3V oil (Sostav osadkov, obrazuiushchikhsia v masle B-3V).** E. A. Kunina, V. G. Kuznetsov, G. T. Novosartov, and L. V. Boiko. *Khimiia i Tekhnologiia Topliv i Masel,* no. 12, 1980, p. 27-29. In Russian.

The composition of sludge which precipitates from B-3V oil and is deposited on oil filters and other components of the lubricating systems of gas turbine engines has been investigated by chemical and IR spectral analyses. It is found that filter deposits are formed by Altax, an oxidation product of the antiscoring additive Captax, while the deposits formed on the hottest components of the system consist mostly of additive oxidation products and oxides of the metals of the structural components. To reduce the deposits, it is recommended to increase the thermal oxidation stability of B-3V oil by means of more effective antioxidation additives. V.L.

A81-17375 # **Joint-laboratory qualification testing of oils for gas turbine engines (Mezhlaboratornye ispytaniia masel dlia GTD po metodam kvalifikatsionnoi otsenki).** R. R. Bureeva, S. E. Krein, and G. T. Novosartov. *Khimiia i Tekhnologiia Topliv i Masel,* no. 12, 1980, p. 41-43. 12 refs. In Russian.

Data on the kinematic viscosity, lubricating properties, and thermal oxidation stability of several aviation oils based on test results from five different laboratories have been statistically evaluated for convergence and repeatability using the method of dispersion analysis. Indices of convergence and repeatability are shown to be useful tools for evaluating the accuracy of test methods used. V.L.

A81-17453 **Captive carry and free flight rain erosion considerations for reinforced ablative fluorocarbon radome materials.** G. F. Schmitt, Jr. (USAF, Materials Laboratory, Wright-Patterson AFB, Ohio). *SAMPE Journal,* vol. 16, Nov.-Dec. 1980, p. 12-16. 6 refs.

Experiments were conducted to assess the rain erosion behavior during captive carry and free flight of reinforced ablative plastics used in missile radomes. Forty-eight specimens were mounted on both the left and right sides of a supersonic rain erosion wedge with 12 each at the following angles: 13.5, 30, 45, 60 deg and then tested on a Holloman rocket sled track 50,000 feet long with 18,000 feet equipped with nozzles for rain simulation at speeds up to Mach 4.0 (4200 fps). The principal materials variables investigated were types of polymer (polytetrafluoroethylene, fluorinated ethylene propylene, polyfluoroalcohol, ethyltetrafluoroethylene), type of reinforcement (S-glass, E-glass, AB-312 aluminum borosilicate), amount of fiber loading (10 to 40 percent by weight), and orientation of fibers (perpendicular to surface, parallel to surface, random). Some of the conclusions show that the fiber reinforced fluorocarbon plastics which exhibited the lowest mean-depth-of-penetration at 60 deg were also the best at the 13.5 deg angle; the polytetrafluoroethylene and polyfluoroalcohol fluorocarbon polymers provide the best erosion resistance; and the aerodynamic heating of supersonic free flight in combination with erosion conditions at Mach 4.0 change the rankings of ablative fluorocarbons compared to erosion resistance at subsonic velocities. B.R.K.

A81-17467 **Problems of flight mechanics involved in all-weather helicopter operation (Flugmechanische Probleme bei der Realisierung des Allwettereinsatzes von Hubschraubern).** P. Hamel and B. Gmelin (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugmechanik, Braunschweig, West Germany). *Zeitschrift für Flugwissenschaften und Weltraumforschung,* vol. 4, Nov.-Dec. 1980, p. 335-345. 12 refs. In German.

In view of the inferior flight mechanical behavior of the helicopter, in particular, with respect to military all-weather requirements, some major factors influencing the flight mechanical behavior of the pilot/helicopter system are examined. Flight mechanical problem areas are elucidated, and the basic flight properties of the helicopter that would enable all-weather operation are discussed. Methods of optimizing basic helicopter flight characteristics are proposed. V.P.

A81-17471 **The effect of aerodynamic coupling on the dynamics of aircraft in fast rolling motion (Einfluss der aerodynamischen Kopplung auf die Flugzeugdynamik bei schnellen Rollbewegungen).** G. Sachs and W. Fohrer (München, Hochschule der Bundeswehr, Neubiberg, West Germany). *Zeitschrift für Flugwissenschaften und Weltraumforschung,* vol. 4, Nov.-Dec. 1980, p. 379-388. 28 refs. In German.

The paper deals with the effects of coupling of longitudinal and lateral aerodynamic characteristics on the dynamics of rolling aircraft. The aerodynamic coupling considered is caused by unsymmetric flow conditions resulting from sideslipping where rolling moments due to angle-of-attack and pitching moments due to angle of sideslip are of particular significance for the problem addressed. It is shown that the attainable rate of roll is significantly influenced and that marked effects on stability are possible. Furthermore, it is shown that aerodynamic coupling can cause autorotation (i.e., a rolling motion without aileron forcing moments). The results are derived using simplified relations and complete six-degree-of-freedom calculations. (Author)

A81-17472 **A wall interference analysis (Zur Ermittlung von Wandinterferenzen).** J. Barche. *Zeitschrift für Flugwissenschaften und Weltraumforschung,* vol. 4, Nov.-Dec. 1980, p. 389-396. 6 refs. In German.

In the present paper, an attempt is made to apply theoretical experience to the problem of correcting for the wall effect in wind tunnels. A method based on Green's theorem is proposed, in which correction for the wall effect is made from the interference signals generated by a body situated in the proximity of the wall. Because of this location, the body itself does not figure in the calculations. The only requirement of the method is that the flow be attached at the wall (i.e., that the interference field may be described by potential theory). V.P.

A81-17488 **The effect of cyclic loading on the apparent cleavage fracture toughness of 1Cr-Mo-V rotor steel.** I. Roman, K. Ono (California, University, Los Angeles, Calif.), and A. S. Tetelman. *Engineering Fracture Mechanics,* vol. 14, no. 1, 1981, p. 155-159, 161-163. 19 refs. Research supported by the Electric Power Research Institute.

A significant increase in the cleavage fracture toughness of 1Cr-Mo-V rotor steel due to cyclic loading was observed. A new model that is capable of predicting and explaining the observation is proposed. The model combines macroscopic fracture criteria with the assumption that transient flow properties of a material in the cyclic plastic zone can be represented by those of the material subjected to macroscopic low cycle fatigue under fully reversed strain control. (Author)

A81-17501 **Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers.** Meeting sponsored by the American Helicopter Society. Washington, D.C., American Helicopter Society, 1980. 239 p. $18.

The meeting focused on engine technology, drive systems, propulsion system operations, and propulsion systems integration. Papers were presented on contingency ratings, digital control for helicopter powerplants, the T700 booster stage, advanced transmission component development and test program, safety considerations for drive train design, survey of propulsion system failures resulting in mishaps, failure indication and corrective action for turboshaft engines, and an infrared suppressor for the Black Hawk helicopter. A.T.

A81-17502 **The impact of contingency ratings on advanced turboshaft engine design.** A. Brooks (General Electric Co., Lynn, Mass.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 7 p.

An aircraft engine designer's consideration of contingency power ratings of advanced turboshaft engines is presented. It was shown that one engine inoperative requires methods of achieving short time horsepower (SHP) increments of 10-20%; large increases in SHP (above 20%) for contingency power will be limited by compressor capability and local high temperatures leading to hot section hardware failures. A.T.

A81-17503 **A simple combustor system for a small gas turbine engine.** G. Opdyke, Jr. and B. C. Forbes (Avco Corp., Avco Lycoming Stratford Div., Stratford, Conn.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 9 p. 12 refs.

The design of a simple, low cost annular combustor, based on a unique aerodynamic mixing concept, is described in terms of its mechanical simplicity, versatility in the use of different fuel injection systems, and its demonstrated performance characteristics. The design, called a circumferentially stirred combustor, incorporates a primary zone flame stabilization method which results in an inexpensive shape for the combustor liner and a reduction of the number of fuel injectors to about one half that normally used for a swirl stabilized annular primary zone design. This circumferentially stirred combustor design has been applied to helicopter engine models and to advanced shaft and fan engines. (Author)

A81-17504 **Digital control for helicopter powerplants.** D. A. Caine (Lucas Industries, Inc., Lucas Aerospace Div., Englewood, N.J.) and S. Janik (Avco Corp., Avco Lycoming Stratford Div., Stratford, Conn.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 16 p.

Full-authority electronic control of helicopter engines using digital large scale integration technology is described. The control uses a 12-bit complementary metal-oxide semiconductor microprocessor as a compromise between the 8-bit and 16-bit systems, requiring low electrical power consumption. The software logic, the interfacing of the digital system with the powerplant and the airframe by optical serial links, and self-diagnostics methods are discussed. A.T.

A81-17505 **The digital control system as part of an integrated accessory fit for future engines.** M. P. Perks and T. G. Morton (Rolls-Royce, Ltd., Aero Div., Leavesden, Herts., England). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers.

Washington, D.C., American Helicopter Society, 1980. 12 p.

The paper suggests that the traditional approach of designing the control system in isolation from the other accessories on a gas turbine engine may not provide the most cost effective total solution for an engine having a digital control system. It is considered that the integrity of the digital control can be maintained while providing additional functions not associated with its prime control task. This

could allow the development of advanced monitoring systems to minimize life cycle costs and achieve maximum aircraft utilization. The application of these principles to helicopter engines is discussed and an arrangement proposed which could provide substantial benefits both to the helicopter pilot and to the ground crew. Pilot workload would be substantially reduced by advising him of engine or aircraft management factors on a 'need to know' basis. Operators would benefit from regular information on the operational status of the engines. (Author)

A81-17506 The T700 booster engine. A. Brooks (General Electric Co., Lynn, Mass.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 7 p.

The T700 booster engine which provides greater horsepower by using a high tip speed transonic axial compressor combined with a moderate pressure ratio centrifugal compressor resulting in high ratio and engine efficiency is described. The engine RDT&E costs were low; the problem of matching the discharge flow of the constant rpm booster stage with the variable flow requirement of the core engine compressor is discussed. A.T.

A81-17507 Advanced transmission component development and test program. P. C. FitzGerald and G. F. Gardner (United Technologies Corp., Sikorsky Aircraft Div., Stratford, Conn.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers.
Washington, D.C., American Helicopter Society, 1980. 14 p.

The Advanced Transmission Components Investigation Program for future helicopters is analyzing stainless steel fabricated main transmission housings, advanced thrust carrying cylindrical roller bearings, and a high contact ratio buttress tooth form gear made of a new CBS 600 low alloy steel. High temperature gearbox operation will be designed to eliminate the oil cooler; a finite element model was used to determine stainless steel housing thicknesses and the rib structure for the crash load design criteria. A.T.

A81-17508 Drive system development for the 1980's. J. W. Lenski, Jr. and J. C. Mack (Boeing Vertol Co., Philadelphia, Pa.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers.

Washington, D.C., American Helicopter Society, 1980. 12 p. 9 refs. Army-sponsored research.

The design and testing of advanced helicopter transmission components including high-speed tapered roller bearings, integrated bearings and gears, high-speed seals, and high-modulus composite gear housings are described. Integral-shaft inner races are being developed for high speed bearings, and means of improving internal oil flow for greater tolerance to oil interruption are designed. The assembly weight, number of bearings, faying surfaces, oil flow rates, and equipment test life are compared for current and advanced transmission systems. A.T.

A81-17509 Development of helicopter transmission components for the 1980s. R. A. Battles (Bell Helicopter Textron, Fort Worth, Tex.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 8 p. 9 refs. Army-supported research.

New components and materials are being evaluated for application to the next generation of helicopter transmissions. Three types of involute gears - standard spur, high contact ratio (HCR) spur, and double-helical (D-H) - are to be evaluated in direct comparison tests. These tests will evaluate the following parameters: noise, efficiency, scoring, pitting, bending, and loss-of-lubricant operation. The test program is not to be concluded until early 1981; however, calculated test results are discussed. All three types of gears are made of Carpenter EX-00053, a new, high-temper-resistant, air-hardening, carburizing steel. The double-helical sun and planet gears are made in one piece by shaping, shaving, carburizing, and honing. In conjunction with the gear tests, three rolling bearing materials, AMS 6444 (CEVM 52100), AMS 6491 (DVM M-50), and silicon nitride will be compared. Additionally, an input spiral bevel pinion with integral ball bearing inner races and a minilube system will be evaluated. (Author)

A81-17510 Safety considerations for helicopter drive systems of the 1980s. H. Ferris (FAA, Los Angeles, Calif.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers.
Washington, D.C., American Helicopter Society, 1980. 8 p.

The impact of helicopter drive systems on safety is reviewed. Problems included the inability to estimate drive system loads, incorrect dynamic analysis for fatigue, failure to design for fatigue by minimizing stress raisers, and inadequate lubrication and cooling. Recommendations are made for manufacturing and testing of gears, bearings, seals, fasteners, housings, couplings, and driveshafts. A.T.

A81-17511 Helicopter propulsion system development and qualification. V. R. Edwards (U.S. Army, Propulsion and Power Div., St. Louis, Mo.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 8 p. 5 refs.

The U.S. Army programs for developing helicopter propulsion systems and relating them to the total aircraft weapon arrangement are described. Turbine engines provided large reductions in weight and their turboshaft systems reduced fuel consumption; a new specification included requirements for polar moments of inertia, torsional spring constants, sand and dust ingestion, and provisions for low cycle fatigue and stress rupture. The airframe design handbook specifies engine circumferential design limits, rotor blades, and fast-acting control devices for rapid aircraft maneuvers. A.T.

A81-17512 Development and operational flight test of the model 250-C28B gas turbine engine. F. J. Schweibold (General Motors Corp., Detroit Diesel Allison Div., Indianapolis, Ind.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers.
Washington, D.C., American Helicopter Society, 1980. 8 p.

The development and flight testing of the 250-C28B gas turbine engine installed in a 206L1 helicopter are described. The tests were made for initial engine/drive train stability, response characteristics, compressor surge margins, water/snow ingestion capabilities, and relight system operation. Mission endurance profiles were established along with requirements for air bleeds, ground and air starts, and full-authority electronic fuel controls. A.T.

A81-17513 A survey of propulsion systems' malfunctions/failures resulting in helicopter mishaps. L. T. Burrows (U.S. Army, Applied Technology Laboratory, Fort Eustis, Va.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers.
Washington, D.C., American Helicopter Society, 1980. 6 p.

A survey of propulsion systems malfunctions/failures (M/F) was based on the record of four Army helicopter models during 1971-1978. The analysis included power plants, power transmissions, lubrication, fuel, and instrumentation; the tail rotor gearbox, the intermediate/combiner gearbox, and drive shafting were evaluated in the power train subsystems. Component M/F histories relating to helicopter mishaps are presented, noting that relatively insignificant components have been a continuing cause of mishaps. M/F occurrence can be reduced by proper design and manufacturing practices, together with adequate maintenance during the life of the helicopter. A.T.

A81-17514 Issues regarding Army turboshaft engines diagnostics and condition monitoring. G. W. Hogg (U.S. Army, Applied Technology Laboratory, Fort Eustis, Va.). In: Specialists'

Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 15 p.

A review of Army helicopter diagnostic methods, condition monitoring equipment, and turboshaft engine maintenance is presented. Engine maintenance by modules detects malfunctions, providing leadtime for repair and reducing secondary damage; it produces data for life-limited hardware tracking, determines operational readiness, and enhances safety. Technological improvements have been utilized in engine gas path determinations, oil monitoring, vibration signature analysis, and application of electronic microminiaturization for analyzing and displaying diagnostic data. A.T.

A81-17515 Failure Indication and Corrective Action for turboshaft engines. A. D. Pisano (General Electric Co., Aircraft Engine Group, Lynn, Mass.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 10 p.

In order to prevent loss of power modulation capability in the event of a failed engine control sensor, an automatic in-flight Failure Indication and Corrective Action (FICA) strategy is developed for advanced turboshaft helicopter applications. FICA provides for both the detection of a failed sensor and the generation of the best estimate of the failed signal which can then be used to provide continuity of stable engine control. The technical basis of FICA is a constant gain extended Kalman filter. The FICA structure consists of a nonlinear model of the turboshaft engine along with update logic to force the model to track the actual engine behavior. Utilizing the results of extensive computer simulations with an advanced turboshaft engine, the T700-GE-700, it is shown that stable engine control can be maintained in the presence of multiple sensor failures. (Author)

A81-17516 *Review of engine/airframe/drive train dynamic* interface development problems. W. J. Twomey (United Technologies Corp., Sikorsky Aircraft Div., Stratford, Conn.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 11 p. 6 refs. Grant No. DAAJ02-77-C-0037.

The coupled interaction between two or more helicopter subsystems has often been the source of vibration problems. This paper gives a review of Sikorsky experience with such problems over the past twenty years of developing gas turbine powered helicopters. This review is part of an overall Government effort to accumulate data which will eventually lead to solutions of generic problems of this type. The problems presented include forced vibration problems, self-excited vibrations, and a transient response problem. Eighteen problems are sumarized and grouped according to type. Five of the problems are described in some detail. Recent trends in problems are discussed. Recommendations are made for future analytical/testing efforts to achieve an improved understanding of interfacing dynamic problems and potential solutions. (Author)

A81-17517 Engine-airframe transient compatibility - Analysis and test. J. R. Alwang (Boeing Vertol Co., Philadelphia, Pa.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 9 p.

This paper discusses dynamic analysis and test requirements related to engine-airframe compatibility in two areas: drive system torsional stability and transient response. Prediction of stability characteristics using linear techniques and correlation with experimental data are reviewed. Control testing, leading to determination of worst-case conditions, is presented with an aircraft flight test procedure for providing an accurate evaluation of propulsion system stability. The importance of developing a nonlinear component-by-component engine simulation for optimizing control functional configurations and transient schedules is emphasized. Use of a dynamic simulation based on steady state matching deck performance for analyzing specific interface problems, including transient loss in compressor surge margin, is demonstrated. (Author)

A81-17518 Is the engine helicopter-worthy. A. G. Attridge (Bell Helicopter Textron, Power Plant Design Group, Fort Worth, Tex.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 9 p.

Is the engine helicopter-worthy is a question posed most frequently at the beginning of every new design program. This paper discusses some of the difficulties encountered in the installation of the engine in terms of effects on airframe hardware. The Bell Helicopter Textron Models 214A and 214ST are used as examples of current single- and twin-engine technology. (Author)

A81-17519 Advanced technology turboshaft IR suppression. F. Husted (U.S. Navy, Naval Air Propulsion Center, Trenton, N.J.), J. F. Hurley, and J. N. Dale (Avco Corp., Avco Lycoming Stratford Div., Stratford, Conn.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 8 p.

The development and testing of a passive IR suppression system for an advanced technology turboshaft engine are described. The exhaust plume gas radiation and exhaust ducting hot metal radiation were analyzed for all aspect and zenith angles; engine power losses were minimized by a suppressor feature which permits full power recovery in permissive flight zones. The suppressor utilizes turbine exhaust gas energy to pump plume dilution and wall cooling air; a maximum plume and hot metal radiation suppression is provided with a minimum power loss by a rectangular vane-vane configuration. Power loss data are presented in terms of increased back pressure on the engine, and metal skin temperatures are given in the form of metal cooling effectiveness. A.T.

A81-17520 General Electric infrared suppressors for the Black Hawk helicopter. M. C. Harrold (General Electric Co., Aircraft Engine Group, Lynn, Mass.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 14 p.

A cruise operation infrared (IR) suppressor has been used in Black Hawk helicopter propulsion systems to counter heat-seeking missiles. The design includes suppressor core, transition duct, nacelle ram inlet, rear seals, and inlet particle ducting system; they operate on ram pressure in forward IR signature for a cruise velocity of 4000 ft altitude, 95 F ambient temperature, with a 9-hp maximum horsepower loss per engine over an unsuppressed engine configuration. A.T.

A81-17521 Exhaust gas reingestion measurements. B. Turczeniuk (Boeing Vertol Co., Philadelphia, Pa.). In: Specialists' Meeting on Helicopter Propulsion Systems, Williamsburg, Va., November 6-8, 1979, Technical Papers. Washington, D.C., American Helicopter Society, 1980. 12 p.

Results of flight tests to measure the magnitude and effects of engine exhaust gas reingestion and inlet pressure distortion are presented. The tandem rotor CH-47 and single rotor YUH-61A helicopters were flown with instrumented engine inlets using fast-response probes. A wide range of flight maneuvers were evaluated, including operating in and out of ground effect, flares, hovering turns, lateral and rearward flight. The dynamic inlet air temperature and pressure patterns, time histories, and variation of basic engine parameters during exhaust reingestion are provided. The effect of instrumentation time constant on the maximum inlet temperature rise is discussed. Also shown is the effect of an inlet screen on pressure distortion. Conclusions are drawn as to the use of this data to establish turbine engine compressor stall margin

requirements needed to avoid experiencing problems with the engine/helicopter integration. (Author)

A81-17522 # **The supercritical profile of the supercritical wing (Superkritische Profile - Superkritische Flügel).** O. Wagner (München, Technische Universität, Munich, West Germany). *Luft- und Raumfahrt,* vol. 1, 4th Quarter, 1980, p. 105, 106, 108, 109. 10 refs. In German.

This paper discusses the profile wing design for supercritical structures. 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 levels 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 larger nose radius, and a thicker profile to the supercritical wing. R.C.

A81-17525 # **Aerial surveying of small areas from a small remotely controlled drone (Aerofotos'emka malykh uchastkov s distantsionno upravliaemogo bespilotnogo mini-nositelia).** A. G. Vanin. *Geodeziia i Kartografiia,* Nov. 1980, p. 55-58. In Russian.

Some aspects of the automation of aerial surveying are discussed. Data obtained in West Germany with radio-controlled model aircraft and helicopter, using a 6 by 6 cm photogrammetric camera are examined. V.P.

A81-17548 # **One-dimensional considerations concerning the stability behavior of inlet diffusers for supersonic aircraft (Eindimensionale Betrachtungen zum Stabilitätsverhalten von Einlaufdiffusoren für Überschall-Flugantriebe).** H.-L. Weinreich. Darmstadt, Technische Hochschule, Fachbereich Maschinenbau, Dr.-Ing. Dissertation, 1979. 192 p. 77 refs. In German.

The thesis deals essentially with the nonlinear interaction between inlet and diffuser in the case of frictionless flow in a long connecting channel. Under the assumption that the inlet length is much smaller than the total length, it is shown that isolated buzz cycles can appear even below the stability boundary if throttling is too nonuniform, while regular (normal) pulsations set in when a certain throttle level is exceeded. The transient process leads swiftly to a well-established cycle. Throttling just above the stable interaction boundary gives rise to vigorous pulsations. V.P.

A81-17577 # **Principle for the design of hybrid control systems for passenger transport systems (Printsip postroeniia gibridnykh sistem upravleniia passazhirsko-transportnykh samoletov).** I. A. Mikhalev and B. N. Okoemov. *Priborostroenie,* vol. 23, Oct. 1980, p. 45-50. In Russian.

Methods for the design of onboard hybrid control and processing systems for passenger aircraft are described. The hybrid automatic control system is designed as a quasi-continuous system whose characteristics are close to those of an initial optimal continuous system. The aircraft control algorithm is constructed on the basis of a law for the control of continuous systems, which are synthesized by a method of optimal continuous linear systems. P.T.H.

A81-17622 **Stationary displacement of a body by a shock wave.** E. I. Zababakhin and N. E. Zababakhin. *(PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki,* Mar.-Apr. 1980, p. 135-137.) *Journal of Applied Mechanics and Technical Physics,* vol. 21, no. 2, Sept. 1980, p. 269, 270. Translation.

The conditions where a streamlined body will travel together with a shock front, on which it floats like a cork in water, are examined. It is shown that the requirements concerning the aerodynamic quality of the body's configuration are not difficult to meet. V.P.

A81-17656 **Laminar boundary layer on swept-back wings of infinite span at an angle of attack.** I. G. Brykina, E. A. Gershbein, and S. V. Peigin. *(Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May-June 1980, p. 27-39.) *Fluid Dynamics,* vol. 15, no. 3, Nov. 1980, p. 344-354. 24 refs. Translation.

In the present paper, the compressible boundary layer flow on swept wings of infinite span is studied for various angles of attack under the assumption of an impermeable or BLC wing surface. A first-approximation analytical solution is obtained (also for axisymmetric flow) by an integral method of successive approximations. Asymptotic solutions of the boundary layer equations are obtained for large values of the BLC parameter. V.P.

A81-17735 # **Experimental investigations on shock-associated noise.** D. Ma, P. Li, G. Dai, and H. Wang (Academia Sinica, Acoustics Institute, Peking, Communist China). *Scientia Sinica,* vol. 23, Oct. 1980, p. 1237-1246. 13 refs.

Shock-associated noise from a choked airjet produces sound fields and spectra which vary widely with different nozzles and pressure ratios between 2 and 8. The overall sound pressure levels in the direction perpendicular to the jet show deviations of the sound pressure level from turbulent noise at the ratio of 2, rising to 20 dB at ratios above 3, and then remaining constant up to the ratio of 8.5. Expressions are derived for screech frequency and peak frequency of wide-band shock-associated noise which agree with experimental data; significant dips are observed in the frequency spectra of a composite jet noise at a specific pressure ratio which results from an interference effect between wide-band and turbulent noises. A.T.

A81-17741 # **Variational principles and generalized variational principles for the hybrid aerodynamic problem of airfoil cascades on an arbitrary stream sheet of revolution.** G. Liu (Shanghai Institute of Mechanical Engineering, Shanghai, Communist China). *Scientia Sinica,* vol. 23, Oct. 1980, p. 1339-1347. 5 refs.

In this paper a hybrid aerodynamic problem of airfoil cascades is suggested and formulated, being a unification as well as a generalization of the conventional direct and inverse problems, so as to meet various requirements of turbomachinery blade design. A new universal function - the moment function - is also introduced. Then, two families of variational principles and generalized variational principles are established for the hybrid problem of type A, in which along some part of the airfoil contour velocity distribution is prescribed, while along remainder contour geometry is given. In order to facilitate the treatment of a variety of boundary conditions all of them have been converted into natural ones, and use is made of the artificial interfaces. This paper is primarily aimed at providing a broader and rigorous theoretical basis for introducing the finite element method and other variational methods into computational aerodynamics of turbomachinery. (Author)

A81-17801 **Recent selected papers of Northwestern Polytechnical University. Parts 1 & 2.** Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979. Pt. 1, 203 p.; pt. 2, 243 p. In English and Chinese.

Papers are presented on such topics as the finite difference computation of steady transonic potential flow past aircraft, the design of subcritical airfoils, the synthesis of array antennas of high directivity and low sidelobe, the calculation of the integral-type flexure hinge assembly of dynamically tuned gyroscopes, the structural analysis of fuselages with cutouts, and the solidification characteristics of superalloys. Also considered are the matrix analysis of wings, pulsed spray transfer arc welding, color discrimination by a color-picture reader, the response of a turbojet engine to inlet pressure distortion, and the acoustic instability of solid propellant rocket engines. B.J.

A81-17802 # **Finite difference computation of the steady transonic potential flow around airplanes.** S. Luo, Y. Zhen, H. Qian, and D. Wang. In: Recent selected papers of Northwestern Polytechni-

cal University. Part 1. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 1-14. 5 refs. In Chinese, with abstract in English.

The velocity potential equation for steady transonic flow past an aircraft is solved by mixed finite difference schemes. The finite difference equations for the velocity potential are solved by the line relaxation method. The influence of the wing on the horizontal tail is computed taking into account the deflection of the wing wake vortices. Two numerical examples are considered and results agree fairly well with wind tunnel test results: (1) a wing-fuselage-horizontal tail-vertical tail configuration at freestream Mach numbers of 0.25 and 0.95; and (2) a wing-fuselage configuration at a freestream Mach number of 1.05 and an angle of attack of 2.2 deg. B.J.

A81-17803 # **Second order approximation theory of an arbitrary aerofoil in incompressible potential flow.** C. Lin. In: Recent selected papers of Northwestern Polytechnical University. Part 1. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 15-25. 11 refs. In Chinese, with abstract in English.

A novel method for calculating incompressible potential flow around an airfoil is presented. The region outside an arbitary airfoil is conformally transformed into the region outside a unit circle. The transformation functions are expanded into ascending power series, and only those terms up to and including the second order are retained. The method gives second-order perturbation solutions which are uniformly valid throughout the flow field. Analytical formulas are given. B.J.

A81-17804 # **Aerodynamic calculations and design of subcritical aerofoils.** C. Lin. In: Recent selected papers of Northwestern Polytechnical University. Part 1. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 27-35. 20 refs. In Chinese, with abstract in English.

Methods are developed for the analysis of the direct problem and inverse problem of airfoils in subcritical potential flow. The direct problem (i.e., the prediction of pressure distribution for a given airfoil at a given angle of attack) is treated on the basis of a compressibility correction in the second-order approximation theory. It is shown that formulas obtained for the direct problem can be combined with the Newton iteration method to treat the inverse problem, i.e., the determination of airfoil geometry and angle of attack for a given pressure distribution. B.J.

A81-17805 # **An aerodynamic design method for transonic axial flow compressor stage.** F. Zhu, X. Zhou, S. Liu, and F. Fan. In: Recent selected papers of Northwestern Polytechnical University. Part 1. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 37-49. 9 refs. In Chinese, with abstract in English.

A three-dimensional aerodynamic design method for the transonic axial flow compressor stage is described. The method consists of three main parts: (1) the mean S2 streamsurface calculation, (2) the approximate calculation of the S1 streamsurface of revolution, and (3) the definition of the blade element on the conical surface and the stacking of blade airfoil sections. The method is unusual in that the stations for calculating the S2 streamsurface are curves, and particularly in that the airfoil parameters of the blade are calculated on a plane tangent to the approximate streamsurface of revolution. On this tangential plane, two-dimensional flow is used as the basic model to calculate the Mach wave system on the suction surface of the cascade entrance region. B.J.

A81-17807 # **An optimum design procedure of total-temperature thermocouple probes.** C. Liu and J. Zhao. In: Recent selected papers of Northwestern Polytechnical University. Part 1. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 65-74. 11 refs. In Chinese, with abstract in English.

A procedure is described for the design of total-temperature thermocouple probes for the investigation of turbojet exhaust gas; the aim of the design is to achieve a minimum steady-state error under given operating conditions. The gas velocity in the sheath, i.e., the optimum internal flow velocity, is determined on the principle that the sum of the radiation error, the conduction error, and the velocity error is a minimum under given operating conditions. By using the optimum internal flow velocity, the diameter of the exhaust hole is determined and the layout of the probe is designed. Verification tests have shown that the error of the thermocouple probe reaches a minimum when the diameter of the exhaust hole is 1.4 mm. B.J.

A81-17815 # **The automatic matrix force method and techniques for handling more complex computations with given computer capacity.** Q. Yang. In: Recent selected papers of Northwestern Polytechnical University. Part 1. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 177-188. 10 refs. In Chinese, with abstract in English.

A detailed description is given of the automatic matrix force method, a numerical method of aircraft structural analysis. It is shown that the method can be applied to complex structures with a high degree of redundancy. B.J.

A81-17816 # **Structural analysis of fuselages with cutouts by finite element method.** S. Ge, C. Sun, X. Tang, and T. Ye. In: Recent selected papers of Northwestern Polytechnical University. Part 1. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 189-200. 6 refs. In Chinese, with abstract in English.

A finite element procedure is developed for the structural analysis of fuselages with cutouts. It is shown that, when the elastic behavior of the bulkhead is considered, the normal stresses exhibit a three-wave circumferential variation. Calculated displacements along the length of the fuselage are in agreement with full-scale test data. B.J.

A81-17818 # **The matrix analysis of wings.** Y. Xu, R. Zhu, J. Jiang, and Y. Cai. In: Recent selected papers of Northwestern Polytechnical University. Part 2. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 41-62. In Chinese, with abstract in English.

A matrix analysis is presented in which plate-beam wing structures are simplified either as plane stress or plate bending models. In addition to applying the element stiffness matrix of plane stress, the paper introduces a triangular element matrix for laminated plates and an element stiffness matrix for beams of axially variable rectangular cross section. Two general computer programs are presented, and numerical results are given for the deflections and stresses of a wing consisting of plates and beams, a honeycomb-core wing, and a solid wing. B.J.

A81-17824 # **A preliminary experimental investigation of the response of a turbojet engine to inlet pressure distortion.** F. Chen, D. Tang, Z. Hu, W. Li, J. Yu, X. Wu, J. Zhao, Q. Lin, Z. Wang, and S. Liu. In: Recent selected papers of Northwestern Polytechnical University. Part 2. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 169-185. 8 refs. In Chinese, with abstract in English.

Preliminary results are presented concerning the influence of inlet pressure distortion on the characteristics and instability of the axial compressor of a turbojet engine. Experiments were performed on the test bed of a turbojet engine with a 9-stage compressor whose first stage is transonic. It is found that the inlet pressure distortion affects not only the stall line but also the shape and position of constant speed lines of the compressor. Inlet pressure distortion shifts the speed lines toward the left and flattens them. The effect of the decrease in the first stage nozzle exit area is similar to that of inlet pressure distortion. B.J.

A81-17825 # **The measurement and analysis of station parameters of a turbojet engine.** Q. Dong, J. Zhao, S. Liu, X. Wu, Z. Hu, M. Cong, Q. Lin, Z. Wang, S. You, and L. Zheng. In: Recent selected papers of Northwestern Polytechnical University. Part 2. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 187-201. 11 refs. In Chinese, with abstract in English.

The flow field parameters at characteristic stations of a turbojet engine were measured under design operating conditions. These data were used to calculate the gasdynamic parameters of the characteristic stations, the main process parameters, the component loss coefficients, and the engine performance. The parameters of the engine under various throttle conditions were recorded for different speeds, different nozzle areas, and with and without compressor bleeding. Attention is also given to the rational selection of probe locations to take due consideration of flow field characteristics, and to the selection of the proper method of data processing for obtaining accurate average station parameters of the engine. B.J.

A81-17826 # **An experimental investigation of the rotating stall, surge, and wake behind the rotor for a single stage axial compressor.** W. Zhang, Z. Liu, C. Zhang, and J. Liu. In: Recent selected papers of Northwestern Polytechnical University. Part 2. Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 203-215. 8 refs. In Chinese, with abstract in English.

Dynamic measurements were used to study the rotor, rotating stall, and surge of a single-stage axial compressor (design speed of 15,000 rpm). The rotating stall is found to be related to the total turbulence caused by the wake of the rotor. It is shown that before rotating stall occurs, the wake range of the rotor widens, the shape of the wake changes significantly, and the total turbulence caused by the wake increases sharply. It is also shown that surge occurs as a result of continuous expansion of the rotating stall cell. As soon as surge occurs, distinct reverse flow appears; the flow pulse frequency of surge is far less than that of rotating stall. B.J.

A81-17827 # **A vaporizing combustor with double combustion spaces.** M. Tang, H. Zhu, and Q. Du. In: Recent selected papers of Northwestern Polytechnical University. Part 2.

Xian, Shaanxi, People's Republic of China, Northwestern Polytechnical University, 1979, p. 217-228. 5 refs. In Chinese, with abstract in English.

A tubular combustor is described that has a novel type of prevaporizing tube, which is of annular cross section. The dome of the combustor is divided into two combustion spaces; fuel is injected under moderate pressure into the annular space of the prevaporizing tube through the orifices on the two fueled-distribution rings. The injected fuel forms oil films on the two walls. The combustor is designed to be used as an air heater for a high-temperature wind tunnel. It is required that the combustor provide a steady uniform hot gas stream at a temperature of 400-1100 C, and that the flame not extend beyond the exit of the flame tube. B.J.

A81-17832 **Sukhoi's pivotal interdictor.** *Air International,* vol. 20, Jan. 1981, p. 6-10.

The article covers the development, design, and operation of the Soviet Su-24 aircraft, NATO code name 'Fencer'. The Su-24 is configurationally similar to its USAF counterpart, the F-111, although scaled down both dimensionally and in weight (empty equipped weight of 41,890 lb rising to a maximum weight of 87,080 lb). It has a combat radius of 1700 km and can attain speeds of 2445 km/hr (M = 2.3) above 36,000 ft and 1470 km/hr (M = 1.2) at sea level. The aircraft is powered by a pair of Tumansky R-29B turbofans (42% more unreheated thrust than the TF30-P-9 of the F-111), with five LP and six HP compressor stages and a maximum unreheated thrust of 17,636 lb. The Su-24 is equipped with a radar of the pulse-Doppler type for navigation, terrain-following, and all-weather weapons delivery, and its armament is comprised of a 23-mm Gatling-style rotary cannon and nine weapons stations containing a total of 16 1,102-lb bombs. The Su-24 is capable of interdiction missions far beyond the FLOT (Front Line of Troops) and is most effective in a HI-LO-HI profile from its Soviet bases. Fencer is being delivered at a production rate of 8-9 monthly, and represents an important advance in Soviet attack capability. B.R.K.

A81-17841 # **An experimental study on kerosene-hydrogen hybrid combustion in a gas turbine combustor.** H. Hiroyasu, M. Arai, T. Kadota (Hiroshima, University, Hiroshima, Japan), and J. Yoso (Japanese National Railways, Tokyo, Japan). *JSME, Bulletin,* vol. 23, Oct. 1980, p. 1655-1662. 7 refs.

Kerosene-hydrogen hybrid combustion was studied in a swirler type combustor. Kerosene was atomized by an air blast atomizer, and gaseous hydrogen was supplied to a kerosene spray through an annular slit in the atomizer. Blow out limit of the flame shifts to the lean side of the air-fuel mixture in the hybrid combustion, which results in a slight decrease in NOx emission and a decrease in soot emission. When the hybrid ratio is under 10%, the flame stability is improved by hybrid combustion; increasing the hybrid ratio from 10 to 50% produces an increased combustion efficiency and reductions of soot and NOx. (Author)

A81-17952 * # **Inlet flow distortion in turbomachinery.** B. S. Seidel, M. D. Matwey (Delaware, University, Newark, Del.), and J. J. Adamczyk (NASA, Lewis Research Center, Cleveland, Ohio). *American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, New Orleans, La., Mar. 10-13, 1980, Paper 80-GT-20.* 6 p. 12 refs. Members, $1.50; nonmembers, $3.00. Grant No. NsG-3189.

A single stage axial compressor with distorted inflow is studied. The inflow distortion occurs far upstream and may be a distortion in stagnation temperature, stagnation pressure or both. The blade rows are modeled as semi-actuator disks. Losses, quasi-steady deviation angles, and reference incidence correlations are included in the analysis. Both subsonic and transonic relative Mach numbers are considered. A parameter study is made to determine the influence of such variables as Mach number and swirl angle on the attenuation of the distortion. (Author)

A81-17953 * # **Comparison of experimental and computational shock structure in a transonic compressor rotor.** G. Haymann-Haber (General Electric Corp., Lyman, Mass.) and W. T. Thompkins, Jr. (MIT, Cambridge, Mass.). *American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, New Orleans, La., Mar. 10-13, 1980, Paper 80-GT-81.* 11 p. 17 refs. Members, $1.50; nonmembers, $3.00. Grant No. NGL-22-009-383.

Measurement of passage shock strength in a transonic compressor rotor using a gas fluorescent technique revealed an unexpected variation in shock strength in the radial direction. An axisymmetric idealization would normally predict that the passage shock strength would gradually weaken when moving radially inward until disappearing at the sonic radius. However, the measurements indicated a sharp peak in strength at the nominal sonic radius. Blade boundary layer separation originating at this point accounts for about one half of the total rotor losses. A numerical computation of the three-dimensional inviscid flow, using time-marching techniques, has accurately predicted in general the radial and tangential variations in passage shock strength and in particular the sharp pressure peak at the nominal sonic radius. The overall shock strength was somewhat overpredicted, but this overprediction may be the result of boundary layer separation in the experiment. This paper presents comparisons between the optical density measurements and computational results and in addition a short analytical discussion which demonstrates that the sharp shock strength rise may occur in many transonic compressor rotors. (Author)

A81-17954 * # **Structure and decay characteristics of turbulence in the near- and far-wake of a moderately loaded compressor**

rotor-blade. A. Ravindranath and B. Lakshminarayana (Pennsylvania State University, University Park, Pa.). *American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, New Orleans, La., Mar. 10-13, 1980, Paper 80-GT-95.* 10 p. 9 refs. Members, $1.50; nonmembers, $3.00. Grant No. NsG-3012.

The wake of a turbomachinery rotor-blade is turbulent, highly three-dimensional, and nonisotropic with appreciable curvature in the trailing-edge and near-wake regions. The characteristics of the turbulence vary considerably with radius, blade loading, free-stream turbulence, Reynolds number, and the rotor-blade geometry. This paper is concerned with the turbulence properties of a moderately loaded compressor blade, particularly near the blade trailing-edge. The tangential variation of the axial, tangential and radial intensities and stresses across the wake, as well as their decay characteristics were measured with a tri-axial hot-wire probe in the rotor frame of reference. The decay of intensities and stresses were found to be very rapid in the trailing-edge and near-wake regions and slow in the far-wake region. The effects of inlet-guide-vane and the hub-wall boundary layers on the rotor wake turbulence spectra are also discussed. Similarity rules for the three components of intensity are also derived and presented in this paper. (Author)

A81-17976 History of flight testing the L-1011 Tristar jet transport. I - The L-1011-1. R. J. Gatineau (Lockheed-California Co., Engineering Flight Test Div., Palmdale, Calif.). *Lockheed Horizons,* Winter 1980-1981, p. 3-17.

The article highlights the flight testing and development of the L-1011 Tristar jet transport. The L-1011 has a take-off gross weight of 430,000 to 504,000 lb, a range of up to 5000 nautical miles, and can carry 300 to 345 passengers at a nominal cruise speed of Mach 0.83. The L-1011 is currently available in four basic models (L-1011-1, L-1011-100, L-1011-200, L-1011-500), each model having differences in design, range, fuel capacity, and passenger capacity. The aircraft were intensively tested overa a period of two years for take-off and landing, noise levels, load capacity, strucural defects, aircraft system and and component performance, and flight performance in a series of tests designed to meet the flight demonstration requirements necessary for certification, which was received from the FAA in 1972. B.R.K.

A81-17977 Autonomous navigation using passively sensed terrain images. O. Firschein and M. J. Hannah (Lockheed Signal Processing Laboratory, Palo Alto, Calif.). *Lockheed Horizons,* Winter 1980-1981, p. 26-34.

The possibility of using passively sensed terrain images as the basis for an autonomous navigation system in subsonic vehicles flying at low altitudes is of interest for unmanned flight applications. Through a TV camera or mosaic of light-sensitive semiconductor devices, the image scene is converted into a number which is stored in a computer and can then be used by the 'Navigation Expert' (a computer program being developed at Lockheed's Signal Processing Laboratory) to make decisions and control the vehicle's flight. The Navigation Expert coordinates several subsystems including the Instruments Subsystem (IS), a Dead Reckoning System (DRS), a Ground Velocity Subsystem (GVS), a Visual Bootstrapping Subsystem (VBS), and a Landmarks Subsystem (LS). Further research is necessary before an automatic navigation system based on images can become operational. B.R.K.

A81-17994 Influence of free-stream turbulence intensity on heat transfer in the two-dimensional turbulent boundary layer of an accelerated compressible flow. K. Bauer, J. Straub, and U. Grigull (München, Technische Universität, Munich, West Germany). *International Journal of Heat and Mass Transfer,* vol. 23, Dec. 1980, p. 1635-1642. 10 refs. Research sponsored by the Bundesministerium der Verteidigung.

The effect of free-stream turbulence on heat transfer in the turbulent boundary layer is investigated experimentally for accelerated compressible flow in a two-dimensional convergent-divergent nozzle. The turbulence intensity varied from nearly zero to about 20%; and the nozzle entrance Reynolds number attained a value of about 10-million. For three different loading cases the free-stream turbulence intensity and fluctuation along the nozzle axial length are determined together with the local Stanton number. For low Reynolds number (less than one-million) no clear change of heat transfer is observed; for Re exceeding one-million, a weak and nearly linear dependence of Stanton number on free-stream turbulence intensity is shown. B.J.

A81-17997 Vector and scalar characteristics of opposing jets discharging normally into a cross-stream. Z. A. Khan and J. H. Whitelaw (Imperial College of Science and Technology, London, England). *International Journal of Heat and Mass Transfer,* vol. 23, Dec. 1980, p. 1673-1680. 10 refs. Research supported by the Science Research Council.

Measurements of mean velocity and a passive scalar (helium tracer) have been obtained for two rows of opposing jets discharging normally into a cross-flowing stream and simulate an important aspect of gas-turbine combustor practice. Results are presented for a downstream distance of 6 jet diameters from the jet center lines and for a jet-to-mainstream velocity ratio of 2.25. The influence of the nonuniform pitch and pitch-to-diameter ratio is quantified with the opposing jets separated by 4D. For a pitch to diameter ratio of 2, a slight geometrical asymmetry of the central jet for one row of holes results in a severe asymmetry of the velocity field. This effect is not, however, propagated to the opposing side. The scalar flux measurements show the nearest adjacent jet aiding the displaced jet to regain symmetry and the counteraction to this of the opposing jet. With a pitch-to-diameter ratio of 4, the scalar measurements indicate 'slipping' between the opposed jets. Furthermore, symmetrical arrangement of the jets with this higher pitch-to-diameter ratio leads to impingement of the opposing jets with the jets bifurcating asymmetrically, and geometrical asymmetry no longer results in severe asymmetry of the velocity field. (Author)

A81-18022 # Effects of axisymmetric sonic nozzle geometry on Mach disk characteristics. A. L. Addy (Illinois, University, Urbana, Ill.). *AIAA Journal,* vol. 19, Jan. 1981, p. 121, 122. 13 refs.

Results are presented on the effects of axisymmetric sonic nozzle geometry on the onset, diameter, and location of the Mach disk in moderately underexpanded freejet flows. A contoured converging nozzle, four conically converging sharp-edged nozzles and a sharp-edged orifice are examined. The mass flow rate and choking characteristics of the six sonic nozzles are investigated over the stagnation to back pressure ratio range greater than 1 and less than 10. R.C.

A81-18024 # A study of multiple jets. S. Raghunathan and I. M. Reid (Belfast, Queen's University, Belfast, Northern Ireland). *AIAA Journal,* vol. 19, Jan. 1981, p. 124-127.

This paper investigates the reduction of noise level through a multiple jet array. Nozzles are equally spaced around a circle with a radius of 5 mm from the axis of the central nozzle, and operate at a supply pressure of 0.3-0.5 MPa (3-5 bar). A noise spectra peak corresponding to f = 20 KHz is found. Noise reduction is observed without significant reduction in the momentum of the jet. R.C.

A81-18051 International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volumes 1 & 2. Conference sponsored by ASCE, SAE, AIAA, ICE, ATRIF, and Transportation Research Board. New York, American Society of Civil Engineers, 1979. Vol. 1, 485 p.; vol. 2, 343 p. Price of two volumes, $59.

The conference included papers on airspace analysis in airport system planning, performance of flexible highway pavements, microwave landing systems, civic-electrical engineering interface, hedging against errors in airport forecasting, a computer program for slabs with discontinuities, and flight instrumentation for all-weather approach and landing. Also discussed were air service for small communities, helicopters for all-weather terminals, NDT techniques,

airline deregulation, runway configuration management systems, and the role of aircraft separation assurance in the cockpit. A.T.

A81-18052 Airspace analysis in airport system planning. G. W. Antis, W. J. Dunlay, Jr., H. Fan (Peat, Marwick, Mitchell and Co., San Francisco, Calif.), and C. Brittle (Metropolitan Transportation Commission, Berkeley, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 1-15.

An airspace capacity model was used to estimate the capacity of the San Francisco Bay Area airspace under a variety of different operating conditions. The results were compared with alternative forecasts of aviation demand in 1997. The comparisons of demand with airspace capacity led to conclusions on: (1) the extent to which the Bay Area airspace will be able to accommodate future aviation activity, and (2) the locations of critical capacity constraints and airspace interactions. T.M.

A81-18054 Introduction to a rigid pavement design procedure. W. R. Barker (U.S. Army, Geotechnical Laboratory, Vicksburg, Miss.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 33-48. 16 refs.

Description of a new mechanistic procedure for the structural design of rigid airport pavements to carry the design traffic under field conditions. The technique involves three major elements: (1) material characterization, (2) computation of load response parameters, and (3) correlation of the load response parameters to pavement performance. One limitation of the procedure is that it must be restricted to standard jointed portland cement concrete pavements. T.M.

A81-18055 Micro-wave landing system - An operational point of view. A. J. Beatty (International Federation of Air Line Pilots Association, Egham, Surrey, England). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 49-53.

The official position of the International Federation of Air Line Pilots Association (IFALPA) is given regarding the need for a new nonvisual approach and landing guidance system. The argument is made that early implementation of the micro-wave landing system (MLS) will enhance the safety, reliability and economy of international civil air operations. The paper does not attempt to investigate in detail the mechanisms of MLS and the theory of its signal propagation. It does, however, investigate its use by the line pilot from the operational point of view, including its effect on commercial air transport. (Author)

A81-18056 RNAV benefits today - Today and future requirements. R. A. Berube (National Airlines, Inc., Clifton, N.J.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 54-71. 37 refs.

Presently experienced and expected future benefits of area navigation systems are reviewed as they relate to the economy, safety, and workload of flight operations. Minimum system characteristics and functional requirements are tabulated on the basis of personal experience, simulations, tests, and postulated aspects of the RNAV environment. T.M.

A81-18057 The introduction of STOL and RNAV to large commercial operations. C. J. Blaydon (Ransome Airlines, Bensalem, Pa.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 85-94.

The rationale, operations, and expected benefits are described for the implementation of fifty passenger DeHavilland Dash-7 aircraft in the Alleghany commuter fleet of Ransome Airlines. The inovative use of STOL aircraft, 3D RNAV, and stub ends of runways is argued to have large potential effects on intercity air transportation. T.M.

A81-18058 Testing model rotorcraft for overwater operations. W. A. Crago and D. L. Williams (British Hovercraft Corp., Ltd., Experimental and Electronic Laboratories, East Cowes, Isle of Wight, England). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 137-152.

This paper presents a brief historical review of some of the problems associated with the ditching and flotation of helicopters. It also discusses the sea conditions likely to be met and shows how the various phenomena involved can be investigated by means of model experiments. (Author)

A81-18059 Flight instrumentation requirements for all-weather approach and landing. J. L. DeCelles and G. Terhune (Air Line Pilots Association, Kansas City, Mo.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 153-164. 5 refs.

The official position and rationale of the Air Line Pilots Association (ALPA) is given regarding instrumentation requirements for air carrier approach and landing. The argument is made that the cost of continuing the status quo is greater (in terms of safety, reliability and economy) than the expense of providing the necessary improvements. The paper expounds the inadequacy of conventional instrumentation for operating to present and future visibility minima, and it presents the rationale for ALPA's contention that these inadequacies can be overcome only by head-up display (HUD) of suitable information to the pilot. (Author)

A81-18060 New major U.S. airports - Capacity considerations. V. J. Drago (Battelle Columbus Laboratories, Columbus, Ohio). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 165-178. 9 refs.

A methodology is developed to investigate the need for major new airports at 21 U.S. hubs through the year 2000. This methodology is based on calculating average runway delays for various airport activity and operational scenarios. Cost estimates are given for the required new facilities. (Author)

A81-18061 An overview - 1980 generation avionic developments. T. A. Ellison (United Air Lines, Inc., Chicago, Ill.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 179-186.

The 1980 generation air transports now under development will incorporate a completely new generation of avionics devices and interfaces, briefly described. The major changes in 1980 avionics will bring new benefits and new problems to the operator. Integration of information through improved computation and display facilities will better optimize aircraft operation. Some of the benefits can be forecast from data recorded in current aircraft operations. Means are suggested to utilize and maintain new avionics capabilities effectively in the transition environment of the 1980's. (Author)

A81-18062 Non-destructive pavement evaluation. M. E. Harr (Purdue University, Lafayette, Ind.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 213-219. 9 refs.

A81-18063 **Prestressed concrete airfield pavements.** R. Heinen (Dyckerhoff and Widmann, Inc.; Dywidag Canada, Ltd., Canada). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 220-235.

A81-18064 **Automating airborne company communications.** R. E. Johnson (United Air Lines, Inc., San Francisco, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 236-242.

As industry matures, the authority to accomplish changes without financial controls is reduced. This paper will outline how the Air Transport Industry finally launched a major change in communications with their aircraft after years of development. In order to meet financial goals, the scope of the programs were reduced and technology advances were utilized to provide answers not previously available. (Author)

A81-18065 **Helicopters - Help for the all weather terminal.** J. C. Kettles (Petroleum Helicopters, Inc., Lafayette, La.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 243-247.

A81-18066 **Runway rehabilitation, Washington National Airport.** F. Moavenzadeh and M. J. Markow (MIT, Cambridge, Mass.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 249-264.

The structural condition of a runway flexible pavement at Washington National Airport was evaluated. Since its last overlay in 1972, the runway has exhibited horizontal and vertical permanent deformations or distortions, including lateral distortions of surface paint and groove patterns, vertical heaves and troughs, and localized depressions. Pavement and soils investigations carried out to identify the causes of these distress mechanisms indicated that observed pavement damage was related more to materials properties and perhaps construction practices, rather than to structural adequacy. Recommendations included: (1) removal of severely distressed material, either by cold-planing or other means; (2) replacement of damaged material with a stiff, high-tensile-strength asphalt concrete base; and (3) overlay of entire pavement surface with an epoxy asphalt layer to resist horizontal stresses induced by braking and turning aircraft and to retard cracking. (Author)

A81-18067 **Community participation in airport planning.** B. D. Myers (Missouri, Aviation Dept., Kansas City, Mo.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 265-274.

Several principles and techniques for community and citizen participation were exercised during the Kansas City International Airport Master Plan and Environs Area Plan update. These procedures include establishing advisory and policy committees, a project information center, the conducting of public information meetings, and various other methods of providing information on the plan for the publics consideration. Advice from the community assisted in shaping the final airport and environs plan. The public must be represented in the continuous planning process. (Author)

A81-18068 **Aviation assumptions in the eighties.** D. E. Raphael (Transportation Research Board, Washington, D.C.; SRI International, Menlo Park, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 275-282.

Respondents to a comprehensive survey concerning the aviation industry are generally optimistic but watchful about the prospects for the growth in the 1980s. Identifying factors most likely to influence air transportation demand was a major purpose of the October 1978 survey of 120 forecasters, planners, and researchers, who came from four different global regions and six different industry sectors. The survey results presented in this paper show changes in real air fares and real economic growth to be the respondent's chief bellwethers, followed closely by jet fuel availability and price, and government regulation. Also considered in the survey are modifiers that would be most disruptive to the industry; here, a prolonged OPEC embargo, a major recession, and further large cuts in air fare discounts topped the list. Base-line values for certain assumptions are also provided. Comparisons are made among respondents in different regions and industry sectors. (Author)

A81-18069 **A new perspective in aviation systems planning.** M. J. Ryan, Jr. (Metropolitan Council of the Twin Cities, St. Paul, Minn.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 283-291.

New and increased emphasis on maximizing the use of existing aviation facilities, particularly in large urban areas, has placed considerably more responsibility on the metropolitan aviation system planners. As part of the process of maintaining a system plan responsive to the area's air transportation needs, the systems planner is the key to protecting and preserving the continued viability of the metropolitan areas' airport system, including both air carrier and general aviation airports. Given that few, if any, new air carrier airports will be built prior to the end of the century, the aviation system planners' role must be centered on coordinating airport plans with community comprehensive plans. This is especially true with respect to the airport/land use compatibility planning currently underway at some airports around the nation, including the Twin Cities. (Author)

A81-18070 * **Avionics and displays in a future airspace system.** S. Salmirs (NASA, Langley Research Center, Hampton, Va.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 292-309. 10 refs.

The terminal configured vehicle (TCV) program was conceived to address the problems of (1) operation in the crowded terminal area airspace, and (2) integration of airborne avionics systems necessary to improve the efficiency of these operations. The program and its interaction with industry task groups are summarized, including elements of research and data collection. New technology is discussed which may be useful in implementing some defined avionics and display requirements. T.M.

A81-18071 **The problems of helicopter ditching.** J. Scanlon (Civil Aviation Authority, London, England). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 310-324.

Technical reasons for the occurrence of emergency helicopter ditchings are reviewed in an attempt to survey current approaches to this problem. Existing legislation affecting overwater operations and airworthiness is examined, and problems of survivability are considered, ranging from evacuation of the helicopter to the search and rescue facilities. T.M.

A81-18072 **Canada's national aviation forecasting models.** W. T. Tucker (Canadian Air Transportation Administration, Ottawa, Canada). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 343-357.

This paper outlines the role of the Canadian Department of Transport in airport planning and site-specific forecasting. It then provides an overview of the national system of aviation forecasting models currently being developed and describes the progress to date. Two of these models, viz., the Air Passenger Origin and Destination Model (PODM) and the Passenger Traffic Allocation Model (PTAM), were recently completed and these are described in some detail. Finally, a brief summary is given of other forecasting methods and models with specific reference to planning peak period forecasts. (Author)

A81-18073 The federal role in airport noise control planning. J. E. Wesler (FAA, Washington, D.C.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 375-382.

Since receiving statutory authority in 1968, the FAA has developed and followed a step-by-step, deliberate program to impose noise limits on all aircraft. Noise reduction at the source cannot solve the aviation noise problem, however, since aircraft can never be silent. Recognizing this, the Department of Transportation (DOT)/FAA Aviation Noise Abatement Policy of November 18, 1976, spells out the shared responsibilities among all elements of the aviation community for aviation noise abatement. This paper reviews briefly these shared responsibilities for aviation noise abatement, and describes those functions which the Federal government is fulfilling. (Author)

A81-18074 L-1011 Flight Management System design considerations. F. F. Wright and R. J. Oliver (Lockheed-California Co., Burbank, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 383-398.

This paper describes some of the design considerations related to the fuel and cost savings aspects of the L-1011 Flight Management System. Reductions in fuel and cost are achieved by optimizing the thrust and speed in the climb, cruise and descent regimes of flight. The system mechanization, operation and design problems to accomplish this optimization are discussed. (Author)

A81-18075 Fully bonded concrete overlay for an airport runway. E. J. Barenberg (Illinois, University, Urbana, Ill.) and B. L. Ratterree (Crawford, Murphy and Tilly, Inc., Springfield, Ill.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 399-416. 6 refs.

Fully bonded concrete overlays are a viable method for rehabilitating concrete pavements. Use of this procedure for upgrading concrete pavements has been limited by the expensive and environmenatlly objectional procedure of acid etching the existing pavement surface. With the newly developed machinery capable of milling off a thin layer of the existing concrete, acid etching of the surface is no longer required, making this approach more economically and environmentally attractive. This paper describes the design analyses leading to the selection of a fully bonded concrete overlay to rehabilitate and upgrade an existing concrete runway, and the construction procedures used to assure full bonding of the overlay to the pavement. (Author)

A81-18076 UK pavement design and evaluation - A new approach. R. M. Hutson (Department of the Environment, Directorate of Civil Engineering Services, Croydon, Surrey, England). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 417-426. 8 refs.

The features of an aircraft pavement classification system are reviewed and a new approach to matching aircraft and pavements is outlined. The system is based on the use of reference construction materials with defined mechanical properties representative of rigid and flexible pavement construction. The depth of construction required by individual aircraft using their unique landing gear configurations is established over a range of subgrade support values from weak to strong. Pavements are classified by establishing the relationship between actual construction on their assessed subgrade support value to an equivalent depth of reference construction by the use of equivalency factors. The problem of limited weight and overload aircraft operations are considered. (Author)

A81-18077 Omega - An economic Loran A replacement. L. L. James (Trans World Airlines, Inc., Kansas City, Mo.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 1. New York, American Society of Civil Engineers, 1979, p. 439-452. 7 refs.

A81-18078 Recent developments in NDT techniques. G. T. Baird and J. P. Nielsen (New Mexico, University, Albuquerque, N. Mex.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 481-493.

The Civil Engineering Research Facility developed three non-destructive pavement testing methods starting with Thumper I which used a steady-state vibrator to determine the wave propagation properties of the pavement. This system's shortcomings included a non-air-transportable van and complex electronics requiring highly trained personnel. The Thumper II excluded these problems by utilizing a drop weight impact source and basic recording equipment, but needed a computer center to digitize and process the recorded signals. The Thumper III is the most modern system which combines air-transportability with the on-board minicomputer resulting in quick and reliable airfield testing. A.T.

A81-18079 Investment decision-making in international airports. P. H. Beinhaker (IBI Group, Toronto; Beinhaker/Irwin Associates; InterBase, Inc.; Beinhaker Planning and Development Services, Ltd., Canada). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 494-503.

The paper discusses the maximization of the initial land resource for airport facilities and the insurance of the protection of airport land and investments by insuring compatible land development on adjacent lands. The location of airport facilities in the close proximity of the airfield with adequate provisions for the expansion of passenger and ground access facilities is discussed. The maximum productivity in land use can be provided by charging land rents in accordance with the accessibility to the airfield; environmental factors should be accounted for by relating the costs of mitigation to the operations and/or facilities causing the problem and recovering the costs through charges. A.T.

A81-18080 Increasing capacity with computer-assisted decision making. R. G. Dear (California State University, Fullerton, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 519-538.

Computer use in the high density terminal areas is discussed with the aim of increasing airport capacity, decreasing delays, and aiding sequencing and scheduling performed by controllers. A method of Constrained Position Shifting (CPS) was developed which is based on resequencing on the first-come, first-serve order with respect to arrival on the runway; simulation is presented for one simple CPS strategy which limits each aircraft to a maximum shift of four positions from its first position (forward or rearward). It was shown that significant improvements in system performance can be attained along with potential savings. A.T.

A81-18081 **Helicopter survivability in overwater situations.** M. J. Evans (British Airways Helicopters, Ltd., Aberdeen, Scotland). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 539-552.

A81-18082 **Computer generated displays and pilot effectiveness.** D. M. Fadden and E. F. Weener (Boeing Commercial Airplane Co., Seattle, Wash.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 553-561.

On-board digital computers and electronic display equipment for 757 and 767 aircraft permit almost any reasonable format or presentation and computation of flight parameters previously unavailable for display. Previous computer display programs have indicated the necessity of dynamic simulation to maximize display effectiveness; optimization in the format of information displays can reduce the mental calculations by the pilot, allowing more time for managing the flight. The pilot panel mockup, pilot adaptation enhancement, and the duties of the pilot as the flight manager are outlined, concluding that the new computer displays will allow the pilot to operate more accurately and efficiently. A.T.

A81-18083 **Airport visual approach, guidance and landing systems - Airline pilots viewpoint.** J. A. Forgas (Air Line Pilots Association, Washington, D.C.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 562-567.

A81-18084 **Design of the new Tehran International Airport.** R. J. Hodge (Tippetts-Abbett-McCarthy-Stratton, Washington, D.C.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 572-585.

This paper covers the design concepts, considerations and parameters for a new major international airport in the Middle East. Included are discussions on the airfield, the terminal complex, air cargo facilities, aircraft support facilities and airport service facilities. (Author)

A81-18085 **Modeling of the terminal area Air Traffic Management and Control.** C.-C. Hsin (Mitre Corp., Metrek Div., McLean, Va.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 586-605. 5 refs.

A study of the advanced terminal area Air Traffic Management and Control (ATM/C) system included the basic structures and control elements, and the design of advanced automation methods. It was shown that the terminal area ATM/C is stochastic and can be effectively measured; the problem is complex due to numerous subsystems and various control functions. Both the generation and the transmission of information should be emphasized to improve the ATM/C; continuous improvements of the surveillance, communication and tracking capabilities are required to accomodate the advanced automation functions. A.T.

A81-18086 **Airspace simulation in airport system planning.** E. S. Joline (Aviation Simulations International, Inc., Huntington, N.Y.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 606-617.

The ASM-3 airport simulation model has been designed for easy adaptation to various applications to maintain analysis costs in balance with other components of the airport planning program. The ASM-3 system includes a highly modular structure so that individual routines, such as runway assignment rules, can be easily recorded and replaced without changing the balance of the program; the space simulation model is comprised of a number of computer algorithms which approximate the flight planning and plan-executing functions of the pilot and air traffic controller. An example of airspace simulation is given which analyzes the time of flight of each aircraft arrival/departure, the aircraft energy consumption, noise and air pollution, and the costs of air traffic control required for safe operation. A.T.

A81-18087 **The importance of 'Interim Standard Microwave Landing System' for small community airports.** L. E. McCabe (Minnesota, Dept. of Transportation, St. Paul, Minn.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 618-621.

A81-18088 **Airport/environs plan making - Managing the planning process.** R. R. Platzek (Williams, Platzek and Mocine, Sausalito, Calif.) and R. H. Doyle (Peak, Marwick, Mitchell and Co., San Mateo, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 649-659.

Airport/environs planning should provide for the joint airport/environs institutional system, acceptable work program, adequate financing, public involvement, and a coordinated technical team. It was shown that a linear analytic approach to airport planning will involve only staff technicians who will recommend a final proposal; this is an in-house effort, which may make it possible to manage airport/environs planning even if the participants do not agree on the final selected plan. The cyclic or iterative method determines whether a consensus exists, and repeats the process through a number of cycles until the technicians, the public, and the decision-makers agree on one feasible plan. The cyclic approach is more applicable to situations involving low mutual thrust, requiring all participants to be familiar with all potential tradeoffs. A.T.

A81-18089 **Runway Configuration Management System concepts.** A. N. Sinha and R. L. Fain (Mitre Corp., Air Transportation Systems Div., McLean, Va.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 668-683. U.S. Department of Transportation Contract No. FA79WA-4184.

The Configuration Management System was based on three concepts representing a wide range of static and dynamic selection processes. The basic model updates operational conditions such as wind and weather, checks on the availability of runways, and analyzes feasible remaining available runways. The model output provides an ordered list of available runway configurations in decreasing order of capacity for a specific set of operating conditions; the intermediate model identifies feasible pairs of configurations (for current conditions and expected changes), and the advanced model produces configurations for the extended period. The model testing at Chicago's O'Hare airport should result in enhancement such as interactions with vortex advisory systems, generation of equipment logs, and identification of relationships between dual and triple arrival configurations to assist in transition between them. A.T.

A81-18090 **Traffic forecasting for the NRIA.** M. A. Thomet and S. M. Sultan (Bechtel, Inc., San Francisco, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 684-708.

A traffic forecasting method for the New Riyadh International Airport was based on an econometric model which uses the value of

imports of goods and services as a variable for predicting air traffic. The variable is projected by estimating petroleum revenues and the ratio of imports to exports; the forecasts were made for 1983, 1990, and 2000. Historical statistics for passenger, air freight, and airmail are presented for the Saudi Arabia airports; it is noted that the econometric model forecasts are under review and do not represent the present basis of planning. A.T.

A81-18091 Environmental aspects of airport planning. R. A. Waller (Atkins Research and Development, Epsom, Surrey, England). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 713-730. 25 refs.

The planning of airports around London is used to illustrate U.K. policy relating to the effects of airports on the environment. The background of legislation is described. Approaches to decision-making where environmental factors are important are compared, with particular reference to social-cost-benefit analysis. Possible trends in environmental concern and in the environmental treatment of airports are put forward for discussion. (Author)

A81-18092 The role of aircraft separation assurance in the cockpit. F. C. White (Air Transport Association of America, Washington, D.C.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 743-751. 8 refs.

The application of an aircraft separation assurance display in the cockpit of a passenger aircraft is discussed. The principal method of aircraft separation assurance will be provided by the ground air traffic control (ATC) systems; the Discrete Address Beacon System and the Air Traffic Advisory and Resolution Service (DABS/ATARS) will supply a backup to the ATC in areas with an aircraft traffic density above 0.02 aircraft/sq mi. The Active BCAS which uses altitude reporting air traffic control transponders will provide backup aircraft separation for the balance of the world airspace. The cockpit display of aircraft separation is under investigation, but optimum cockpit display information has not yet been developed for installing this system. A.T.

A81-18093 Saudi Arabia's new Gateway Airports. J. Hoyt and R. Campbell (Ralph M. Parsons Co., Pasadena, Calif.). In: International Air Transportation Conference, New Orleans, La., April 30-May 3, 1979, Proceedings. Volume 2. New York, American Society of Civil Engineers, 1979, p. 768-795.

A81-18100 * # Geometric dilution of precision in Global Positioning System navigation. B. T. Fang (Computer Sciences Corp., System Sciences Div., Silver Spring, Md.). *Journal of Guidance and Control*, vol. 4, Jan.-Feb. 1981, p. 92-94. Contract No. NAS5-24300.

The evaluation of the GPS navigation performance is essentially equivalent to the computation of the diagonal terms of the geometric dilution of precision (GDOP) matrix. Certain theoretical results concerning the general properties of the GDOP matrix are obtained. An efficient algorithm for the computation of the GDOP matrix and the navigation performance index is given; and applications of the results are illustrated by numerical examples. B.J.

A81-18105 Dialogue on bridging some gaps in stability and transition research. T. Herbert (Stuttgart, Universität, Stuttgart, West Germany) and M. V. Morkovin (Illinois Institute of Technology, Chicago, Ill.). In: Laminar-turbulent transition; Proceedings of the Symposium, Stuttgart, West Germany, September 16-22, 1979. Berlin, Springer-Verlag, 1980, p. 47-72. 43 refs. Research supported by the Alexander von Humboldt-Stiftung; Contract No. F49620-77-C-013.

Typical applied problems in stability and transition in external, internal, and free-shear layer through-flow systems are reviewed. Consideration is given to exact and approximate theories, computer experiments, temporal and spatial normal-mode response, nonparallel flows, and nonlinear effects. Other concepts discussed include secondary instability, coupling, and advanced perturbation methods. V.L.

A81-18122 Three-dimensional boundary layer transition via the mechanisms of 'attachment line contamination' and 'cross flow instability'. D. I. A. Poll (Cranfield Institute of Technology, Cranfield, Beds., England). In: Laminar-turbulent transition; Proceedings of the Symposium, Stuttgart, West Germany, September 16-22, 1979. Berlin, Springer-Verlag, 1980, p. 253-262. 8 refs.

Transition via the mechanisms of attachment line contamination and cross flow instability has been studied experimentally by using a highly swept wing with a large leading edge radius. Although the principal objective was to determine the conditions necessary for the onset of turbulence, particular consideration has been given to the identification of the forms of disturbance which occur in the laminar boundary layer before the turbulent spots appear. (Author)

A81-18318 Aeronautical-Maritime Engineering Satellite /AMES/ program of Japan. S. Miura, H. Morikawa (Ministry of Posts and Telecommunications, Radio Research Laboratories, Koganei, Tokyo, Japan), Y. Watanabe (Ministry of Transport, Electronic Navigation Research Institute, Mitaka, Tokyo, Japan), and S. Morimoto (National Space Development Agency of Japan, Tokyo, Japan). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-D-171.* 11 p.

A spin-stabilized geosynchronous satellite to be positioned over the Pacific Ocean between 160 deg E long and 180 deg E long, AMES (Aeronautical Maintenance Engineering Satellite) is scheduled for a 1986 launch by Japan. Developed by the National Space Development Agency (NASDA), the cylindrical satellite 2 m in length and 2 m in diameter weighs 350 kg BOL and carries an L-band multiple spot beam antenna to operate in the 5 GHz-5.25 GHz range as well as a global-beam C-band horn antenna transmitting at 1.5 GHz/1.6 GHz. With an expected lifetime of 1.5 years, AMES will conduct navigation and communications studies within the joint AEROSAT program. Possible applications will be in the ATC and small fishing vessels communications domain. R.S.

A81-18371 A study of air breathing rockets - Subsonic mode combustion. G. Masuya, N. Chinzei, and S. Ishii (National Aerospace Laboratory, Kakuda, Miyagi, Japan). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-F-270.* 15 p. 6 refs.

A study of subsonic mode combustion in cylindrical secondary combustors of air-breathing rockets determined the effects of the oxidizer-fuel ratio of the primary rocket, mass flow ratio of secondary air to primary rocket propellants, and the length of secondary combustors. Gaseous hydrogen and oxygen were the primary rocket propellants and room temperature compressed air was used as secondary air. Combustion efficiency and air inlet pressure were related to the ratio of experimental to theoretical exit pressure using a one-dimensional model which assumes incomplete combustion. A.T.

A81-18410 Satellites to aid flight safety. C. Rosetti (ESA, Paris, France). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-IAA-17.* 13 p.

A satellite-based system of communications for civil aviation is discussed. Changes in the present system are felt to be necessary; (1) because voice communication wastes the frequency spectrum; and (2) because many areas of the earth are not covered by radar. The need is stressed for an integrated system based on terrestrial infrastructures over developed continental areas, and on satellites in

ocean and desert areas for communication as well as for global navigation. Link budgets are given for a satellite-aircraft link having a transmission speed of 2400 bit/sec. The functions that could be performed by an integrated L-band satellite system are enumerated. The simplifications that such a system would make possible are discussed, as are the resulting improvements in safety. C.R.

A81-18497 # **Elimination of vibrations in aircraft piping systems (Ustranenie kolebanii v aviatsionnykh truboprovodakh).** V. P. Shorin. Moscow, Izdatel'stvo Mashinostroenie, 1980. 160 p. 42 refs. In Russian.

The book examines problems of designing acoustic dampers for preventing vibrations in aircraft piping systems. Methods of computing damper effectiveness, design optimization, and experimental testing are presented. Simple designs of jet type, low frequency acoustic filters, and resonating devices which prevent pipe and valve vibrations are described. A.T.

A81-18576 # **Cruise-missile-carrier navigation requirements.** G. T. Schmidt and R. H. Setterlund (Charles Stark Draper Laboratory, Inc., Cambridge, Mass.). *Journal of Guidance and Control*, vol. 3, Nov.-Dec. 1980, p. 487-493. 6 refs. Contracts No. F33657-78-C-0473; No. F33615-78-C-1563.

This paper addresses the modeling, simulation, and performance predictions used in determining aircraft avionics and transfer-alignment requirements for a generic aircraft that would launch cruise missiles over water, a considerable distance from a first TERCOM (terrain comparison) update area. Such would be the case for an undefended wide-body aircraft that must remain far away from an opponent's air defense system. This long standoff range presents some unique requirements that are not present in a mission where cruise missiles are launched 'close' to the first fix point, as from a penetrating bomber. The methodology used and the system requirements' results are described. (Author)

A81-18577 # **Model-following system with assignable error dynamics and its application to aircraft.** N. Kawahata (National Aerospace Laboratory, Chofu, Tokyo, Japan). *Journal of Guidance and Control*, vol. 3, Nov.-Dec. 1980, p. 508-516. 19 refs.

A main objective of this paper is to propose a practical tool for designing a model-following system. Successive differentiations of output errors between a linear time-invariant system (a plant) and a model yield controllable output error dynamics in a block-decoupled companion form. Such a particular form of the error dynamics makes it easy to determine a model-following control law such that the output error dynamics have arbitrarily assigned stability characteristics. Assigning asymptotic stability to the output error dynamics alone does not guarantee system stability. The transmission zeros which are inherent to the input-output relations must be in the left-hand half-plane for internal system stability. The approach has been applied to a variable stability and response aircraft under development. An example of the longitudinal model-following system on this aircraft is shown to demonstrate the proposed method. (Author)

A81-18578 # **Frequency-shaped cost functionals - Extension of linear-quadratic-Gaussian design methods.** N. K. Gupta (Integrated Systems, Inc., Palo Alto, Calif.). *Journal of Guidance and Control*, vol. 3, Nov.-Dec. 1980, p. 529-535. 6 refs. Contract No. N00014-77-C-0247.

The linear-quadratic-Gaussian method for feedback control design is extended to include frequency-shaped weighting matrices in the quadratic cost functional. This extension provides a means to meet classical design requirements with automated computational procedures of modern control theory. A design algorithm to optimize frequency-shaped cost functionals requires definition of new states and the solution of a modified linear-quadratic-Gaussian problem. Four examples are presented to demonstrate frequency shaping methodology: (1) aircraft in lateral wind, (2) an industrial crane, (3) vibration control in helicopters, and (4) a system with truncated modes. (Author)

A81-18599 # **Radio navigation for aircraft: Handbook (Aviatsionnaia radionavigatsiia: Spravochnik).** A. A. Sosnovskii and I. A. Khaimovich. Moscow, Izdatel'stvo Transport, 1980. 256 p. 36 refs. In Russian.

The basic principles of air navigation instruments and systems are described. Attention is given to loran, satellite navigation systems, shoran, beacon landing systems (meter and centimeter wavelengths), radio altimeters, and Doppler velocity meters. B.J.

A81-18600 # **Practical aerodynamics of the helicopter Mi-6A (Prakticheskaia aerodinamika vertoleta Mi-6A).** K. N. Laletin and L. T. Artamonov. Moscow, Izdatel'stvo Transport, 1980. 168 p. 14 refs. In Russian.

The book deals with some characteristic features of the rotor and airframe of the Mi-6A helicopter. The balancing, stability, and controllability of the helicopter in unsteady and some special modes of flight are examined. Attention is given to the behavior of the helicopter in flights with a suspended load and in emergency situations, such as failure of one of the two engines, failure of the tail rotor, etc. V.P.

A81-18639 # **Turbine blade technology - Present and future.** R. E. Allen and J. E. Sidenstick (General Electric Co., Aircraft Engine Group, San Francisco, Calif.). *American Society of Mechanical Engineers, Century 2 Aerospace Conference, San Francisco, Calif., Aug. 13-15, 1980, Paper 80-C2/Aero-10.* 7 p. Members, $1.50; nonmembers, $3.00.

Research being done on turbine blades and on the cooling systems used in turbines is surveyed. Attention is given to the advances that have been made in the CF6 turbine blade with the shaped gill holes used on recent CF6 designs and film cooling cited as examples of cooling improvements. Attention is also given to the cast cored design for blades. The benefits (among them corrosion resistance) offered by the alloy Rene' 80 are enumerated, and the greater repairability of blades made possible by General Electric's CODEP coating is discussed. The use of Hot Isostatic Pressing (HIP) to eliminate micro shrink is analyzed (the improvement in the CF6 blade from this type of pressing being equivalent to a metal temperature increase of approximately 25 F). Directional solidification is also discussed and the characteristics of new alloys (DS Rene' 80H, Rene' 150, DS Eutectics) are presented. C.R.

A81-18640 # **Water content of helicopter gear oils.** H. A. Spikes (Imperial College of Science and Technology, London, England) and P. B. Macpherson (Westland Helicopters, Ltd., Yeovil, Somerset, England). *American Society of Mechanical Engineers, Century 2 International Power Transmissions and Gearing Conference, San Francisco, Calif., Aug. 18-21, 1980, Paper 80-C2/DET-12.* 8 p. 13 refs. Members, $1.50; nonmembers, $3.00.

The dissolved water contents of a number of gearbox lubricants have been measured in laboratory experiments, fatigue test rigs and helicopter test and service gearboxes. The effect of temperature and humidity on water content has been determined. It is concluded that the water levels present in test and service gearboxes may be sufficient to reduce rolling fatigue lives. A comparison of water content in fatigue test rigs and service gearboxes shows that differences exist between the two which may impair correlations of fatigue lives. (Author)

A81-18642 # **A low height 2300 kW helicopter transmission with an enclosed planetary gear.** G. White (Transmission Research, Inc., Cleveland, Ohio). *American Society of Mechanical Engineers, Century 2 International Power Transmissions and Gearing Conference, San Francisco, Calif., Aug. 18-21, 1980, Paper 80-C2/DET-17.* 6 p. Members, $1.50; nonmembers, $3.00.

A helicopter main rotor transmission with inputs from two

1150-kW engines can be arranged to have the exceptionally low height of 32 cm. This low height, and consequent 10 percent reduction in weight, is made possible by the novel feature of enclosing the final-stage planetary gear within the support walls and bearings of a large diameter spur gear. The three drive stages provide an overall speed-reduction ratio of 81:1 at a main gearbox efficiency of 97.5 percent. Additionally, the number of critical bearings in the main gearbox is reduced by 24 percent in comparison with production transmissions of similar rating. (Author)

A81-18646 # **Approximation of gear transmission error by standard gear errors.** A. Toda and G. V. Tordion (Université Laval, Quebec, Canada). *American Society of Mechanical Engineers, Century 2 International Power Transmissions and Gearing Conference, San Francisco, Calif., Aug. 18-21, 1980, Paper 80-C2/DET-71.* 6 p. 5 refs. Members, $1.50; nonmembers, $3.00. Research supported by the National Research Council of Canada.

The standard errors such as profile error, pitch error, etc. are commonly measured through the existing gear testing machines. However, the gear transmission error is not measured as such, although it is a total error of the gear system and is a principal contributor to the gearbox vibration. An attempt was made to relate these individual errors to this important transmission error using automotive and gas turbine gears. The results show that the combined pitch and profile error may be approximated as the transmission error. (Author)

A81-18648 # **Experience with advanced high performance gear steel.** S. Binder and J. C. Mack (Boeing Vertol Co., Philadelphia, Pa.). *American Society of Mechanical Engineers, Century 2 International Power Transmissions and Gearing Conference, San Francisco, Calif., Aug. 18-21, 1980, Paper 80-C2/DET-77.* 7 p. 7 refs. Members, $1.50; nonmembers, $3.00.

A material development program is described that led to an advanced, high-hot-hardness gear steel with improved load-carrying capacity at elevated temperatures and under marginal lubrication. Development tasks included definition of scoring, bending fatigue strength, and tooth contact capacities and fracture mechanics properties. Gears were load-run in test rigs and in endurance gearboxes. Since the gear steel is also used for bearing surfaces, rolling-contact fatigue tests were conducted. It has been found that melting practice has direct effects on fracture toughness and fatigue threshold properties. Improved properties have been obtained by double-vacuum melting both the advanced steel and AISI 9310. To date, over 100 tons of the advanced steel have been processed into helicopter drive components. Approximately 27,000 hr of development, reliability and flight testing have been accomplished. The material was selected for the gear train of the modernized U.S. Army CH-47D (Chinook) helicopter, for which qualification testing is now complete. Improved characteristics will reduce maintenance and provide increased reliability for this helicopter. (Author)

A81-18654 # **The rigidity and performance of a simple spiral bevel helicopter gearbox.** M. M. A. Taha, C. M. M. Ettles, and P. B. Macpherson (Imperial College of Science and Technology, London, England). *American Society of Mechanical Engineers, Century 2 International Power Transmission and Gearing Conference, San Francisco, Calif., Aug. 18-21, 1980, Paper 80-C2/DET-103.* 10 p. 5 refs. Members, $1.50; nonmembers, $3.00. Research supported by the Ministry of Defence (Procurement Executive).

The analysis of Taha et al (1978) on the performance of a helicopter gearbox with a cantilevered housing and two taper roller bearings is extended to include a complete gearbox. The deflections at the tooth contact points must be determined precisely to provide an even operation of spiral bevel gears; these deflections are a function of the transmitted torque, bearing preloads, rigidity of the casings and shafts, bearing spacings, and bearing alignment. Finally, the effects of misalignment between the bearing races, shaft and casing, and spacer deformations are discussed. A.T.

A81-18668 * # **Calculated and experimental data for a 118-mm bore roller bearing to 3 million DN.** H. H. Coe and F. T. Schuller (NASA, Lewis Research Center, Cleveland, Ohio). *American Society of Mechanical Engineers and American Society of Lubrication Engineers, Century 2 International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, ASME Paper 80-C2/Lub-14.* 8 p. 16 refs. Members, $1.50; nonmembers, $3.00.

Operating characteristics for a 118-mm bore cylindrical roller bearing were calculated using the computer program CYBEAN. The predicted results of inner and outer-race temperatures and heat transferred to the lubricant generally compared well with experimental data for shaft speeds to 3 million DN (25,500 rpm), radial loads to 8900 N (2000 lb), and total lubricant flow rates to 0.0102 cu m/min (2.7 gal/min). (Author)

A81-18671 # **On the steady state and dynamic performance characteristics of floating ring bearings.** C.-H. Li and S. M. Rohde (GM Research Laboratories, Warren, Mich.). *American Society of Mechanical Engineers and American Society of Lubrication Engineers, Century 2 International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, ASME Paper 80-C2/Lub-17.* 9 p. 13 refs. Members, $1.50; nonmembers, $3.00.

An analysis of the steady state and dynamic characteristics of floating ring journal bearings has been performed. The stability characteristics of the bearing, based on linear theory, are given. The transient problem, in which the equations of motion for the bearing system are integrated in real time was studied. The effect of using finite bearing theory rather than the short bearing assumption was examined. Among the significant findings of this study is the existence of limit cycles in the regions of instability predicted by linear theory. Such results explain the superior stability characteristics of the floating ring bearing in high speed applications. An understanding of this nonlinear behavior, serves as the basis for new and rational criteria for the design of floating ring bearings. (Author)

A81-18672 * # **Performance of computer-optimized tapered-roller bearings to 2.4 million DN.** R. J. Parker (NASA, Lewis Research Center, Cleveland, Ohio), S. I. Pinel, and H. R. Signer (Industrial Tectonics, Inc., Compton, Calif.). *American Society of Mechanical Engineers and American Society of Lubrication Engineers, Century 2 International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, ASME Paper 80-C2/Lub-18.* 8 p. 5 refs. Members, $1.50; nonmembers, $3.00.

The temperature distribution and bearing heat generation of 120.65 mm bore high-speed tapered roller bearings was determined at shaft speeds of 20,000 rpm under simultaneous thrust and radial loads. The temperatures and thermal outputs were computed as functions of shaft speed, loading lubricant flow rates, and lubricant inlet temperatures. Bearing temperatures and heat generation were considerably lower than in standard bearings; cup cooling was effective in lowering cup temperatures to levels of cone temperatures. A.T.

A81-18683 * # **Dynamic characteristics of a high-speed rotor with radial and axial foil-bearing supports.** L. Licht, W. J. Anderson (NASA, Lewis Research Center, Cleveland, Ohio), and S. W. Doroff (U.S. Navy, Office of Naval Research, Arlington, Va.). *American Society of Mechanical Engineers and American Society of Lubrication Engineers, Century 2 International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, ASME Paper 80-C2/Lub-35.* 10 p. 15 refs. Members, $1.50; nonmembers, $3.00. NASA-Navy-sponsored research.

An asymmetric rotor (19N; 4.3 lb), supported radially and axially by compliant bearings is subjected to severe excitation by rotating unbalance in the 'pitching' mode at speeds to 50,000 rpm. The resilient, air-lubricated bearings provide very effective damping, so that regions of resonance and instability can be traversed with amplitudes and limit-trajectories within acceptable bounds. A novel journal bearing is introduced, in which a resilient support is furnished by the outer turn of the coiled foil-element bent to form an open polygon. The experimental apparatus and procedure are described,

and the response of the rotor and flexible support system are documented by oscilloscope records of motion. (Author)

A81-18738 * # **Lubrication of rolling element bearings.** R. J. Parker (NASA, Lewis Research Center, Cleveland, Ohio). *American Society of Mechanical Engineers and American Society of Lubrication Engineers, Century 2 International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, Paper.* 24 p. 47 refs.

This paper is a broad survey of the lubrication of rolling-element bearings. Emphasis is on the critical design aspects related to speed, temperature, and ambient pressure environment. Types of lubrication including grease, jets, mist, wick, and through-the-race are discussed. The paper covers the historical development, present state of technology, and the future problems of rolling-element bearing lubrication. (Author)

A81-18748 Surface analysis of bearing steels after solvent treatments. II - Lubricant-coated bearing surfaces. M. K. Barnett (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *American Society of Lubrication Engineers and American Society of Mechanical Engineers, International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, ASLE Preprint 80-LC-8A-6.* 7 p. 15 refs. Navy-sponsored research.

In order to evaluate the effectiveness of standard cleaning procedures and individual solvents, reference surfaces of 440C bearing steel were coated with thin films of a formulated synthetic hydrocarbon or a formulated polyol ester instrument lubricant and exposed to the solvent cleaning process. The surfaces were then analyzed by wettability, Auger electron and X-ray photoelectron spectroscopies, and by Fourier transform infrared spectroscopy. Results are discussed in terms of cleaning efficiency, recontamination, and types of random contamination. V.L.

A81-18758 The wear of PTFE-containing dry bearing liners contaminated by fluids. R. W. Bramham, R. B. King, and J. K. Lancaster (Royal Aircraft Establishment, Farnborough, Hants., England). *American Society of Lubrication Engineers and American Society of Mechanical Engineers, International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, ASLE Preprint 80-LC-6B-3.* 9 p. 15 refs.

The influence of fluid contamination on the wear of aircraft dry bearing liners has been examined using an accelerated test procedure. It is shown that fluids generally increase wear to an extent depending on the level of stress, the type of fluid and the structure and composition of the liner material. Water is deleterious, but at low stresses mineral and diester oils can sometimes reduce the wear rate below that obtained in dry conditions. Explanations for the trends observed are deduced from an examination of worn surfaces by X-ray photoelectron spectroscopy and scanning electron microscopy. (Author)

A81-18759 Ferrography as a health monitor and a design aid for the development of helicopter gearboxes. G. Pocock and S. J. Courtney (Admiralty Marine Technology Establishment, Poole, Dorset, England). *American Society of Lubrication Engineers and American Society of Mechanical Engineers, International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980, ASLE Preprint 80-LC-6B-4.* 6 p. 9 refs.

The use of ferrography to monitor the health of helicopter gearboxes undergoing fatigue substantiation trials is described. The results illustrate the sensitivity of ferrography in detecting the onset of gear fatigue and indicate that the fatigue was initiated by micropitting. This suggests that the gears were not properly lubricated under the fatigue loads. (Author)

A81-18773 # **Detection of moving objects (Obnaruzhenie dvizhushchikhsia ob'ektov).** P. A. Bakut, Iu. V. Zhulina, and N. A. Ivanchuk. Moscow, Izdatel'stvo Sovetskoe Radio, 1980. 288 p. 59 refs. In Russian.

The book deals with the optimization of information processing, decision making, and observational control in the detection of unexpectedly appearing objects and measurement of their parameters. Such situations may arise in astronomy, laser, sonar, and lidar observations, recording of microparticles, etc. The analysis is carried out within the framework of the theory of statistical solutions. Attention is given to practical aspects and to the effectiveness of the optimal and suboptimal algorithms proposed for information processing and observation control. V.P.

A81-18777 Prediction methods for fatigue crack growth in aircraft material. J. Schijve (Delft, Technische Hogeschool, Delft, Netherlands). In: Fracture mechanics; Proceedings of the Twelfth National Symposium, Washington University, St. Louis, Mo., May 21-23, 1979. Philadelphia, Pa., American Society for Testing and Materials, 1980, p. 3-34. 41 refs.

The present state of knowledge of fatigue crack growth and qualitative and quantitative understanding of predictions are reviewed with reference to the developments in experimental techniques and indications obtained from fatigue of aircraft structures. Results of recent work on the prediction of fatigue crack growth in aluminum alloys are reported, including (1) crack growth under flight-simulation loading with crack closure measurements, (2) crack growth predictions for flight-simulation loading based on a constant crack opening stress level, and (3) crack growth under random loading to explore the usefulness of the root mean square K-value and to observe effects of irregularity and crest factor. V.L.

A81-19296 # **A fault tolerant multiprocessor system with reconfiguration suitable for multiaxial flight stabilization and trimming (Fehlertolerantes, rekonfigurierbares Mehrrechnersystem, geeignet zur mehrachsigen Flugstabilisierung und -trimmung).** D. Schmidt (Litton Technische Werke der Hellige GmbH, Freiburg im Breisgau, West Germany). *Bundesministerium für Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper.* 12 p. In German. Research supported by the Bundesministerium für Forschung und Technologie.

This paper investigates a redundant processor system for time critical process control with high reliability, fault tolerant procedures, and soft-wave control reconfiguration. Redundancy in the assemblies and the bus system of the hardware is discussed and the structure of the computer system is presented for n identical and autonomous processors coupled with m serial bus connections. A cross coupler consisting of several multiplexers is examined in relation to configuration of the central processing units and the storage units. A model for the software system which is subdivided into a central unit and parallel operating functions is illustrated. R.C.

A81-19297 # **Automatization of the adhesion process for supporting airframe parts in light contour systems (Automatisierter Klebeprozess für tragende Flugzeug-Zellenbauteile in leichten Kontursystemen).** H.-J. Rieckhof (Messerschmitt-Bölkow-Blohm GmbH, Hamburg, West Germany). *Bundesministerium für Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper.* 19 p. In German.

This paper examines a simpler fixture along with automatic procedures for a more economical construction of airframes. The fixture consists of a light profile airframe and several milled or cast mounting parts. The mass of the fixture is 190 kg compared to 700 kg for previous fixtures and better pressure ratios in the adhesion joints are obtained. An automatic quality control procedure based on the Squirter inspection principle is also discussed. R.C.

A81-19298 # **A summary of proposals for airflight research by the BMFT (Überblick über die Förderung der Luftfahrtforschung durch das BMFT).** H. Hertrich (Bundesministerium für Forschung und Technologie, Bonn, West Germany). *Bundesministerium für Forschung und Technologie, Statusseminar zur Luftfahrtforschung*

und Luftfahrttechnologie, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper. 30 p. In German.

This paper examines the aims and distribution of government grants by the Federal Department for Research and Technology (BMFT) for airflight research. Projects include investigations into interference phenomena related to airfoil and lift, and carbon fiber technology for civilian aircraft construction. Research into better handling of increased air traffic and cooperation in projects with other European countries and the U.S. are also discussed. Statistics on financial support for airflight research are reported for 1979 to 1982. R.C.

A81-19299 # **Stress measurements on landing gear for the Airbus A-300 B2 (Beanspruchungsmessungen am Fahrwerk des Airbus A-300 B2).** O. Buxbaum (Fraunhofer-Institut für Betriebsfestigkeit, Darmstadt, West Germany). *Bundesministerium für Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper.* 20 p. 12 refs. In German.

This paper investigates operational characteristics of landing gear in relation to changes in aircraft design. The distinction between fail safe and safe line landing parts is discussed and preliminary results with an Airbus A-300 B2 aircraft are presented. Measurement of spring deflection of the landing gear stabilizer is discussed along with determination of the steering force on the nose end landing gear. The effect of increased rolling time on landing gear design is examined along with the torsion moment during the banking roll. R.C.

A81-19300 # **Hingeless tailrotor in fiber composite construction and vibration-isolation systems /ARIS, ASIS/ for helicopters (Gelenkloser Heckrotor in Faserverbund-Bauweise und Schwingungs-Isolationssysteme /ARIS, ASIS/ für Hubschrauber).** G. Reichert (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany). *Bundesministerium für Forschung und Technologie, Statusseminar zur Luftfahrtforschung und Luftfahrttechnologie, Garmisch-Partenkirchen, West Germany, Oct. 8, 9, 1980, Paper.* 35 p. 8 refs. In German. (MBB-UD-311-80-0)

The design of tailrotors and vibration isolation systems for helicopters is discussed. Elastic bend-torsion elements are examined in place of the hinge and bearings of the tail rotor, which provide a reduction in weight, cost, and waiting time for operation. Emphasis is placed on determining the aerodynamic stability of the system for full operation. The reduction of rotor induced cell vibration through rotor isolation is also investigated. Passive units without additional energy input and active units with disturbance variable compensation are considered. R.C.

A81-19325 # **Some aspects of optimizing the aerodynamics of turbine stages (Problemy optymalizacji aerodynamicznej stopnia turbiny).** R. Puzyrewski (Polska Akademia Nauk, Instytut Maszyn Przeplywowych, Gdansk, Poland). *Instytut Maszyn Przeplywowych, Prace,* no. 78, 1980, p. 101-108. In Polish.

The principal factors which define the efficient operation of a turbine stage are discussed, and the characteristic areas of kinetic energy dissipation are identified. A method of matching the guide wave and rotor blade systems for maximal stage efficiency is proposed. V.P.

A81-19335 # **Determination of the effect of transverse cutouts on the hydrodynamic characteristics of a finite-span wing in the case of steady and unsteady motion near a wall (K otsenke vliianiia poperechnykh vyrezov na gidrodinamicheskie koeffitsienty kryla konechnogo razmakha pri statsionarnom i nestatsionarnom dvizhenii vblizi stenki).** K. V. Rozhdestvenskii. *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Nov.-Dec. 1980, p. 122-128. In Russian.

A81-19337 # **Characteristics of the velocity field near a wing-body combination located at an angle of attack to an oncoming supersonic flow (Osobennosti polia skorostei vblizi kombinatsii krylo-korpus, raspolozhennoi pod uglom ataki k nabegaiushchemu sverkhzvukovomu potoku).** S. I. Kusakin. *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Nov.-Dec. 1980, p. 136-148. 8 refs. In Russian.

A theoretical study of the velocity field formed near a wing-body combination in supersonic flow is presented; the characteristics of the field related to the effects of the body (i.e., the fuselage) are emphasized. Attention is given to the general form of the singular term of the asymptotic expansion of the solution of the linear equation in the vicinity of the Mach cone that starts at the intersection of the leading edge of the wing and the surface of the body. A uniformly exact solution is obtained for the nonlinear differential equation of additional velocity potential. The position and location of the shock on the upper surface of the wing are determined. B.J.

A81-19338 # **Propagation of three-dimensional acoustic perturbations in channels of variable cross-sectional area at frequencies close to cutoff frequency (Rasprostranenie trekhmernykh akusticheskikh vozmushchenii v kanalakh peremennoi ploshchadi poperechnogo secheniia pri chastotakh, blizkikh v chastote otsechki).** A. A. Osipov. *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Nov.-Dec. 1980, p. 149-159. 8 refs. In Russian.

The paper presents a theoretical study of the propagation of three-dimensional acoustic disturbances in a two-dimensional gas flow in axisymmetric channels of variable cross-sectional area at frequencies close to the cutoff frequency. Attention is given to slow changes of cross-sectional area along the channel. The application of the WKB approximation to the present problem is considered, and a method is developed for calculating the reflection coefficient of the acoustic disturbances. The present study may be applicable to the investigation of noise emission from jet engines. B.J.

A81-19342 SNIAS helicopters (Les hélicoptères de la SNIAS). G. Bruner. *L'Aéronautique et l'Astronautique,* no. 84, 1980, p. 21-30. 34 refs. In French.

The helicopters manufactured by the French firm SNIAS (the Aerospatiale National Industrial Company) are reviewed. Specifications, model types and brief commercial histories are presented for the Alouette III, Super Frelon, Puma, Gazelle, Lama, Dauphin, Ecureuil and Super Puma. SNIAS facilities for helicopter production and means employed for the fabrication of composite blades are also pointed out. A.L.W.

A81-19344 The design-to-cost of aircraft (La conception à coûts objectifs des avions). M. Tassinari (Société Nationale Industrielle Aérospatiale, Paris, France). *L'Aéronautique et l'Astronautique,* no. 84, 1980, p. 37, 38. In French.

The application of the design-to-cost approach to the manufacture and design of aircraft is examined. The various costs involved in the production and utilization of an aircraft are reviewed, with attention given to development, industrialization, production and indirect costs borne by the manufacturer, the acquisition, utilization, maintenance and life cycle costs borne by the user, and the global cost borne by all involved, and advantages of the design-to-cost approach in controlling global production costs while ensuring product quality are pointed out. The development of design-to-cost in the United States as a means of controlling Defense Department cost overruns is then traced, and the use of a proposal procedure based on minimal technical specifications and an imposed production cost is emphasized. A.L.W.

A81-19346 Aircraft engine programs employing cost objectives (Programmes de moteurs d'avions à objectifs de coût). C. Foure. *L'Aéronautique et l'Astronautique,* no. 84, 1980, p. 41, 43-48. In French.

Consideration is given to the procedures to be followed in a program of aircraft engine development, production and utilization in which cost objectives are accorded the same importance as

technical objectives. The practice of value analysis, which includes the identification and ordering of user requirements, the identification of functions to be provided and the prediction of production costs, is discussed and illustrated for the case of the cycle definition and scaling stage of engine airflow using the technique of mass estimation. The roles of studies of technical and technological progress, reliability and lifetimes, and maintenance requirements in engine development are considered, and measures which can be taken following the initial design stage to reduce life cycle costs are pointed out. Finally, organizational structures developed for the carrying out of engine programs with cost objectives are examined. A.L.W.

A81-19347 Design to cost and new technologies (Design to cost et technologies nouvelles). F. Cordie (Avions Marcel-Dassault-Bréguet Aviation, Direction Générale Technique, Saint-Cloud, Hauts-de-Seine, France). *L'Aéronautique et l'Astronautique,* no. 84, 1980, p. 49-55. In French.

The impact of the advent of new aircraft production technologies on the design to cost process is discussed. The process of determining the mass-cost relationship of a new construction technology representing an improvement in aircraft weight and a reduction in cost is considered, and design consequences of a weight reduction are pointed out. Consideration is then given to the development of composite material technology for military aircraft, and it is pointed out that the use of composites, which currently represent 35 to 40 percent of the mass of an advanced combat aircraft, has lead to reductions in both aircraft mass and cost, particularly when the technology is considered in the design stage in the design to cost process. A.L.W.

A81-19348 Pyrotechnics serving safety (La pyrotechnie au service de la sécurité). S. Morlan (Société Nationale Industrielle Aérospatiale, Division Systèmes Balistiques et Spatiaux, Les Mureaux, Yvelines, France). *L'Aéronautique et l'Astronautique,* no. 84, 1980, p. 57, 59-61, 63-66. In French.

Possible applications of pyrotechnics technology capable of improving aircraft safety in the air and on the ground are examined. Consideration is given to the use of pyrotechnics in military aviation automatic canopy jettisoning systems and pyrotechnic logic circuits, in civil aviation in the in-flight evacuation and protection system of the Corvette prototype aircraft, and in possible ground escape systems for civil and commercial aircraft that have crashed. A.L.W.

A81-19375 System considerations in the implementation of digital control. K. C. Daly (Charles Stark Draper Laboratory, Inc., Cambridge, Mass.). In: Guidance and control 1980; Proceedings of the Annual Rocky Mountain Conference, Keystone, Colo., February 17-21, 1980. San Diego, Calif., Univelt, Inc., 1980, p. 651-664. 16 refs. (AAS 80-032)

The intent of this paper is to address several of the most significant system requirements for digital controllers and to determine how the processing system organization and performance affects these criteria. Special emphasis is given to control requirements resulting from system configurations designed to produce high integrity controllers. The resulting interaction between reliability and performance considerations is also discussed. (Author)

A81-19392 # Reduction of profile drag by blowing out through peg holes in areas of streamline separation bubbles (Verringerung des Profilwiderstandes durch Ausblasen aus Lochreihen im Bereich laminarer Ablöseblasen). K. H. Horstmann and A. Quast (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Entwurfs-Aerodynamik, Braunschweig, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper 80-103.* 18 p. In German.

This paper investigates the problem of streamline separation bubbles on aircraft profiles and fuselages. The additional drag is examined in relation to increased angle of incidence and unusually high wall shear stress. A reduction in the separation bubble and a decrease in drag is obtained with pneumatic turbulators that blow ram air out of 0.6 mm pilot tubes at a distance of 16 mm. The pneumatic models can be implemented at various positions and are also found to be effective after the position of separation. R.C.

A81-19393 # Drag reduction through formation flight (Widerstandersparnis durch Formationsflug). D. Hummel and K.-W. Bock (Braunschweig, Technische Universität, Braunschweig, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper 80-106.* 53 p. 12 refs. In German.

Improved performance through formation flying is examined with an estimation procedure. Reductions up to 20% of the performance in solo flight are obtained. Total performance is shown to be dependent on the number and lateral distance of the aircraft and independent of the arrangement. The greatest reduction is found towards the center of the formation, and the optimal flight speed of a formation of similar aircraft is less than that for a solo flight. The reciprocal induction field with gliders at close distances is also investigated. R.C.

A81-19395 # Calculation of the lift dependent drag polar of cambered fighter plane configurations with deflected maneuver flaps in the subsonic region by means of a modified procedure according to Lamar (Berechnung der auftriebsabhängigen Widerstandspolaren von verwölbten Kampflugzeugkonfigurationen mit ausgeschlagenen Manöverklappen im Unterschall an Hand eines modifizierten Verfahrens nach Lamar). G. Wedekind (Dornier GmbH, Friedrichshafen, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper 80-109.* 15 p. In German.

A procedure to calculate lift and camber dependent drag is examined in relation to the suction force analogy of Polhamus (1971) and a method by Lamar (1975, 1974) in which the suction forces at the wing leading edge and side edge are calculated directly and rotated vertical to the wing plane. The effects of a rounded-off nose and wing camber are also taken into account. A correction method is derived for the polars of an uncambered wing-fuselage combination along with modification for variations in the width of the nose region. In the case of cambered wings, the suction force is rotated vertical to the wing plane regardless of the nose camber for calculating leading edge turbulence. R.C.

A81-19396 # Procedures for optimal drag design of camber and flap deflection in supersonic regions with consideration to geometric limits (Verfahren zum widerstandsoptimalen Entwurf der Wölbung und Klappenausschläge im Überschall unter Berücksichtigung geometrischer Einschränkungen). G. Wedekind (Dornier GmbH, Friedrichshafen, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper 80-110.* 17 p. In German.

This paper examines procedures for the optimization of camber in wing design of fighter planes. The method of Lagrange multipliers is presented for the camber optimization algorithm in the supersonic region along with calculations for the determination of pressure distribution and drag. An optimally cambered delta wing is illustrated and the induced drag is compared to drag with and without suction force. A method for combining individual wings with similar design but different camber is also examined. R.C.

A81-19397 # Experimental investigation of a right angle wing with partially separated flow with and without ground effects (Experimentelle Untersuchung eines Rechteckflügels bei teilweise abgelöster Strömung ohne und mit Bodeneinfluss). H. Bippes, M. Turk, and K. Jacob (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Göttingen, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper 80-111.* 19 p. 6 refs. In German.

This paper investigates ground effects on flight performance with partially separated flow. Tests are carried out with a NACA 4415 profile with an aspect ratio from 1.5 to 6.2. At smaller distances higher pressure along the total wing chord is found in the middle section of the pressure side of the wing with an increase in the collection point of the suction side leading to an increase in lift. A net performance gain is registered despite an increase in the profile drag. A secondary flow of low intensity is observed in the region between the separated and adjoining flow. R.C.

A81-19398 # **The practical application of the Wake Blocking Corrections according to Maskell (Die praktische Anwendung der Wake Blocking-Korrekturen nach Maskell).** H. Kamber (Eidgenössisches Flugzeugwerk, Emmen, Switzerland). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper 80-112.* 30 p. In German. (FO-1533)

With the construction of larger wind channel models, wall effects play a greater role. This paper examines uncertainties found in the Wake Blocking Correction method, particularly in reference to larger models. Difficulties arise in the selection of the profile resistance and in the determination of the induced resistance which cannot be obtained satisfactorily through measurement. A modification for calculating the profile resistance is presented along with various methods for determining the induced resistance. R.C.

A81-19399 # **Drag estimations for stream-line and cylindrical contour distortions on aircraft fuselages and train cars (Widerstandsabschätzung für stromlinienförmige und zylindrische Konturstörungen an Flugzeugrümpfen und Eisenbahnwaggons).** H. Neppert (Messerschmitt-Bölkow-Blohm GmbH, Hamburg, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper 80-116.* 17 p. 21 refs. In German.

This paper discusses drag estimations for cylindrical and aerodynamically stream-line bodies such as warning lights on aircraft fuselages and trains. Compressibility measurements in wind channels are examined in relation to drag estimations. Cylindrical and stream-line warning light casings are compared for drag reduction and fuel conservation. The effect of the length of the boundary layer on drag is investigated with casings on train wagons. R.C.

A81-19400 # **The determination of the induced drag on slim wings with high lift systems in the transonic region (Zur Ermittlung des induzierten Widerstandes an schlanken Flügeln mit Hochauftriebssystemen im transsonischen Bereich).** W. Sonnleitner (Messerschmitt-Bölkow-Blohm GmbH, Ottobrunn, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Aerodynamischen Widerstand, Cologne, West Germany, Nov. 25, 26, 1980, Paper.* 27 p. 28 refs. In German. (MBB-FE122)

This paper investigates the effect of aircraft flaps with emphasis on trail edge flaps. Potential theoretical methods for the calculation of flap effects are compared with semi-empirical handbook methods. A Gaussian least squares method is presented for approximation of polars near the crown and a formula for calculating the suction power explicitly is presented. The discrepancy between the calculated K-values for the induced drag and experimental results is discussed along with empirical correction functions. R.C.

A81-19417 **Performance evaluation of an interrogation-reply scheduling technique for a discrete address beacon system.** G. Bucci (CNR, Centro di Studio per l'Interazione Operatore-Calcolatore, Bologna, Italy) and D. Maio (Bologna, Università, Bologna, Italy). In: Digital signal processing.
London and New York, Academic Press, 1980, p. 239-250. 8 refs. Research supported by the Consiglio Nazionale delle Ricerche.

Some results of a study carried out as part of an ATC project sponsored by the Italian CNR are presented. The main objectives were to implement the ATC system on mini or micro computers; to give an account of the maximum supported target load; and to achieve the greatest reliability of the surveillance and communication functions performed by ATC. The structure of a real-time system proposed for channel management is described; the major surveillance functions are developed, and a number of design criteria to reduce the associated computational effort are presented. Finally, an evaluation of interrogation-reply scheduling techniques is presented. B.J.

A81-19425 **Characteristics of NAVSTAR user stations (Particularités des stations d'utilisateur du système NAVSTAR).** G. David and J. P. Van Uffelen (Télécommunications Radio-Electriques et Téléphoniques, Le Plessis-Robinson, Hauts-de-Seine, France). *L'Onde Electrique,* vol. 60, Dec. 1980, p. 23-29. 7 refs. In French.

The characteristics of the NAVSTAR/GPS satellite navigation system are examined in relation to the operational requirements for a user station. Following a brief review of the NAVSTAR system and its advantages over previous navigation systems, consideration is given to the types of signals emitted by the 18 satellites in the system, their modulation and the C/A (clear acquisition) and P (protected) codes used for distance measurements. The synchronization of a local code with the received signal in the decoding of the transmitted signal and the acquisition of time measurements by the synchronization acquisition and tracking components of the receiver is discussed, and the functions and components of the user station, including antenna and preamplifier, receiver, and signal processor, are examined. It is pointed out that the GPS offers users moving at high speeds the possibility of determining their position with greater accuracy than any other existing system of long-range navigation. A.L.W.

A81-19441 # **Experimental investigation of orographic waves and vertical motions in the Krasnovodsk airport area (Eksperimental'nye issledovaniia orograficheskikh voln i vertikal'nykh dvizhenii v raione Aeroporta Krasnovodsk).** O. A. Liapina and E. I. Sofiev (Sredneaziatskii Regional'nyi Nauchno-Issledovatel'skii Institut, USSR). *Meteorologiia i Gidrologiia,* Nov. 1980, p. 49-53. In Russian.

The difficult conditions for aircraft approach for landing in strong northerly winds were investigated. Orographic waves were studied using constant level balloons tracked by double-theodolite observations; vertical motions were determined by conventional pilot-balloon measurements. Wave parameters, their origins, and their effects on aircraft landing approach conditions are presented. A.T.

A81-19442 # **Conditions of generation and methods of damping the inlet vortex of a turbojet engine (Warunki generowania i metody tlumienia wiru wlotowego turbinowego silnika odrzutowego).** T. Gajewski (Wuzsza Oficerska Szkola Lotnicza, Deblin, Poland). *Technika Lotnicza i Astronautyczna,* vol. 35, Nov. 1980, p. 5-8. 19 refs. In Polish.

An aeromechanical analysis of the generation of an inlet vortex in a turbojet engine is presented. Methods for the prevention of vortex generation and methods of vortex damping are described. B.J.

A81-19443 # **Map-type displays (Wskazniki mapowe).** Z. Mrotek (Instytut Lotnictwa, Warsaw, Poland). *Technika Lotnicza i Astronautyczna,* vol. 35, Nov. 1980, p. 11-16. 5 refs. In Polish.

The basic characteristics of map-type displays are described in order to compile a classification of such devices. Particular attention is given to the Decca Automatic Chart Display, the Decca Flight Log, the ACA Horizontal Situation Indicator, and the Ferranti Combined Map and Electronic Display. B.J.

A81-19444 # **Calculation of propeller efficiency for an ideal propeller (Obliczenie sprawnosci smigla idealnego).** *Technika Lotnicza i Astronautyczna,* vol. 35, Nov. 1980, p. 25, 26. In Polish.

In the initial design of aircraft power plants, use is made of an 'estimated' propeller characteristic which reflects correctly the influence of changes in such parameters as the propeller diameter, air density, etc. In the present paper, a method of deriving such a characteristic is proposed. The solution obtained yields the upper

bounds of the theoretical potentialities of propeller-type aircraft power plants. V.P.

A81-19445 # **Collisions between aircraft and birds (Zderzenia samolotow z ptakami).** S. Tujaka (Przemyslowy Instytut Telekomunikacji, Gdansk, Poland). *Technika Lotnicza i Astronautyczna,* vol. 35, Nov. 1980, p. 27, 28. In Polish.

The danger that birds pose for aircraft is described. Attention is given to the flight altitudes of various species of birds, types of bird flight, and methods of preventing collisions between aircraft and birds in the vicinity of airfields. B.J.

A81-19469 **Circulation Control Wing /CCW/ flight tests.** C. Sewell (Grumman Aerospace Corp., Bethpage, N.Y.). *Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 1, 1980, p. 6-20.

The Circulation Control Wing (CCW) design, based on the Coanda effect, involves the conversion of the trailing edge of the airfoil into an enlarged rounded surface to which a jet of air adheres when blown tangentially from the upper surface. The resulting high augmentation of circulation lift reduces landing approach and takeoff velocities and distances, and offers options for increased aircraft payload and wing loading. The aerodynamic technology for the CCW program was developed by the NSRDC. A contract for the design and modification of an A-6A aircraft to the CCW configuration and subsequent flight testing was awarded to Grumman in 1977. Flight testing began Jan. 29, 1979 and was completed Mar. 1, 1979 in 16 flights for a total of 25 hours. P.T.H.

A81-19470 **Planning for and evaluating the potential of a land based aircraft for carrier operations.** P. S. Norton (Lockheed-California Co., Burbank, Calif.). *(Society of Experimental Test Pilots, European Symposium, 11th, Bristol, England, Apr. 1979.) Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 1, 1980, p. 21-35.

The role of the test pilot in performing a compressed and fairly complicated shore-based carrier suitability evaluation of a land-based aircraft is considered. Particular attention is given to an evaluation which Lockheed conducted with the Dassault/Dornier Alpha Jet at Istres, France; the evaluation is examined through the test pilot's viewpoint, with emphasis on the test pilot's personal role and contribution to the overall effort. The evaluation is relatively unique because it has served to measure the potential of a land-based aircraft for carrier operations without operation from an actual aircraft carrier. Several primary facilities, such as a mirror landing system, adjustable angle of attack system, and telemetry, were required. P.T.H.

A81-19471 * **A status report on NASA general aviation stall/spin flight testing.** J. M. Patton, Jr. (NASA, Langley Research Center, Hampton, Va.). *Society of Experimental Test Pilots, Technical Review,* vol. 15, no. 1, 1980, p. 36-49. 9 refs.

The NASA Langley Research Center has undertaken a comprehensive program involving spin tunnel, static and rotary balance wind tunnel, full-scale wind tunnel, free flight radio control model, flight simulation, and full-scale testing. Work underway includes aerodynamic definition of various configurations at high angles of attack, testing of stall and spin prevention concepts, definition of spin and spin recovery characteristics, and development of test techniques and emergency spin recovery systems. This paper presents some interesting results to date for the first aircraft (low-wing, single-engine) in the program, in the areas of tail design, wing leading edge design, mass distribution, center of gravity location, and small airframe changes, with associated pilot observations. The design philosophy of the spin recovery parachute system is discussed in addition to test techniques. P.T.H.

A81-19490 **Industry proposes supersonic V/STOL.** C. A. Robinson, Jr. *Aviation Week and Space Technology,* vol. 114, Jan. 12, 1981, p. 36-39, 42.

A joint supersonic V/STOL fighter development and flight demonstration program is being proposed by McDonnell Douglas and Rolls-Royce. The proposed flight demonstration aircraft is based on the use of a modified Marine/British Aerospace AV-8A airframe and the Rolls-Royce Pegasus 11 engine to increase overall engine thrust by 50%. The four-to-five year development and flight demonstration program would produce an aircraft capable of flight in the Mach 1.6 region and would cost 300-500 million dollars. By using the STOL capability, USAF aircraft could be airborne in approximately 1200 ft, carrying a full load of ordnance. Mission capabilities include close air support and interdiction. P.T.H.

A81-19491 **Solid-state power system use expands.** P. J. Klass. *Aviation Week and Space Technology,* vol. 114, Jan. 12, 1981, p. 70, 71, 73.

Variable-speed constant-frequency (VSCF) systems for supplying aircraft electric power are challenging more traditional hydromechanical constant-speed type systems for military applications after nearly two decades of development. The potential appeal of VSCF is the reduction of moving parts, which holds promise of higher reliability and reduced maintenance. It also offers more precise control of frequency and voltage, and responds more quickly to large electric load changes to minimize voltage and frequency transients. The operational payoff in terms of increased avionics reliability is difficult to measure, however. This paper examines applications of VSCF, with particular attention given to the 40-kva system that Westinghouse will supply for the F-5G (the system is expected to be scaled-up version of its 20-kva dc link system designed for the AV-8B). P.T.H.

A81-19497 **Fighters for the 1990s.** M. Lambert. *Interavia,* vol. 36, Jan. 1981, p. 19-26.

Programs under way in the U.S., Britain, West Germany, and France to design fighter aircraft for the 1990's are surveyed noting that the principles of survivability, lethality, and affordability are paramount. The stealth concept is illustrated through a diagram of the Tactical High Altitude Penetrator. Various concepts that will figure in fighter design are presented, among them the supercruiser, forward sweep, and the Advanced Fighter Technology Integrator AFTI/F-16 (offering six-degree-of-freedom flight). The AFTI/F-111 Mission Adaptive Wing, with flexible plastic skin on the upper wing surface and special internal control linkages, is discussed, as is the HiMAT Highly Maneuverable Aircraft Technology demonstrator (performance design point, Mach 0.9 at 30,000 ft; maximum speed, more than Mach 1.5; able to pull 6G at Mach 1.2 at 30,000 ft). Attention is also given to runway dependence, integrated avionic control, and propulsion to Integrated Flight/Fire Control. C.R.

A81-19498 **Primary training of military pilots - Changing theories and new trainers.** M. Grangier. *Interavia,* vol. 36, Jan. 1981, p. 29-33.

The need to choose between propeller, turboprop, and jet aircraft for the primary training of military pilots is discussed with high fuel costs cited as one of the factors limiting flight training. It is noted that turboprops seem to be growing in favor since they make it possible to give pilots more advanced training. They can be used not only to train pilots in the classical missions of primary training (basic training, conversion) but also to give them experience in instrument flying, navigation with IFR equipment for day/night observation, aerobatics, and formation flying. Training aircraft under development in various countries are discussed, including the Aérospatiale Epsilon, the Caproni Vizzola C-22J, the Embraer EMB-312, the Gulfstream American Peregrine 600, and the SIAI-Marchetti S.211 and SF.260TP. C.R.

A81-19499 **Visual systems at Lufthansa's simulator centre.** J. Gegerle. *Interavia,* vol. 36, Jan. 1981, p. 42, 43.

The high cost of in-flight pilot training has spurred the development of simulators in civil aviation. Lufthansa's experience with simulators is discussed, with attention given to recent improve-

ments. Redifon's Daynite, a daylight Computer Generated Imagery system, is analyzed, as is the newer Novoview SP2 system. The latter can offer night scenes having as many as 5,000 light points and daylight scenes having a large number of surfaces. Economic incentives will ensure the continued development of simulators: Lufthansa estimates that it costs $12,360 for one flight hour on a 747, compared with $515 for the same time in a simulator. C.R.

A81-19500 The flying hologram - Latest in head-up display systems. D. Boyle. *Interavia*, vol. 36, Jan. 1981, p. 44, 45.

The holographic or diffractive optics head-up display (D-HUD) is analyzed. This new equipment uses holographic principles to provide a head-up display with a wider field of view and improved brightness for the symbols that are presented to the pilot superimposed on his view of the outside world. The different types of optical path for the D-HUD system are presented diagramatically. With holographically produced lenses, symbol brightness is improved from 1,600 to 5,000 ft-Lamberts and raster presentation brightness is raised from 400 to 1,200 ft-Lamberts. The use of the D-HUD in the U.S. Air Force's Low Altitude Navigation Targeting Infra-Red for Night (LANTIRN) program is discussed. C.R.

A81-19552 # Model vibrations beyond low-speed stall (Vibrations de maquettes au-dela du décrochage à basse vitesse). X. Vaucheret (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *La Recherche Aérospatiale*, Nov.-Dec. 1980, p. 387-397. 5 refs. In French.

Vibrations of a string-mounted model beyond stall are analyzed by using the nonlinear equation of motion established for moderate amplitudes around high angle of attack according to a time/angle of attack cycle. The nonlinear solution yields frequency and damping variations versus amplitude and amplitude history beyond stall. A parametric study shows that the effects of maximum angle of attack and the duration of the step at this angle are decisive. For hard stall, the operator can perform the tests from indications that are aimed at avoiding amplitude divergences at nonzero frequency. B.J.

A81-19629 Nonlinear aerodynamic characteristics of a thin airfoil of arbitrary plane configuration. S. M. Belotserkovskii and M. I. Nisht. (Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 9-24.) *Fluid Mechanics - Soviet Research*, vol. 9, Mar.-Apr. 1980, p. 1-13. 26 refs. Translation.

General approaches to the schematization of separated inviscid incompressible flows are reviewed, along with numerical methods of solving the flow equations. Nonlinear and nonstationary problems concerning separated flows are described on the basis of the three-dimensional Laplace equation, the conditions at wing surface and the vortex sheet, and the initial conditions. The behavior of the wakes in space and time is determined from differential equations resulting from the condition that the vortex sheet must move along the trajectory of the fluid particles. The mechanical load over the wing is computed by means of the Cauchy-Lagrange integral. A method of discrete vortices is used to implement the scheme on a computer, and an example is considered in which the vortex structures and nonlinear aerodynamic coefficients of rectangular and delta wings are determined for separated and nonseparated flows. A.Y.

A81-19630 Thin minimum-drag airfoils. V. N. Zhigulev. (Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 24-31.) *Fluid Mechanics - Soviet Research*, vol. 9, Mar.-Apr. 1980, p. 14-19. Translation.

The variational problem of 'returned' suction force on a cambered slender wing is analyzed and solved for a class of infinite slender wings of arbitrary planform in a gas flow at small angles of incidence in nonlinear regime. The requirement that the leading edge of the wing be shock-free is shown to be necessary for a complete implementation of the suction force. Various methods are proposed for the determination of the optimal distribution of the wing cambers for subsonic and transonic flight velocities. A.Y.

A81-19631 The coordinate-deformation method in the problem of a supersonic gas flow over an airfoil. S. I. Kusakin and M. F. Pritulo. (*Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu* so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 32-39.) *Fluid Mechanics - Soviet Research*, vol. 9, Mar.-Apr. 1980, p. 20-26. Translation.

The essentially three-dimensional flow field at a delta wing situated in a supersonic gas flow is examined. It is shown that a singularity generated by the breaking point on the leading edge arises in the pressure gradient of the wing surface. The general form of this singularity is determined. The method of deformed coordinates is used to obtain an exact solution of the differential equation for the additional velocity potential. A.Y.

A81-19632 Hypersonic gas flow over a delta wing. A. I. Golubinskii and A. I. Shchedrin. (Aeromekhanika. Sbornik statei *posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira* Vasil'evicha Struminskogo, p. 39-45.) *Fluid Mechanics - Soviet Research*, vol. 9, Mar.-Apr. 1980, p. 27-32. 9 refs. Translation.

The problem of a plane delta wing of moderate aspect ratio in a hypersonic gas flow, whose freestream Mach number tends to infinity as the adiabatic index tends to zero is examined. The analysis is carried out for small angles of attack. An asymptotic expression for the pressure at the center of the Mach cone is derived. A.Y.

A81-19633 Some characteristics of subsonic flow over the root area of a sweptback wing. M. N. Nekrasova. (Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 46-55.) *Fluid Mechanics - Soviet Research*, vol. 9, Mar.-Apr. 1980, p. 33-40 5 refs. Translation.

Flows past peaked profiles at the root of a swept wing and at the sections of a straight wing are studied by visualization techniques, and the pressure distribution is determined. Two types of flow were observed: flow with an almost complete isentropic compression of the supersonic flow along the surface of a swept transonic wing; and flow with partially isentropic compression, with a shock-wave at the wing root. A.Y.

A81-19634 Plane vortex gas flows. A. A. Nikol'skii. (Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 55-66.) *Fluid Mechanics - Soviet Research*, vol. 9, Mar.-Apr. 1980, p. 41-50. 5 refs. Translation.

The two-dimensional turbulent gas flow equations are studied by expressing them in a convenient form. Two dual laws are established for subsonic flows: (1) under constant pressure, the angle of inclination of the velocity vector varies monotonously along the pressure line; (2) with constant inclination of the velocity vector, the pressure varies monotonously along the velocity vector line. These laws are used to investigate the uniqueness of the location of the shock-waves in supersonic flows of two-dimensional tapered bodies with angles of inclination not exceeding a critical value. A.Y.

A81-19636 The sonic boom from an aircraft flying along an arbitrary path in a stratified atmosphere in the presence of a three-component wind. Iu. L. Zhilin. (Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 73-86.) *Fluid Mechanics - Soviet Research*, vol. 9, Mar.-Apr. 1980, p. 57-68. 19 refs. Translation.

General theory of acoustic shock is applied to the study of the acoustic shock from an aircraft flying in a layered atmosphere with a three-component wind, all the parameters of which depend only on the altitude above the earth's surface. Calculation of attenuation factors is reduced to four quadratures. It is shown that for a given state of the atmosphere the attenuation factors depend on only five

similarity parameters, characterizing the flight regime and the position of the observer perceiving the acoustic shock relative to the flight path. P.T.H.

A81-19643 **The influence of flow disturbances on the laminar-turbulent transition in a supersonic boundary layer.** A. M. Kharitonov (Akademiia Nauk SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR). (Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 153-164.) *Fluid Mechanics - Soviet Research,* vol. 9, Mar.-Apr. 1980, p. 125-134. 18 refs. Translation.

Results of experimental studies on the effect of various factors on the transition of a supersonic boundary layer are discussed. It is shown that in supersonic wind tunnels, a significant effect on the transition of the boundary layer on a model is exerted by the scale of acoustic perturbations, which is proportional to the boundary layer displacement thickness of the working section. Experimental data obtained over a wide range of variation of flow parameters in aerodynamically similar test installations with different dimensions of the working section are generalized by means of a correlation parameter based on the displacement thickness. P.T.H.

A81-19644 **Wall cooling and the laminar-turbulent boundary layer transition at supersonic flow velocities.** M. A. Alekseev, V. A. Kuz'minskii, N. F. Ragulin, and Iu. G. Shvalev. (Aeromekhanika. Sbornik statei posviashchaetsia 60-letiiu so dnia rozhdeniia akademika Vladimira Vasil'evicha Struminskogo, p. 164-170.) *Fluid Mechanics - Soviet Research,* vol. 9, Mar.-Apr. 1980, p. 135-139. Translation.

Results of an experimental investigation of the effect of cooling the surface on the transition of a boundary layer from a turbulent to a laminar to a turbulent one on straight wing models and bodies of revolution with ogive nose in a supersonic wind tunnel are discussed. The flow velocities corresponded to Mach numbers of 3, 3.5, and 4, and the Reynolds number ranged from 18 million to 40 million. The phenomenon of reversal is seen to be characteristic of turbulent transition under these conditions. P.T.H.

A81-19657 **Nondestructive dynamic testing.** E. M. Uygur (Middle East Technical University, Ankara, Turkey). In: Research techniques in nondestructive testing. Volume 4.
London, Academic Press, 1980, p. 205-244. 117 refs.

Recent advances in nondestructive dynamic testing based on damping and resonant frequency measurements are reviewed with reference to the underlying theory, applications, and instrumentation. Examples which illustrate the application of dynamic testing techniques to the study and detection of both macroscopic and microscopic defects and properties are given. It is shown that in most cases the same arrangement and instrumentation can be employed for both micro- and macro-scale work. V.L.

STAR ENTRIES

N81-13916# Southern California Association of Governments, Los Angeles
SOUTHERN CALIFORNIA AVIATION SYSTEM STUDY Technical Report, 1978 - 1980
Lawrance H. Goldman, J. Timothy Merwin, Lisa D. Murphy, and Walter E. Gillfillan Jul. 1980 237 p refs
(PB80-215544) Avail: NTIS HC A11/MF A01 CSCL 13B

Southern California's 1995 air travel needs are examined. Existing and planned air carrier airports are restricted by policy constraints and cannot accommodate the air travel demand forecast for 1995. Seven overall strategies, joint civilian/ military use of an existing military facility, removal or revision of the policy constraints, a new air carrier airport are described. Alternative airport sites are evaluated for market attractiveness, noise impacts, airspace workability, financial feasibility, etc. GRA

N81-13917*# New Mexico Univ., Albuquerque. Technology Application Center.
AIRCRAFT MAINTENANCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1980
Gerald F. Zollars Sep. 1980 84 p Supersedes NTIS/PS-79/0859/3 Sponsored in cooperation with NASA and NTIS
(NASA-CR-163837; P880-815905; NTIS/PS-79/0859/3) Avail: NTIS HC $30.00/MF $30.00 CSCL 01B

These citations from the international literature concern various aspects of aircraft maintenance. Both military and civil aviation experience are included. Articles cited concern airline operations, engine and avionics reliability, the use of automatic test equipment, maintenance scheduling, and reliability engineering. This updated bibliography contains 347 citations, 85 of which are new additions to the previous edition. GRA

N81-13918*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL TEST OF AN ARTICULATED HELICOPTER ROTOR MODEL WITH SEVERAL TIP SHAPES
John D. Berry and Raymond E. Mineck Dec. 1980 95 p refs Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.
(NASA-TM-80080; L-12774; AVRADCOM-TR-79-49) Avail: NTIS HC A05/MF A01 CSCL 01A

Six interchangeable tip shapes were tested: a square (baseline) tip, an ogee tip, a subwing tip, a swept tip, a winglet tip, and a short ogee tip. In hover at the lower rotational speeds the swept, ogee, and short ogee tips had about the same torque coefficient, and the subwing and winglet tips had a larger torque coefficient than the baseline square tip blades. The ogee and swept tip blades required less torque coefficient at lower rotational speeds and roughly equivalent torque coefficient at higher rotational speeds compared with the baseline square tip blades in forward flight. The short ogee tip required higher torque coefficient at higher lift coefficients than the baseline square tip blade in the forward flight test condition. Author

N81-13920*# Boeing Commercial Airplane Co., Seattle, Wash.
A SYSTEM FOR AERODYNAMIC DESIGN AND ANALYSIS OF SUPERSONIC AIRCRAFT. PART 2: USER'S MANUAL Final Contractor Report, Sep. 1978 - Aug. 1980
W. D. Middleton, J. L. Lundry, and R. G. Coleman Washington Dec. 1980 124 p refs
(Contract NAS1-15534)
(NASA-CR-3352; D6-41840-2) Avail: NTIS HC A06/MF A01 CSCL 01C

The system uses linearized theory methods for the calculation of surface pressures and supersonic area rule concepts in combination with linearized theory for calculation of aerodynamic force coefficients. Interactive graphics were included in the system to display or edit input and to permit monitoring and readout of program results. T.M

N81-13921*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.
A COMPUTER PROGRAM FOR THE DESIGN AND ANALYSIS OF LOW-SPEED AIRFOILS, SUPPLEMENT
Richard Eppler (Stuttgart Univ.) and Dan M. Somers Dec. 1980 30 p refs
(NASA-TM-81862) Avail: NTIS HC A03/MF A01 CSCL 01A

Three new options were incorporated into an existing computer program for the design and analysis of low speed airfoils. These options permit the analysis of airfoils having variable chord (variable geometry), a boundary layer displacement iteration, and the analysis of the effect of single roughness elements. All three options are described in detail and are included in the FORTRAN IV computer program. Author

N81-13922*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PASSIVE CONTROL OF WING/STORE FLUTTER
Wilmer H. Reed, III, F. W. Cazier, Jr., and Jerome T. Foughner, Jr. Dec. 1980 19 p refs Presented at the 5th Joint Tech. Coordinating Group Aircraft Stores Compatibility Symp., St. Louis, 9-11 Sep. 1980
(NASA-TM-81865; L-14010) Avail: NTIS HC A02/MF A01 CSCL 01A

Results are presented for a passive flutter suppression approach known as the decoupler pylon. The decoupler pylon dynamically isolates the wing from store pitch inertia effects by means of soft spring/damper elements assisted by a low frequency feedback control system which minimizes static pitch deflections of the store because of maneuvers and changing flight conditions. Wind tunnel tests and analyses show that this relatively simple pylon suspension system provides substantial increases in flutter speed and reduces the sensitivity of flutter to changes in store inertia and center of gravity. Flutter characteristics of F-16 and YF-17 flutter models equipped with decoupler pylon mounted stores are presented and compared with results obtained on the same model configuration with active flutter suppression systems. These studies show both passive and active concepts to be effective in suppressing wing/store flutter. Also presented are data showing the influence of pylon stiffness nonlinearities on wing/store flutter. Author

N81-13923*# Bihrle Applied Research, Inc., Jericho, N. Y.
ROTARY BALANCE DATA FOR A SINGLE-ENGINE AGRICULTURAL AIRPLANE CONFIGURATION FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG Final Report
William Mulcay and Julio Chu Washington NASA Dec. 1980 243 p refs
(Contract NAS1-14849)
(NASA-CR-3311) Avail: NTIS HC A11/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a helical flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/10 scale single engine agricultural airplane model. The configurations tested include the basic airplane, various wing leading edge and wing tip devices, elevator, aileron, and rudder control settings, and other modifications. Data are presented without analysis for an angle of attack range of 8 deg to 90 deg, and clockwise and counter-clockwise rotations covering a spin coefficient range from 0 to .9. Author

N81-13925# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
DOWNWASH CALCULATION AT CLOSE RANGE BEHIND A TRAPEZOIDAL WING IN SUPERSONIC FLOW

Anders Hasselrot 1980 37 p refs
(Contract FMV-F-K-80123-78-017-21-001)
(FFA-TN-AU-1661; ISSN-SW-0081-5640) Avail: NTIS HC A03/MF A01

The results were determined as a function of values at the wing trailing edge and at the Trefftz-plane. A correction for off the wing plane points is given. A description of the method, a FORTRAN listing of the coded method and results to be compared with theoretical and experimental values of downwash are presented. T.M.

N81-13926# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Rettungs-und Bergungssysteme.

A CONTRIBUTION TO STABILIZATION OF FLIGHT VEHICLE PARACHUTE SYSTEMS

Christos Saliaris and Dieter Muenscher Apr. 1980 34 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-679)
(DFVLR-Mitt-80-05) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8,30

The dynamic behavior of the two dimensional motion of a parachute load system was considered. For a mathematical model, the system of nonlinear differential equations was numerically integrated without linearization. For a number of examples with a modified guide surface parachute, the influence of the canopy size, the distance between the attachment point and the canopy, and the distance between the attachment point and the center of gravity of the load on the oscillation of the flight vehicle was studied. T.M.

N81-13929# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abt. Instationaere Aerodynamik.

ANALYSIS OF UNSTEADY PRESSURE MEASUREMENTS ON AN AEROFOIL SECTION WITH AN HARMONICALLY OSCILLATING, SLOTTED FLAP

Karl Kienappel and David F. Round (MBB, Hamburg) Apr. 1980 66 p ref
(DFVLR-FB-80-22) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 14,20

An analysis is made of unsteady pressure distribution and aerodynamic coefficients measured for an airfoil and harmonically oscillating slotted control surface in a low speed wind tunnel. The influences on the pressure distribution and aerodynamic coefficients are examined: frequency of oscillation; flap steady deflection; section incidence; flow velocity and slot geometry, i.e. whether the slot is open or closed. There is a carry over between steady and unsteady pressure distributions, which although small at low incidence and flap deflections, becomes more important at higher values, particularly when separation related effects begin to affect the overall flow behavior. Author

N81-13930# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

REVIEW OF THEORETICAL AND EXPERIMENTAL RESULTS ON THREE DIMENSIONAL TURBULENT WAKES AND BOUNDARY LAYERS

J. Cousteix, B. Aupoix, and G. Pailhas 1980 54 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-678)
(ONERA-NT-1980-4; ISSN-0078-3781) Avail: NTIS HC A04/MF A01

Various turbulence models were analyzed for boundary layer predictions: mixing length, transport equations for the components of the shear stress. The influence of the shear stress direction was studied. Various solutions are discussed for taking into account the nonalignment between the shear stress and the velocity derivative normal to the wall. Such a nonalignment was also introduced in an integral method. The results of an experiment in a wake which is initially strongly dissymmetric and three dimensional are discussed. They were obtained by detailed measurements of mean velocities and of the six components of the Reynolds stress tensor. Attempts of prediction are discussed. T.M.

N81-13931# ARO, Inc., Arnold Air Force Station, Tenn.

AN EVALUATION OF WIND TUNNEL TEST TECHNIQUES FOR AIRCRAFT NOZZLE AFTERBODY TESTING AT TRANSONIC MACH NUMBERS Final Report, 1 Oct. 1977 - 1 Jan. 1979

T. L. Kennedy AEDC Nov. 1980 184 p refs
(AD-A091775; AEDC-TR-80-8) Avail: NTIS HC A09/MF A01 CSCL 20/4

The results of many experiments to develop and verify wind tunnel test techniques for determining engine exhaust effects on aircraft performance at transonic Mach numbers are summarized. The influence of model support interference, exhaust jet simulation techniques, wind tunnel calibration flow quality and operating conditions, model geometric effects, and measurement techniques in afterbody aerodynamic forces are discussed. Recommendations are given for reducing or eliminating adverse interference effects on wind tunnel test data. GRA

N81-13932# ARO, Inc., Arnold Air Force Station, Tenn.

EVALUATION OF WIND TUNNEL NOZZLE AFTERBODY TEST TECHNIQUES UTILIZING A MODERN TWIN ENGINE FIGHTER GEOMETRY AT MACH NUMBERS FROM 0.6 TO 1.2 Final Report, Oct. 1975 - Sep. 1979

Ernest J. Lucas AEDC Oct. 1980 122 p refs
(AD-A091545; AEDC-TR-79-63) Avail: NTIS HC A06/MF A01 CSCL 01/3

Analyses of surface pressure data from wind tunnel tests conducted in the Propulsion Wind Tunnel (16T) on the 0.1- and 0.2-scale models of the YF-17 aircraft and flight tests conducted at the NASA Dryden Flight Research Center with the prototype YF-17 were conducted to substantiate the effectiveness of the subscale wind tunnel test techniques currently used at AEDC to provide data to evaluate throttle-dependent effects. The data were obtained at Mach numbers 0.6, 0.9, and 1.2 at characteristic Reynolds numbers based on fuselage length from 14 million to 250 million. The data obtained at Mach numbers 0.6 and 0.9 indicate that valid techniques are available to obtain subscale wind tunnel data that are directly applicable to aft-end throttle-dependent flight performance prediction. The wind tunnel plume simulation techniques, however, do not provide data for directly predicting the flight vehicle, aft-end, calculated loads at Mach number 1.2. Additional corrections must be applied to the data to compensate for temperature effects associated with afterburning operations, such as that encountered at Mach 1.2. GRA

N81-13933# Committee on Public Works and Transportation (U. S. House).

AVIATION SAFETY: INTERIOR COMPARTMENT MATERIALS

Washington GPO 1979 373 p Hearings before the Subcomm. on Oversight and Rev. of the Comm. on Public Works and Transportation, 96th Congr., 1st Sess., 25-26 Apr. 1979
(GPO-50-388) Avail: Subcommittee on Oversight and Review

Safety efforts are divided into two aspects: accident prevention and accident survivability, or crashworthiness. The hearings focus on the frequent occurence of postcrash fire in survivable air carrier accidents and on the effect that fire has on the materials which surround the passengers in the aircraft cabin.

N81-13934# Committee on Public Works and Transportation (U. S. House).

TESTIMONY OF ELWOOD T. DRIVER, VICE CHAIRMAN, NATIONAL TRANSPORTATION SAFETY BOARD, ACCOMPANIED BY GERRIT J. WALHOUT, CHIEF, HUMAN FACTORS DIVISION, AND MATTHEW M. MCCORMICK, SENIOR AIR SAFETY INVESTIGATOR, HUMAN FACTORS DIVISION

In its Aviation Safety: Interior Compartment Mater. 1979 p 4-64

Avail: Subcommittee on Oversight and Review

The importance of fuel ignition prevention, and when this measure fails, the control of fire propagation inside the aircraft, is discussed. Two air carrier accidents investigated by the Safety Board are described. It is recommended by the Board that the FAA conduct research in four specific areas affecting the severity

of injuries of aircraft occupants. These are: (1) containment of flammable fluids, including the fuel, oil, hydraulic fluid, etc.; (2) control of flammable fluids through chemical alteration or the inerting of fuel systems; (3) the reduction or elimination of the toxic effects of burning materials; and (4) improved escape methodology and passenger education. E.D.K.

N81-13935# Committee on Public Works and Transportation (U. S. House).
TESTIMONY OF JAMES J. KRAMER, ASSOCIATE ADMINISTRATOR FOR AERONAUTICS AND SPACE TECHNOLOGY, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, ACCOMPANIED BY JOHN H. ENDERS, PROJECT MANAGER, AVIATION SAFETY TECHNOLOGY OFFICE, JOHN A. PARKER, CHEMICAL RESEARCH PROJECTS OFFICE, NASA-AMES RESEARCH CENTER, AND DEMITRIUS A. KOURTIDES, CHEMICAL RESEARCH PROJECTS OFFICE, NASA-AMES RESEARCH CENTER
In its Aviation Safety: Interior Compartment Mater. 1979 p 65-158
Avail: Subcommittee on Oversight and Review CSCL 01C

The materials system development program FIREMEN (Fire Resistant Materials Engineering) is described. The program is carried out through contracts with the major aircraft manufacturers whereby they are funded to test and evaluate these advanced material systems under the real constraints of state of the art manufacturing processes, production schedules, costs, weight, and so forth. E.D.K.

N81-13936# Committee on Public Works and Transportation (U. S. House).
TESTIMONY OF RICHARD W. TAYLOR, VICE PRESIDENT AND SPECIAL ASSISTANT TO THE PRESIDENT, AND EUGENE A. BARA, CHIEF ENGINEER, PAYLOADS SYSTEMS, BOEING COMMERCIAL AIRPLANE COMPANY
In its Aviation Safety: Interior Compartment Mater. 1979 p 159-297
Avail: Subcommittee on Oversight and Review

A brief review of the Boeing aircraft interior materials and fire test methods development programs is given. This activity has gone on for many years and contributed to the AIA crashworthiness program in 1968. As a result of these activities, the 747 was designed and built using the latest available technology, thereby establishing the requirements for wide body jet transports. Boeing's program in interior materials has continued and the highlights of the last five years are reviewed. E.D.K.

N81-13937# Committee on Public Works and Transportation (U. S. House).
TESTIMONY OF A PANEL CONSISTING OF: LLOYD E. FRISBEE, VICE PRESIDENT, ENGINEERING AND OPERATIONS, LOCKHEED CALIFORNIA COMPANY; LYLE A. WRIGHT, DIRECTOR, POWERPLANT ENGINEERING, DOUGLAS AIRCRAFT COMPANY, ACCOMPANIED BY DOCTOR H. C. SCHJELDERUP, CHIEF TECHNOLOGY ENGINEER, MATERIALS AND PROCESS ENGINEERING, AND F. E. DUSKIN, SENIOR DESIGN ENGINEER, INTERIORS ENGINEERING, DOUGLAS AIRCRAFT COMPANY
In its Aviation and Safety: Interior Compartment Mater. 1979 p 298-370
Avail: Subcommittee on Oversight and Review

Lockheed has conducted programs to improve aircraft material flame resistance and develop advanced techniques for firesafety testing in coordinated programs with other airframe companies, materials suppliers, and NASA. During this time, Lockheed has had active, continuous liaison with governmental agencies to develop firesafety testing techniques, study the feasibility and trade offs for advanced aircraft fire management systems, and seek meaningful and productive areas of research and development in aircraft fire safety. Active support and participation was also maintained in technical committee work such as ASTM-F7 Committee on Aerospace Test Methods to standardize on flammability, smoke, and other combustion byproducts test techniques and to perform inter-laboratory comparison testing of flammability and smoke emission methods. Improved flammability and smoke test techniques have contributed to substantial improvements in flame resistance of aircraft interior construction material in all categories and an order of magnitude reduction in smoke emission of materials. In other words, the smoke emission was reduced by an order of 10 times in the last few years. E.D.K.

N81-13938# Naval Weapons Center, China Lake, Calif.
AN INVESTIGATION OF SAFETY HAZARDS AND RELIABILITY PROBLEMS IN AERIAL REFUELING STORES Final Report, Mar. - Jul. 1980
Leo D. Budd Aug. 1980 70 p refs
(AD-A091788; AD-E900014; NWC-TP-6218) Avail: NTIS HC A04/MF A01 CSCL 01/2

An investigation was conducted to identify sources of safety hazards and reliability problems in model D-704 aerial refueling stores. A failure modes and effects analysis was performed on the D-704. Mishap data, safety UR (unsatisfactory report) data, and 3-M (maintenance and material management) data were analyzed to identify historical problems. Comparisons of model 31-300 failure statistics to model D-704 failure statistics is included. GRA

N81-13940# Boeing Military Airplane Development, Seattle, Wash. Aircrew Escape Group.
ADVANCED EJECTION SEAT FOR HIGH DYNAMIC PRESSURE ESCAPE. WIND TUNNEL TEST Final Report, 15 Aug. 1979 - 20 May 1980
John O. Bull, David T. Ther, and Roger F. Yurczyk Aug. 1980 139 p refs
(Contract F33615-79-C-3406; AF Proj. 2402)
(AD-A091810; AFWAL-TR-80-3084) Avail: NTIS HC A07/MF A01 CSCL 01/3

Wind tunnel tests were conducted to evaluate new high dynamic pressure protective devices incorporated into a conventional ejection seat. These tests are part of a development program 'Advanced Ejection Seat for High Dynamic Pressure Escape'. The objectives of this program are to develop an ejection seat design which will provide safe escape during emergency conditions encountered throughout the performance envelope of an aircraft with speed capability to 687 KEAS. Preliminary phases of this program have resulted in selection and definition of a windblast shield, an aft body drag reduction boom, a horizontal stabilizer and a flow diverter. These devices were incorporated into a one-half scale ejection seat/crewmember model and were tested in the AEDC PWT 16-T transonic tunnel. Aerodynamic data derived from these tests are being used in six-degree-of-freedom computer simulations for performance assessments of the ejection seat configurations. GRA

N81-13941*# Quinby (Gilbert F.), Fort Washington, Pa.
AN ASSESSMENT OF GENERAL AVIATION UTILIZATION OF ADVANCED AVIONICS TECHNOLOGY Final Report
Gilbert F. Quinby Dec. 1980 38 p
(NASA Order L-11593)
(NASA-CR-159328) Avail: NTIS HC A03/MF A01 CSCL 17G

Needs of the general aviation industry for services and facilities which might be supplied by NASA were examined. In the data collection phase, twenty-one individuals from nine manufacturing companies in general aviation were interviewed against a carefully prepared meeting format. General aviation avionics manufacturers were credited with a high degree of technology transfer from the forcing industries such as television, automotive, and computers and a demonstrated ability to apply advanced technology such as large scale integration and microprocessors to avionics functions in an innovative and cost effective manner. The industry's traditional resistance to any unnecessary regimentation or standardization was confirmed. Industry's self sufficiency in applying advanced technology to avionics product development was amply demonstrated. NASA research capability could be supportive in areas of basic mechanics of turbulence in weather and alternative means for its sensing. Author

N81-13942# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Regelungssysteme.

THE COLLISION COURSE: CONDITIONS, GUIDANCE LAWS AND PROPERTIES
Winfried Hofmann Jan. 1980 108 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-80-06) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 18.40

An evaluation of the influence of distinct missile properties (acceleration phase, lead single constraints and maneuverability) and real world disturbances on the properties and requirements of collision course guidance is presented. For proportion navigation guidance, comprehensive diagrams are presented to evaluate the terminal miss behavior, the requirements on the missile and on a line of sight angular rate measuring sensor. Missile dynamics, initial alignment errors, target maneuvers and target aspect-angle caused measurement errors were considered as real world disturbances. Author

N81-13944# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
MIDAIR AND NEAR MIDAIR COLLISIONS ON TWO- AND THREE-DIMENSIONAL CURVILINEAR FLIGHT PATHS
Otto Weber Mar. 1980 108 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-685)
(DFVLR-FB-80-13) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 21

Collision avoidance by means of the 'see and avoid' concept, advanced secondary radar systems on the ground, and independent electronic systems onboard is discussed. For two- and three-dimensional stationary turns, basic geometrical and physical aspects of conflict detection were derived and details given on the apparent size and motion of the other airplane on the windshield. For conflict warning by means of electronic systems on the ground or onboard, a linear track model was used. T.M.

N81-13945# Federal Aviation Administration, Atlantic City, N.J.
FLIGHT TEST INVESTIGATION OF LORAN-C FOR EN ROUTE NAVIGATION IN THE GULF OF MEXICO Final Report
Robert Pursel Sep. 1980 102 p
(FAA Proj. 045-390-130)
(AD-A091637; FAA-CT-80-18; FAA-RD-80-47) Avail: NTIS HC A06/MF A01 CSCL 17/7

Flight tests of a long range navigation (LORAN-C) airborne navigator were conducted in the Gulf of Mexico oil exploration and production area. Two systems were installed in a CV-580 aircraft to examine simultaneously the performance from two different LORAN-C triads. Four separate test routes were flown over a period of 3 days. These routes covered the eastern, central, and western test areas, and an overland route from Houston, Texas, to Lafayette, Louisiana. An inertial navigation system (INS) was used as a position reference standard. The INS data were updated to correct for drift. Accuracy of the position reference from the corrected INS data was - or - 0.3 nautical miles (nmi). The flight test data collected indicated that both the Malone, Raymondville, Jupiter and the Malone, Raymondville, Grangeville triads provided en route LORAN-C navigation capability which met Federal Aviation Administration (FAA) Advisory Circular AC-90-45A accuracy requirements except when operating near the baseline extension of the Malone Grangeville baseline when using the Malone, Raymondville, Grangeville triad. GRA

N81-13947# National Technical Information Service, Springfield, Va.
MICROWAVE LANDING SYSTEMS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1980
William E. Reed Sep. 1980 105 p Supersedes NTIS/PS-79/0778; NTIS/PS-78/0732
(PB80-814643; NTIS/PS-79/0778; NTIS/PS-78/0732) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The bibliography cites reports from worldwide research on the planning development, and operation of microwave landing systems, including feasibility, systems engineering, equipment, signal propagation, and cost analysis. This updated bibliography contains 100 abstracts, 11 of which are new entries to the previous edition. GRA

N81-13948# National Technical Information Service, Springfield, Va.
MICROWAVE LANDING SYSTEMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
William E. Reed Sep. 1980 205 p Supersedes NTIS/PS-79/0777; NTIS/PS-78/0731
(PB80-814635; NTIS/PS-79/0777; NTIS/PS-78/0731) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

Federally sponsored research on the planning, development, and operation of aircraft microwave landing systems, is presented. Studies include feasibility, systems engineering, equipment, signal propagation, and cost analysis. This updated bibliography contains 181 abstracts, 35 of which are new entries to the previous edition. GRA

N81-13949# Automation Industries, Inc., Silver Spring, Md. Vitro Labs.
WIND SHEAR SYSTEMS INTEGRATION PLAN, VICON (VISUAL CONFIRMATION) RELIABILITY ANALYSIS Final Report
Charles W. Hamby and James R. DeMattio Feb. 1980 74 p (Contract DOT-FA79WA-4279)
(PB80-218233; VITRO/JOB-03021-03540; FAA-RD-80-61) Avail: NTIS HC A04/MF A01 CSCL 17G

The reliability of a visual confirmation system which visually confirmed that an aircraft awaiting takeoff has been verbally cleared for takeoff by the airport controller is examined. It is found that the predicted availability of the VICON system as installed at Bradley International Airport is 99.94% for the seven month test period. It is also found that the number of spare parts to provide a 99% assurance that there will be no degradation of VICON system performance due to a lack of spare parts over 6 months is predicted to be sixty-three total spares covering twenty-seven different component types. Thirty percent of the spares are required for the controller's operating switches. GRA

N81-13950# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Theorgtische Aerodynamik.
COMPUTATIONAL AERODYNAMIC DESIGN TOOLS AND TECHNIQUES USED AT FIGHTER DEVELOPMENT
P. Sacher, W. Kraus, and R. Kunz 6 Sep. 1979 54 p refs Presented at Meeting SMP of AGARD., Neubiberg, Germany, 3-6 Sep. 1979
(MBB-FE-122/S/PUB/13) Avail: NTIS HC A04/MF A01

Configuration optimization, component design, and experimental proof in fighter design are summarized. Requirements for supersonic performance, including supersonic drag reduction and canard tail design, were reviewed. The main aerodynamic principles in use throughout the aircraft industry are described. T.M.

N81-13951# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FUNDAMENTALS OF CONCEPTUAL DESIGN OPTIMIZATION OF SUBSONIC TRANSPORT AIRCRAFT
E. Torenbeek Aug. 1980 173 p refs
(VTH-LR-292) Avail: NTIS HC A04/MF A01

Various merit functions and feasible design program structures are discussed and program elements common to most design exercises were analyzed. Criteria for optimum cruise conditions are presented for aircraft with or without Mach number dependent drag polars and arbitrary propulsion systems. Constrained and unconstrained optima for design cruise speed and altitude, engine thrust, wing loading, aspect ratio and lift coefficient are presented in the form of generalized analytical expressions. Different criteria were found when engines were sized for optimum cruising flight or for specified low speed performance. A generalized cruise performance analysis is presented for modern turbofan and propeller aircraft, resulting in new criteria for optimum flight conditions. A detailed account of the aircraft mass breakdown sensitivity to parametric variations, derivations for the payload fraction, and partial (constrained) and global optima were derived.

Some opportunities for improvements and extended applications to non-conventional and advanced designs are discussed briefly. T.M.

N81-13952# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Entwurfsaerodynamik.

LAMINAR-AIRFOILS FOR TRANSPORT AIRCRAFT

Armin Quast Mar. 1980 34 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-680)

(DFVLR-Mitt-80-07; ESA-TT-680) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8,30

Wing sections with laminar flow and their effects on fuel consumption are discussed. It was shown that laminarization by section shape is possible at certain Reynolds numbers and at reduced Mach numbers. T.M.

N81-13955# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.

THE EFFECTS OF WARHEAD-INDUCED DAMAGE ON THE AEROELASTIC CHARACTERISTICS OF LIFTING SURFACES. VOLUME 1: AEROELASTIC EFFECTS Final Report, 1 Feb. 1979 - 31 Jan. 1980

J. H. Chang and R. O. Stearman Jul. 1980 122 p refs (Grant AF-AFOSR-3569-78; AF Proj. 2301)

(AD-A091674; AFOSR-80-1039TR) Avail: NTIS HC A06/MF A01 CSCL 01/3

An investigation is being conducted to determine whether ballistic damage can seriously degrade the aeroelastic integrity of lifting surfaces on aircraft. A potential aeroelastic failure mode that was identified in the first year's study has been investigated here over a larger range of parameters. This failure mechanism results from the localized steady drag generated when a lifting surface encounters damage to its aerodynamic shape. Its modeling has been extended in this study to swept wing configurations and to possible multiple and distributed damage sites. In addition, a larger range of single damage site locations has also been considered to assess the possible tradeoffs between the influence of both structural and aerodynamic damage locations. A check on the validity of the strip theory aerodynamic modeling employed in this study has also been made by comparing these results with those obtained from a lifting surface theory modeling. Finally, an additional failure mechanism is identified that results from any unsteady but periodic fluctuating aerodynamic drag loads that are generated by the damage. A parametric and oscillatory instability can be induced by relatively low level drag loads in this case if they happened to be appropriately tuned to the structural frequencies of the wing. GRA

N81-13956# Federal Aviation Administration, Oklahoma City, Okla. Standards Development Branch.

CURRENT AIRCRAFT SURVEY (APPROACH SPEEDS, GROSS WEIGHTS, AND DIMENSIONS)

Frank Parr Jul. 1980 36 p (Proj. AFS-560-79-17)

(PB80-225691; FAA-AFO-500-20) Avail: NTIS HC A03/MF A01 CSCL 01B

A survey of current aircraft was conducted to determine the effect of a revision to FAR 97.3. The revision deleted the use of gross weight in categorization of aircraft for instrument approach minimums. Of 237 aircraft types and models of 22 nations surveyed, 180 were not affected by the rule change. Of the affected aircraft, 31 changed from Category D to C, one from D to B, one from D to A, 17 to C to B, three from C to A, and four from B to A. Ten aircraft types have series which fall into two categories. GRA

N81-13957*# New Mexico Univ., Albuquerque. Technology Application Center.

TECHNOLOGICAL FORECASTING--AIRCRAFT DESIGN. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Aug. 1980

Gerald F. Zollars and Mary K. Gallagher Sep. 1980 45 p Supersedes NTIS/PS-79/1017 Sponsored in part by NASA and NTIS

(NASA-CR-163833; PB80-815970; NTIS/PS-79/1017) Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

Technological forecasts of aircraft design are discussed in approximately 162 citations. Forecasts dealing with the configuration of both civil and military aircraft are included. Specific topics stressed are fuel consumption, avionics, and cost and noise reduction. GRA

N81-13958*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EVALUATION OF A COMPUTER-GENERATED PERSPECTIVE TUNNEL DISPLAY FOR FLIGHT PATH FOLLOWING

Arthur J. Grunwald, James B. Robertson, and Jack J. Hatfield Dec. 1980 100 p refs

(NASA-TP-1736; L-13253) Avail: NTIS HC A06/MF A01 CSCL 01D

The display was evaluated by monitoring pilot performance in a fixed base simulator with the vehicle dynamics of a CH-47 tandem rotor helicopter. Superposition of the predicted future vehicle position on the tunnel image was also investigated to determine whether, and to what extent, it contributes to better system performance (the best predicted future vehicle position was sought). Three types of simulator experiments were conducted: following a desired trajectory in the presence of disturbances; entering the trajectory from a random position, outside the trajectory; detecting and correcting failures in automatic flight. The tunnel display with superimposed predictor/director symbols was shown to be a very successful combination, which outperformed the other two displays in all three experiments. A prediction time of 4 to 7 sec. was found to optimize trajectory tracking for the given vehicle dynamics and flight condition. Pilot acceptance of the tunnel plus predictor/director display was found to be favorable and the time the pilot needed for familiarization with the display was found to be relatively short. Author

N81-13959*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DEVELOPMENT OF A COMPUTER PROGRAM DATA BASE OF A NAVIGATION AID ENVIRONMENT FOR SIMULATED IFR FLIGHT AND LANDING STUDIES

Hugh P. Bergeron, Alix T. Haynie (Georgia Inst. of Tech.), and James B. McDede (Embry-Riddle Aeronautical Inst.) Nov. 1980 35 p refs

(NASA-TM-80064) Avail: NTIS HC A03/MF A01 CSCL 17G

A general aviation single pilot instrument flight rule simulation capability was developed. Problems experienced by single pilots flying in IFR conditions were investigated. The simulation required a three dimensional spatial navaid environment of a flight navigational area. A computer simulation of all the navigational aids plus 12 selected airports located in the Washington/Norfolk area was developed. All programmed locations in the list were referenced to a Cartesian coordinate system with the origin located at a specified airport's reference point. All navigational aids with their associated frequencies, call letters, locations, and orientations plus runways and true headings are included in the data base. The simulation included a TV displayed out-the-window visual scene of country and suburban terrain and a scaled model runway complex. Any of the programmed runways, with all its associated navaids, can be referenced to a runway on the airport in this visual scene. This allows a simulation of a full mission scenario including breakout and landing. R.C.T.

N81-13960# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugsimulation.

EQUIPMENT FOR TESTING AND MEASURING A 'HELMET MOUNTED SIGHT AND DISPLAY' SYSTEM WITH A COUPLED MOVABLE TELEVISION CAMERA IN THE FLIGHT-SIMULATOR FOR RESEARCH OF THE DFVLR

R. Dierke, Friedrich Erdmann, E. Biertuempel, R. Ehlers, and H. Loehr Jan. 1980 81 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-675)

(DFVLR-Mitt-80-04) Avail: NTIS HC A05/MF A01

Equipment for testing a helmet mounted sight and display system (HMS/D) in a flight simulator is described. After defining the values to be measured and the corresponding reference values, the software and hardware of the testing equipment is described, as well as the control program of the equipment and the methods of data recording. Special aspects of the mathematical background and measurement of static errors of a HMS/D System (Honeywell) are given in the appendices. E.D.K.

N81-13963*# Teledyne Continental Motors, Mobile, Ala. Aircraft Products Div.

ADVANCED TECHNOLOGY SPARK-IGNITION AIRCRAFT PISTON ENGINE DESIGN STUDY Final Report

Kenneth J. Stuckas Nov. 1980 127 p refs

(Contract NAS3-21272)

(NASA-CR-165162) Avail: NTIS HC A07/MF A01 CSCL 21G

The advanced technology, spark ignition, aircraft piston engine design study was conducted to determine the improvements that could be made by taking advantage of technology that could reasonably be expected to be made available for an engine intended for production by January 1, 1990. Two engines were proposed to account for levels of technology considered to be moderate risk and high risk. The moderate risk technology engine is a homogeneous charge engine operating on avgas and offers a 40% improvement in transportation efficiency over present designs. The high risk technology engine, with a stratified charge combustion system using kerosene-based jet fuel, projects a 65% improvement in transportation efficiency. Technology enablement program plans are proposed herein to set a timetable for the successful integration of each item of required advanced technology into the engine design. Author

N81-13964# Rolls-Royce Ltd., Derby (England).

THE FUTURE OF CIVIL TURBO-FAN ENGINES

A. G. Newton and J. F. Coplin 1980 41 p

(PNR-90034) Avail: NTIS HC A03/MF A01

The scarcity of fuel and rapidly increasing fuel prices means that there will be ever increasing pressure to reduce the fuel consumption of commercial aeroengines. The present generation of large fan engines has consolidated significant improvements in this respect compared with the engines it replaced. The fuel consumption of this class of engines can be greatly reduced (by amount 12-15 percent) by adopting a derivative approach and, in the longer term, by a further 10 percent by more radical changes. The methods by which the current performance was achieved are described. Author

N81-13966# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.

ORGANIC COMPOUNDS IN THE EXHAUST OF A J85-5 TURBINE ENGINE Interim Report, Jan. - Sep. 1978

James P. Conkle, William W. Lackey, Charles L. Martin, and Andrew Richardson, III Sep. 1980 35 p refs

(AF Proj. 7930)

(AD-A091712; SAM-TR-80-29) Avail: NTIS HC A03/MF A01 CSCL 21/2

Information related to exhaust hydrocarbons associated with a J85-5 turbine engine is presented. A comparison of two sampling techniques (cryogenic trapping and sorption tube) is discussed. The collected samples were analyzed by coupled gas chromatograph-mass spectrometer-data system. The number of compounds identified in the samples was 231, with equivalent results from the two sampling techniques. Less than half of the compounds identified were aromatic and oxygenated species. GRA

N81-13968*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ECONOMIC EVALUATION OF FLYING-QUALITIES DESIGN CRITERIA FOR A TRANSPORT CONFIGURED WITH RELAXED STATIC STABILITY

Steven M. Sliwa Dec. 1980 30 p refs

(NASA-TP-1760; L-13944) Avail: NTIS HC A03/MF A01 CSCL 01C

Direct constrained parameter optimization was used to optimally size a medium range transport for minimum direct operating cost. Several stability and control constraints were varied to study the sensitivity of the configuration to specifying the unaugmented flying qualities of transports designed to take maximum advantage of relaxed static stability augmentation systems. Additionally, a number of handling qualities related design constants were studied with respect to their impact on the design. Author

N81-13969*# Calspan Advanced Technology Center, Buffalo, N.Y.

LANDING FLYING QUALITIES EVALUATION CRITERIA FOR AUGMENTED AIRCRAFT Final Report

Robert C. Radford, Roger Smith, and Randall Bailey Jun. 1980 99 p refs

(Contract NAS4-2534)

(NASA-CR-163097; CALSPAN-6339-F-3) Avail: NTIS HC A05/MF A01 CSCL 01C

The criteria evaluated were: Calspan Neal-Smith; Onstott (Northrop Time Domain); McDonnell-Douglas Equivalent System Approach; R. H. Smith Criterion. Each criterion was applied to the same set of longitudinal approach and landing flying qualities data. A revised version of the Neal-Smith criterion which is applicable to the landing task was developed and tested against other landing flying qualities data. Results indicated that both the revised Neal-Smith criterion and the Equivalent System Approach are good discriminators of pitch landing flying qualities; Neal-Smith has particular merit as a design guide, while the Equivalent System Approach is well suited for development of appropriate military specification requirements applicable to highly augmented aircraft. Author

N81-13970# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

APPLICATION OF VECTOR PERFORMANCE OPTIMIZATION TO A ROBUST CONTROL LOOP DESIGN FOR A FIGHTER AIRCRAFT

Gerhard Kreisselmeier and Reinhold Steinhauser Apr. 1980 70 p refs In GERMAN; ENGLISH summary

(DFVLR-FB-80-14) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 13,20

For a McDonnell-Douglas F-4C aircraft a robust, fixed gain controller is designed, which provides satisfying handling qualities of the longitudinal motion of the aircraft over the complete flight range without gain scheduling. Robustness is achieved in the sense of covering large parameter variations and providing good gain and phase margins. Only low control rates and low feedback gains are involved. The results are obtained by application of a performance vector optimization design method which permits a great many different design objectives simultaneously and in a highly systematic fashion. Two different designs are presented placing emphasis on pitch rate control and normal acceleration control. E.D.K.

N81-13971# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Flaechenflugzeuge.

SYSTEM IDENTIFICATION OF THE LONGITUDINAL MOTION OF THE DFVLR HFB 320 RESEARCH AIRCRAFT WITH PARTICULAR CONSIDERATION OF CONTROL SURFACE EFFECTIVENESS

Ohad Rix Jul. 1979 58 p ref In GERMAN; ENGLISH summary

Report will also be announced as translation (ESA-TT-666)

(DFVLR-Mitt-79-16) Avail: NTIS HC A04/MF A01

The identification of the longitudinal motion of the DFVLR HFB 320 research aircraft using a maximum likelihood method is described. The main emphasis is on the identification of control surface effectiveness of separately or simultaneously deflected DLC flaps and spoilers. The flight test technique and the influence of different model approaches on the results are discussed. E.D.K.

N81-13972# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Airplane Div.

ACTIVE FLUTTER SUPPRESSION ON AN F-4F AIRCRAFT WITH EXTERNAL STORES USING ALREADY EXISTING CONTROL SURFACES

O. Sensburg, H. Hoenlinger, and T. E. Moll (AFFDL) 25 Mar. 1980 9 p refs Presented at AIAA 21st Struct., Struct. Dyn. and Mater. Conf., Seattle, 12-14 May, 1980

(MBB-FE-17/S/PUB/24) Avail: NTIS HC A02/MF A01

The flutter suppression system was flight tested using classical flight flutter tests, open loop tests, and closed loop tests. The control law was found by applying optimal control theory thus minimizing the control surface motion due to disturbances and providing the required stability margins. The selection of the wing mounted store configuration is described. T.M.

N81-13973# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Airplane Div.

ACTIVE CONTROL OF AN EXPLOSIVE WING-STORE FLUTTER CASE

H. Hoenlinger, O. Sensburg, M. Kuehn, and H. Goedel 8 Apr. 1980 9 p refs Presented at 50th Meeting Struct. and Mater. Panel of AGARD, Athens, 13-18 Apr. 1980

(MBB-FE-17/S/PUB/25) Avail: NTIS HC A02/MF A01

Control laws were calculated, using optimal control theory, to suppress an explosive wing store flutter case on a YF-17 dynamically scaled model. The trailing edge flap was used for flutter suppression because usually hydraulically driven ailerons are available in modern fighters. The design aim of 1.5 times the flutter dynamic pressure could be demonstrated during the wind tunnel test. It should be emphasized that no changes to the analytically developed control law were necessary in the test which proves that theory has well advanced during the last years. E.D.K.

N81-13974# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Airplane Div.

EFFECTS OF NONLINEARITIES ON WING STORE FLUTTER

G. DeFerrari, L. Chesta, O. Sensburg, and A. Lotze 9 Apr. 1980 16 p refs Presented at 50th Meeting Struct. and Mater. Panel of AGARD., Athens, 13-18 Apr., 1980 Prepared jointly with Agritalia, Turin

(MBB-FE-17/S/PUB/27) Avail: NTIS HC A02/MF A01

The effects of structural nonlinearities, in particular friction and backlash, on the dynamic behavior of airplanes can be very important for flutter. Larger nonlinearities do exist on sweepable wing airplanes with sweepable wing mounted stores because a considerable amount of joints (with possible play) and bearings (with play and friction) is necessary but the problem is also present for fired wing airplanes. A major problem is the interpretation of linear ground resonance and flight flutter tests and their comparison with analytical predictions. Findings from ground resonance tests and flight flutter tests are presented and an explanation for these test results is given. Calculations with linear assumptions (parameter variations) were made and the method of harmonic balance for finding these parameters was applied. It is shown certain levels of excitation must be reached in order to make flight flutter tests reliable for establishing flutter clearance speeds. Author

N81-13975# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flaechenflugzeuge.

THEORETICAL INVESTIGATION OF THE INFLUENCE OF SPOILER DYNAMICS ON THE HANDLING QUALITIES OF AN AIRCRAFT WITH DIRECT LIFT CONTROL

Dieter Schafranek Nov. 1979 72 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-681)

(DFVLR-FB-80-07) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 14,70

Parameters describing the pilots workload during pitch tracking and flight path tracking tasks on a transport aircraft equipped with spoiler direct lift control (DLC) were determined. The determined parameters are the necessary phase compensation and gain adaption which the pilot must perform and also the closed loop resonance. The influence of DLC gain factor, spoiler actuator rate and spoiler deflection wash-out time constant on pilot workload, is presented. Simulated time histories of pitch rate and normal acceleration response due to step type control inputs show the corresponding reactions of the various DLC configurations which are essential for pitch control and flight path control. Author

N81-13977# Calspan Corp., Buffalo, N. Y.

FURTHER INVESTIGATIONS OF ADAPTIVE-WALL WIND TUNNELS Final Report, Aug. 1978 - Dec. 1979

J. C. Erickson, Jr., C. E. Wittliff, and D. C. Daughtery Oct. 1980 72 p refs

(Contract F40600-78-C-0003)

(AD-A091774; CALSPAN-6374-A-1; AEDC-TR-80-34) Avail: NTIS HC A04/MF A01 CSCL 20/4

The objective of this investigation was to continue the assessment of the Calspan perforated-wall, segmented-plenum adaptive-wall wind tunnel for flows in which the tunnel walls are supercritical. An important aspect of the investigation was the development of a static pipe measuring technique for determining the normal velocity distributions. This technique was developed to overcome the limitations on the number of flow angle probe measurements that could be made in the Calspan tunnel. The flow about a static pipe in the presence of model/wall induced disturbances was analyzed within the framework of slender body theory to give the relationship between differential pressure measurements across the pipe and the steam wise derivative of the normal velocity at the pipe centerline. GRA

N81-14004# Rolls-Royce Ltd., Derby (England). Plastics and Composite Materials Lab.

A RESIN INJECTION TECHNIQUE FOR THE FABRICATION OF AERO ENGINE COMPOSITE COMPONENTS

W. R. Jones and J. W. Johnson 1980 10 p

(PNR-90024) Avail: NTIS HC A02/MF A01

A method for the manufacture of high quality composite aero engine components, free from voids and having a high degree of dimensional reproducibility is described. A porous fiber preform held in the component shape by the use of a thermoplastic binder is employed. The preform is then infiltrated with epoxy resin in a closed die using a vacuum assisted high pressure injection method. It is possible to include inserts or third dimension reinforcement in components, and reference is made to the production of a carbon fiber fan blade and a nose spinner. S.F.

N81-14006# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Aircraft Div.

CONSTANT-AMPLITUDE AND FLIGHT-BY-FLIGHT TESTS ON CERP SPECIMENS

F. J. Arendts, K. O. Sippel, and D. Weisgerber 9 Apr. 1980 13 p refs Presented at 50th Meeting Struct. and Mater. Panel of AGARD, Athens, 13-18 Apr., 1980 Supported by FRG Min. of Defense

(MBB-FE-2/S/PUB-26) Avail: NTIS HC A02/MF 01

Constant-amplitude and flight-by-flight tests with five different load spectra were done with unnotched carbon fiber reinforced points specimens. Also the influence of overloads was investigated. The test results were compared with fatigue life predictions based on 'Miner's Rule' applied for different conditions. The results show that overloads in all cases cause a significant reduction of the fatigue life. It turned out that fatigue life estimations based on 'Miner's Rule' are on the unsafe side in some cases by more than a factor 10, getting a big scatter among the cases investigated. Author

N81-14061# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.

THE STRESS BEHAVIOR OF THREE ADVANCED NICKEL BASE SUPERALLOYS DURING HIGH TEMPERATURE LOW CYCLE FATIGUE Technical Report, Jan. 1977 - Aug. 1978

Henry L. Bernstein Jun. 1980 243 p refs
(Contract F33615-76-C-5191; AF Proj. 7351)
(AD-A091694; SRL-9799; AFWAL-TR-80-4075) Avail: NTIS HC A11/MF A01 CSCL 11/6

This report is a compilation of data on stress behavior as a function of cycles obtained during high temperature, low cycle fatigue tests on three advanced Ni-base superalloys--Rene 95, AF-115, and AF2-1DA. The data are presented in both tabular and graphical formats. The materials studied are those used for jet engine turbine disks, and the fatigue tests were conducted at their operating temperatures. The purpose of this report is to make the test data available to the technical community. No discussion is presented on an analysis or an understanding of the data, although some observations are included. GRA

N81-14064# Massachusetts Inst. of Tech., Cambridge. Lab. for Manufacturing and Productivity.
PREVENTION OF SPLINE WEAR BY SOFT METALLIC COATINGS Final Report, 1 Jan. 1977 - 30 Jun. 1979
Nannaji Saka, Hyo Chol Sin, and Nam P. Suh Jul. 1980 71 p refs
(Contract N00014-76-C-0068)
(AD-A091861; MIT/LMP/TRB-80-2) Avail: NTIS HC A04/MF A01 CSCL 01/3

The purpose of this cooperative program between MIT, Naval Air Development Center (NADC) and Foxboro-Analytical is to study the mechanism of wear and increase the wear resistance of aircraft splines. In addition to testing a much larger number of splines under a variety of conditions than has been done so far, optical microscopy, scanning electron microscopy and ferrography have been extensively used to identify the wear mechanism. Test specimens of aircraft splines were coated with Au, Ni, Ag and Cd with various thicknesses (0.1 - 10 micron m) and tested in the SwRI spline wear tester with and without grease. The gold coated splines exhibited induction periods of 250 hours, which is four times that exhibited by the uncoated splines. Ni, Ag and Cd failed to increase the induction period. Unlubricated splines wore exactly at the same rate as the post-induction wear rates of the grease lubricated splines. Optical and scanning electron microscopy results indicate that the mode of wear is by subsurface deformation, crack nucleation and growth processes (i.e., by the delamination mechanism) both in the induction and the post-induction periods. Analysis of the splines by the energy dispersive X-ray analysis showed that the metallic coatings did not react with grease. This and other evidence indicates that the costing/substrate bond strength is an important factor in the wear of splines. Methods for improving the bond strength and reducing the cost of the coatings are suggested.
GRA

N81-14077* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SURFACE FINISHING Patent
Jack A. Kinzler, James T. Hefferman, Leroy G. Fehrenkamp, and William S. Lee, inventors (to NASA) Issued 30 Sep. 1980 8 p Filed 25 Jan. 1979 Supersedes N79-21183 (17-12, p 1540) Continuation of abandoned US Patent Appl. SN-785279, filed 6 Apr. 1977 which is a division of US Patent Appl. SN-568541, US Patent-4, 032, 089, filed 16 Apr. 1975
(NASA-Case-MSC-12631-3; US-Patent-4,225,372;
US-Patent-Appl-SN-006952; US-Patent-Class-156-154;
US-Patent-Class-156-160; US-Patent-Class-156-163;
US-Patent-Class-156-212; US-Patent-Class-156-267;
US-Patent-Class-156-295; US-Patent-Class-156-323;
US-Patent-Class-156-331; US-Patent-Appl-SN-785279;
US-Patent-Appl-SN-568541; US-Patent-4,032,089) Avail: US Patent and Trademark Office CSCL 11A

A surface of an article adapted for relative motion with a fluid environment is finished by coating the surface with a fluid adhesive, covering the adhesive with a sheet of flexible film material under tension on the film material whereby the tensioned film material is bonded to the surface by the adhesive.
Official Gazette of the U.S. Patent and Trademark Office

N81-14082*# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
IMPROVED CERAMIC HEAT EXCHANGER MATERIALS Final Report
Harry W. Rauch Dec. 1980 39 p refs
(Contracts NAS3-19698-EC-77-A-31-1011;
DE-AI01-77CS-51040)
(NASA-CR-159678; DOE/NASA/9698-2) Avail: NTIS HC A03/MF A01 CSCL 07C

The development and evaluation of materials for potential application as heat exchanger structures in automotive gas turbine engines is discussed. Test specimens in the form of small monolithic bars were evaluated for thermal expansion and dimensional stability before and after exposure to sea salt and sulfuric acid, followed by short and long term cycling at temperatures up to 1200 C. The material finally selected, GE-7808, consists of the oxides, ZrO2-MgO-Al2O3-SiO2, and is described generically as ZrMAS. The original version was based on a commercially available cordierite (MAS) frit. However, a clay/talc mixture was demonstrated to be a satisfactory very low cost source of the cordierite (MAS) phase. Several full size honeycomb regenerator cores, about 10.2 cm thick and 55 cm diameter were fabricated from both the frit and mineral versions of GE-7808. The honeycomb cells in these cores had rectangular dimensions of about 0.5 mm x 2.5 mm and a wall thickness of approximately 0.2 mm. The test data show that GE-7808 is significantly more stable at 1100 C in the presence of sodium than the aluminosilicate reference materials. In addition, thermal exposure up to 1100 C, with and without sodium present, results in essentially no change in thermal expansion of GE-7808. M.G.

N81-14084# Naval Weapons Center, China Lake, Calif.
VANADIUM TRINEODECANOATE PROMOTER FOR FIBERGLASS-POLYESTER SOIL SURFACINGS Final Report, Apr. 1979 - Mar. 1980
Alan L. Woodman, Ronald A. Henry, Arnold Adicoff, and Dwight A. Fine Jun. 1980 30 p refs
(AD-A091785; AD-E900008; NWC-TP-6184) Avail: NTIS HC A03/MF A01 CSCL 11/2

A Marine Corps chemical formulation developed for the construction of fiberglass-reinforced plastic surfaces for soils consists of a polyester resin, cumene hydroperoxide catalyst and a promoter solution containing a vanadium salt and N,N-dimethyl-p-toluidine. A new, relatively simple method for preparing the vanadium trineodecanoate (VND) solution has been devised to replace the previously used commercial salt solution which is no longer being manufactured. This preparation is now ready to be scaled-up to pilot plant size. Reactivity and accelerated aging studies indicate that the VND solution functions at least as well as the commercial salt. Laminates made under either dry or wet conditions with the VND displayed significantly higher flexural strengths than those made with the commercial material. GRA

N81-14182# Transportation Research Board, Washington, D.C.
SEALING JOINTS AND CRACKS, THIN RESURFACING, AND LOCATING VOIDS UNDER CONCRETE SLABS
Wouter Gulden, Gordon K. Ray, I. Minkarah, J. P. Cook, and J. B. Thornton 1980 38 p refs
(PB80-215635; TRB/TRR-752; ISBN-0-309-03062-5;
LC-80-23303) Avail: NTIS HC A03/MF A01 CSCL 13B

The six papers in this report deal with the following areas: effect of defective joint seals on pavement performance; pavement design features and their effect on joint seal performance; pavement restoration measures to precede joint resealing; and conditions and operations for joint and crack resealing of airfield pavement. The use of a very thin overlay to reestablish the skid resistance of a concrete pavement and applicability of radar subsurface profiling in estimating sidewalk undermining are also discussed. GRA

N81-14195# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

VOLUMETRIC PATTERN PREDICTION OF ANTENNAS ON AIRCRAFT USING THE GEOMETRICAL THEORY OF DIFFRACTION Ph.D. Thesis - Kaiserslautern Univ.
Thomas Jank Nov. 1979 178 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-677)
(DFVLR-FB-80-01; TT-677) Avail: NTIS HC A09/MF A01

The patterns of small dipoles or slot antennas mounted on the fuselage of an aircraft are computed in the high frequency case. For the computation of the field the geometrical theory of diffraction is used. A very versatile and realistic mathematical aircraft mode is developed. The construction of all rays which contribute considerably to the total field is a complicated numerical problem. Via the solution of this ray tracing problem it is possible to obtain arbitrary pattern cuts. Author

N81-14265*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL STUDY OF SUPERSONIC VISCOUS LEESIDE FLOW OVER A SLENDER DELTA WING
Joachim Szodruch Dec. 1980 62 p refs
(NASA-TM-81248; A-8408) Avail: NTIS HC A04/MF A01 CSCL 20D

An investigation was conducted to study in detail the vortical flow over the leeward side of a 70 deg swept delta wing having subsonic and supersonic leading edges. Two types of flow were encountered and studied, namely leading edge separation and separation with a shock. Especially for the latter type, Reynolds number plays an important role and unexpected strong streamwise vortices were observed. An optical method is described to obtain a first aproximation of shear stress values in the streamwise direction across the wing span. Author

N81-14275# ARO, Inc., Arnold Air Force Station, Tenn.
LASER-RAMAN/RAYLEIGH FLOW DIAGNOSTIC TECHNIQUES APPLIED TO SUBSONIC FLOW Final Report, 13 Apr. 1977 - 14 Mar. 1978
W. D. Williams, D. W. Sinclair, and L. L. Price AEDC Oct. 1980 57 p refs Sponsored by Air Force
(AD-A091695; AEDC-TR-80-20) Avail: NTIS HC A04/MF A01 CSCL 20/4

The feasibility of performing laser-Raman/Rayleigh scattering measurements in subsonic flows was demonstrated in the 6 in. Acoustic Research Tunnel (ART) of the Propulsion Wind Tunnel facility at AEDC. The ART is an open-circuit, atmospheric inbleed tunnel that operates on the Plenum Evacuation System of the 16 ft transonic Propulsion Wind Tunnel (16T). Laser-Raman/Rayleigh scattering techniques were used to measure air number density, H2O number density, and static temperature and to detect the onset of water vapor condensation. Measurements were made near the tunnel axial centerline over the Mach number range from 0.10 to 0.80. Measurements were also made in the turbulent boundary layer on the wall of the test section at Mach numbers 0.50 to 0.80. GRA

N81-14276# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
EFFECTS OF DOWNSTREAM DISTANCE ON TURBULENCE DECAY FOR THE COMPRESSOR RESEARCH FACILITY LOW CONDITIONING SYSTEM Final Report, 1 Feb. 1978 - 1 Jul. 1979
Douglas C. Rabe Mar. 1980 72 p refs
(AF Proj. 3066)
(AD-A091543; AFWAL-TR-80-2023) Avail: NTIS HC A04/MF A01 CSCL 14/2

The turbulence decay of the 304.8 cm (120 in) diameter flow conditioning system for the Air Force Aero Propulsion Laboratory's Compressor Research Facility was investigated in a 25.4 cm (10 in) diameter channel to predict turbulence levels that can be expected at the entrance to compressors being tested in the facility. Results of this experimentation show that the flow conditioning system will meet the design goal of reducing the expected imcoming turbulence level of 30-40% to less than 1% at the entrance to a test compressor. Further, the turbulence decay associated with the full-flow conditioning system and its individual components possesses initial period of decay characteristics throughout the 600 cm decay length investigated. It is concluded that these decay characteristics are due to the large scale of turbulence incoming and exiting the flow conditioning system of the Compressor Research Facility. GRA

N81-14289# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
A COMPUTER-BASED LASER DOPPLER VELOCIMETER
Jens-Carsten Petersen Jun. 1979 64 p refs In GERMAN; ENGLISH summary
(DFVLR-Mitt-79-14) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 11,50

A Laser-Doppler-Velocimeter is described which is specially designed for windtunnel applications. Facing other Velocimeters the data analysis is here performed digitally by use of a computer. The control of the testing procedure is also done by the computer, while a remote control is installed between computer and positioning control for the optical part of the Velocimeter, built up on two three-axis-travers mechanisms. This remote control generates or improves all signals necessary for control procedures. In addition to the description of the system's functions, necessary and desirable improvements are briefly discussed. Author

N81-14292# Institut Franco-Allemand de Recherches, St. Louis (France).
THE DALEMBERTOMETER
P. Smigielski and P. G. Sava 20 Nov. 1979 9 p refs Presented at 2nd European Congr. on Opt. Appl. to Metrology (OPIEM 79), Strasburg, Nov. 1979
(ISL-CO-220/79) Avail: NTIS HC A02/MF A01

A new device is presented utilizing a He-Ne 5 mW laser as a light source, and including a Mach-Zehnder interferometer coupled with schlieren systems with defocalized phase plates permitting the measurement of the dalembertian of the optical path along a trajectory of the laser beam in a transparent medium. This device which required a long development, as much optically as electronically, is used for the study of noise sources in the air jets. The particularities of the system are described and its performances are illustrated by applications in aerodynamics. Author

N81-14300# Institut Franco-Allemand de Recherches, St. Louis (France).
CONTROLS OF AERONAUTICAL STRUCTURES UNDER FATIGUE TESTING BY HOLOGRAPHIC PULSED LASERS INTERFEROMETRY
H. Fagot, F. Albe, P. Smigielski, A. Stimpfling, and J. L. Arnaud (SNIAS) 20 Nov. 1979 11 p refs Presented at 2nd European Congr. on Opt. Appl. to Metrology (OPIEM 79), Strasburg, Nov. 1979 Sponsored in part by Direction des Recherches, Etudes et Techniques
(ISL-CO-218/79) Avail: NTIS HC A02/MF A01

A compact and mobile holographic camera is described which is capable of recording holograms by double exposure. The time lapse between the 2 laser impulses (duration 20 ns, energy 100 mJ approx.) is adjustable from 0.1 micron to infinity. The successful 'in situ' experimentation of this device took place while bars of aeronautical structures were being tested for fatigue (periodical tensile stress). The holograms were recorded without interrupting the fatigue testings which lasted several hours. The testbars being used were chosen because their characteristics demonstrate problems typically met in aeronautics. A.R.H.

N81-14318* National Aeronautics and Space Administration. Pasadena Office, Calif.
POWER CONTROL FOR HOT GAS ENGINES Patent
William F. MacGlashan, inventor (to NASA) (JPL) Issued 21 Oct. 1980 10 p Filed 19 May 1978 Supersedes N78-25430 (16 - 16, p 2122) Sponsored by NASA

(NASA-Case-NPO-14220-1; US-Patent-4,228,656; US-Patent-Appl-SN-907421; US-Patent-Class-60-518; US-Patent-Class-74-417) Avail: US Patent and Trademark Office CSCL 13I

A hot gas engine in which the expander piston of the engine is connected to an expander crankshaft. A displacer piston of the engine is connected to a separate displacer crankshaft which may or may not be coaxial with the expander crankshaft. A phase angle control mechanism used as a power control for changing the phase angle between the expander and displacer crankshaft is located between the two crankshafts. The phase angle control mechanism comprises a differential type mechanism comprised of a pair of gears, as for example, bevel gears, one of which is connected to one end of the expander crankshaft and the other of which is connected to the opposite end of the displacer crankshaft. A mating bevel gear is disposed in meshing engagement with the first two level gears to provide a phase angle control between the two crankshafts. Other forms of differential mechanisms may be used including conventional spur gears connected in a differential type arrangement.

Official Gazette of the U.S. Patent and Trademark Office

N81-14324# Lord Kinematics, Erie, Pa.

SERVICE LIFE DETERMINATION FOR THE UH-60-A (UTTAS) HELICOPTER ELASTOMERIC BEARINGS Final Report, Aug. 1978 - Apr. 1980

Ernest P. Gaudette Apr. 1980 86 p

(Contract DAAG46-78-C-0030)

(AD-A091756; APE-79-021; USAAVRADCOM-TR-80-F-9; AMMRC-TR-80-25) Avail: NTIS HC A05/MF A01 CSCL 01/3

A method for predicting the endurance life of the elastomeric bearings on the UTTAS helicopter rotor is presented. The critical layers, based on elastomer strain, are determined analytically for these two bearings. Representative standard laboratory test specimens bonded with the specified elastomers are subjected to the same static and typical dynamic strains, and tested to failure. Two resulting S-N curves are reported, one for each of the two rotor elastomeric bearings. A short verification of Miner's cumulative damage theory is also conducted and reported. GRA

N81-14325# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

IMPROVED CAPABILITIES TO DETECT INCIPIENT BEARING FAILURES Final Report, 1 May 1978 - 31 Mar. 1980

J. A. Alcorta, J. H. Mohn, and L. L. Packer Jul. 1980 86 p refs

(Contract F33615-78-C-2008; AF Proj. 3048)

(AD-A091687; PWA-FR-13036A; AFWAL-TR-80-2057) Avail: NTIS HC A05/MF A01 CSCL 13/9

A methodology using safe, low level radiation technique for the detection of wear in gas turbine engine mainshaft bearings has been developed and evaluated in a simulated gas turbine engine bearing environment. In conjunction with spectrometric analyses of engine oil samples, the radioactive tag will detect low levels of wear and will simultaneously indicate whether the tagged bearing is the source of the wear. Iron-55 is employed as the active tag owing to its low radiation levels, long half-life, and homogeneity of the isotope in the bearing rollers. The low levels of radiation existent in the tagged wear particles requires the separation of wear debris from the oil. Test results showed that the tagging method would provide a means of identifying the tagged rollers experiencing abnormal wear at the + or - 0.5 part per million iron level. Safe, low-level radioactive bearing roller tagging was achieved by waiting six months after neutron irradiation for the decay of the iron-59 and the chromium-51 gamma emitting radioisotopes. Wear measurements are conducted using the long half-life, low energy emitting X-rays from iron-55. The technique used for tagging, debris concentration, debris measurement, and bearing testing is given. GRA

N81-14327# United Technologies Corp., South Windsor, Conn. Power Systems Div.

COMPRESSOR CONFIGURATION AND DESIGN OPTIMIZATION FOR THE HIGH RELIABILITY GAS TURBINE Final Report

Diana L. Day and Fred H. Boenig Apr. 1980 54 p Prepared in cooperation with Pratt and Whitney Aircraft, West Palm Beach, Fla.

(Contract DE-AC03-79ET-15425)

(DOE/ET-15425/T1: GTR-2136) Avail: NTIS HC A04/MF A01

The compressor and diffuser preliminary designs were completed to define size and performance characteristics. The compressor has 9 stages and a predicted adiabatic efficiency of 88.35%. The diffuser selected is a conventional straight wall configuration with an equivalent conical angle of 8 degrees. An alternate diffuser configuration was recommended because of its excellent performance potential in high Mach number applications. The HTF compressor configuration appears to offer equivalent COE and reliability as compared to the Baseline Reliable Engine configuration, but at more conservative aerodynamic loading levels. J.M.S.

N81-14329# Detroit Diesel Allison, Indianapolis, Ind.

GAS TURBINE ENGINES AND TRANSMISSIONS FOR BUS DEMONSTRATION PROGRAMS Technical Status Report, 31 Jan. - 30 Apr. 1980

D. N. Nigro May 1980 7 p

(Contract DE-AC02-78CS-54867)

(COO-4867-07) Avail: NTIS HC A02/MF A01

Activities related to the procurement and delivery of 11 gas turbine engines, 11 automatic transmissions, and software items such as cost reports, drawings and parts lists for the bus demonstration program are reported. DOE

N81-14332# General Electric Co., Schenectady, N. Y. Gas Turbine Div.

DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Jul. - Sep. 1979

M. W. Horner Oct. 1979 172 p

(Contract EX-76-C-01-1806)

(FE-1806-72) Avail: NTIS HC A08/MF A01

The program was divided into three phases: Program and System Definition, Technology Testing and Test Support Studies, and Technology Readiness Verification Test Program. The work scope for the overall three phases of the program encompasses the design, development, manufacture, and test of a GE-TRV turbine subsystem to be tested at a DOE facility. The objectives of Phase 2 are to: perform component design and technology testing in critical areas; perform system design and tradeoff analyses in sufficient depth to support the component design and test tasks; and update the Phase 1 combined cycle studies to evaluate the commercial viability of GE-TRV turbine system. DOE

N81-14347*# California Univ., Los Angeles. Dept. of Mechanics and Structures.

DUAL METHODS AND APPROXIMATION CONCEPTS IN STRUCTURAL SYNTHESIS Final Report, Feb. 1978 - Aug. 1979

Claude Fleury and Lucien A. Schmit, Jr. Washington NASA Dec. 1980 223 p refs

(Grant NsG-1490)

(NASA-CR-3226) Avail: NTIS HC A10/MF A01 CSCL 20K

Approximation concepts and dual method algorithms are combined to create a method for minimum weight design of structural systems. Approximation concepts convert the basic mathematical programming statement of the structural synthesis problem into a sequence of explicit primal problems of separable form. These problems are solved by constructing explicit dual functions, which are maximized subject to nonnegativity constraints on the dual variables. It is shown that the joining together of approximation concepts and dual methods can be viewed as a generalized optimality criteria approach. The dual method is

successfully extended to deal with pure discrete and mixed continuous-discrete design variable problems. The power of the method presented is illustrated with numerical results for example problems, including a metallic swept wing and a thin delta wing with fiber composite skins. Author

N81-14363# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
MECHANISMS OF DAMAGE ACCUMULATION IN TIME-DEPENDENT CYCLIC DEFORMATION Progress Report, 1 Jan. - 31 Dec. 1980
Campbell Laird Aug. 1980 15 p refs
(Contract DE-AC02-80ER-10570)
(DOE/ER-10570/1) Avail: NTIS HC A02/MF A01

Two kinds of damage produced in cyclic creep were investigated. The change in dislocation density and arrangement in copper and damage phenomena involving precipitates in Cr-Mo-V rotor steel. In copper tested at low temperatures, strain bursts were recognized for the first time in polycrystals of a pure metal in both cyclic and static creep. The stress regime for producing bursts was defined and the dislocation structures associated with them studied. Interpretation based on instabilities associated with the persistent slip bands which form in regular fatigue is being explored. For the study of rotor steel, three batches of material were obtained and characterized and a new high temperature apparatus built to do tests. A literature review justifying the choice of steels and tests is provided. DOE

N81-14525# National Technical Information Service, Springfield, Va.
MANEUVERING AIRCRAFT: NOISE POLLUTION AND CONTROL. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Aug. 1980
Guy E. Habercom, Jr. Sep. 1980 189 p Supersedes NTIS/PS-79/0973 and NTIS/PS-78/0930
(PB80-815566; NTIS/PS-79/0973; NTIS/PS-78/0930) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Methods for alleviating noise created by maneuvering aircraft are cited. Flyby, turning flight, takeoffs, and landings are the maneuvers investigated. This updated bibliography contains 184 citations, 25 of which are new entries to the previous edition. GRA

N81-14550# Los Alamos Scientific Lab., N. Mex.
STATISTICAL RELATIONSHIP BETWEEN MEDIAN VISIBILITY AND CONDITIONS OF WORSTCASE MANMADE IMPACT ON VISIBILITY
John D. Gins (Technology Service Corp., Santa Monica, Calif.), David Nochumson, and John Trijonis (Santa Fe Research Corp., N. Mex.) 1980 16 p refs Presented at the Symp. on Plumes and Visibility, Grand Canyon, Ariz., 10-14 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2485; CONF-801114-1) Avail: NTIS HC A02/MF A01

The data base for the study consisted of midday visibility recordings for the years 1974 to 1976 at 28 suburban/nonurban airports throughout the United States. The visibility recordings were converted to estimates of extinction coefficients with the use of the Koschmeider formula. The data were sorted according to meteorology in order to eliminate days that were obviously dominated by natural causes of poor visibility. Three approaches were used for relating worst-case extinction to median extinction. The first approach was based upon frequency distribution functions. The second used observed ratios of upper percentile to median extinction. The third employed regression techniques. All ot the relationships were formulated and evaluated with the 1974 to 1976 data on a national/annual basis as well as regional/quarterly basis. Performance tests were run against 1954 to 1956 data at 11 of the 28 sites. Simple ratio relationships are recommended for use in translating median visibility impacts into worst-case impacts. The errors associated with these ratio models are approximately 30%. DOE

N81-14555*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS: FOURTH ANNUAL WORKSHOP ON METEOROLOGICAL AND ENVIRONMENTAL INPUTS TO AVIATION SYSTEMS
Walter Frost, ed. and Dennis W. Camp, ed. Mar. 1980 287 p refs Workshop held in Tullahoma, Tenn., 25-27 Mar. 1980; sponsored in part by FAA and NOAA Prepared in cooperation with Tennessee Univ. Space Inst.
(Contract NAS8-32692)
(NASA-CP-2139; FAA-RD-80-67) Avail: NTIS HC A13/MF A01 CSCL 04B

Various aspects of the interaction of the atmosphere with aviation systems are discussed. The topics for discussion addressed the following: winds and wind shear; turbulence; icing and frost; fog, visibility, and ceiling; and atmospheric electricity and lightning.

N81-14556*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SURVEY OF WORKSHOPS ON METEOROLOGICAL AND ENVIRONMENTAL INPUTS TO AVIATION SYSTEMS
Walter Frost (Tennessee Univ. Space Inst.) and Dennis W. Camp *In its* Proc: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 23-39

Avail: NTIS HC A13/MF A01 CSCL 04B

Various aspects of aviation meteorology are discussed with respect to their relative effects on aircraft terminal operations. Existing data on turbulence and wind shear from aircraft and towers are summarized. The significance of obtaining more real time wind and temperature information is emphasized. The application and testing of various radiometer devices are also described. Airborne methods to indicate wind differences at flight altitude and at touchdown are reported. R.C.T.

N81-14557*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AVIATION METEOROLOGY RESEARCH AND DEVELOPMENT: A STATUS REPORT
John Enders *In its* Proc: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 40-44

Avail: NTIS HC A13/MF A01 CSCL 04B

The dynamic and rapid growth of technology in the area of aviation meteorology research and development are described with emphasis on the measurement of hazardous weather phenomena. Aspects of both onboard instrumentation and ground based facilities are evaluated in terms of their effectiveness of in avoiding hazards due to atmospheric electricity and lightning. Methods of alleviating terminal are hazards such as fog, low visibility and ceilings are also described. R.C.T.

N81-14558*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FEDERAL AVIATION ADMINISTRATION AND NATIONAL WEATHER SERVICE AVIATION RESEARCH AND DEVELOPMENT
John W. Connolly *In its* Proc: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 45-48

Avail: NTIS HC A13/MF A01 CSCL 04B

An overview is given of the developmental status of aviation weather services. Particular attention is given to justifying the need for better, more reliable service. The accomplishments of several automatic weather stations are discussed. R.C.T.

N81-14560*# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT ICING INSTRUMENTATION: UNFILLED NEEDS
Phyllis F. Kitchens *In* NASA. Marshall Space Flight Center Proc: Fourth Ann. Worksnop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 61-65
Avail: NTIS HC A13/MF A01 CSCL 04B

A list of icing instrumentation requirements are presented. Because of the Army's helicopter orientation, many of the suggestions are specific to rotary wing aircraft; however, some of the instrumentation are also suitable for general aviation aircraft. R.C.T.

N81-14561*# Lockheed Aircraft Service Co., Pasadena, Calif.
TURBULENCE: FROM A PILOT'S VIEWPOINT
Charles L. Pocock *In* NASA. Marshall Space Flight Center Proc: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 66-70

Avail: NTIS HC A13/MF A01 CSCL 04B
The measurement of atmospheric turbulence is discussed in terms of a pilots viewpoint. Two areas of measurement are considered: frequency and severity of turbulence. Suggestions are given for helping the pilot solve the turbulence problem. R.C.T.

N81-14562*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
CLEAR AIR TURBULENCE: HISTORICAL COMMENTS
L. J. Ehernberger *In* NASA. Marshall Space Flight Center Proc: Fourth Ann. Workshop on Meterol. and Environ. Inputs to Aviation Systems Mar. 1980 p 71-81 refs

Avail: NTIS HC A13/MF A01 CSCL 04B
The basic reference material for gust design criteria are cited. The status of clear air turbulence meteorology (forecasting and detection) is discussed. The directions of further research technology is indicated. R.C.T.

N81-14563*# Federal Aviation Administration, Atlantic City, N.J.
WINDS AND WIND SHEAR IN-SITU SENSORS
R. Craig Goff *In* NASA. Marshall Space Flight Center Proc: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 82-108

Avail: NTIS HC A13/MF A01 CSCL 04B
The problem of development of instrumentation for providing wind speed and direction information directly or indirectly to a pilot in the cockpit is considered. The pilots need for horizontal wind information at various stages of flight (i.e., at liftoff, in approach and departure corridors, and even in flight outside the terminal area) are emphasized. R.C.T.

N81-14566*# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
OBSERVING LIGHTNING FROM GROUND-BASED AND AIRBORNE STATIONS
John C. Corbin, Jr. *In* NASA. Marshall Space Flight Center Proc.: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 130-139 refs

Avail: NTIS HC A13/MF A01 CSCL 04B
The operational designs and performance capabilities of ground-based and airborne lightning detection systems are reviewed. The airborne Stormscope system is described and compared with onboard radar and the lightning detection and ranging system (LDAR). Two examples of difference-in-time-of-arrival systems for detecting spherics from discharges in electrified clouds are described: (1) The LDAR system and (2) Taylor's lightning mapping system. Next, an interferometric system adapted to lightning location is discussed. Finally, systems that are based upon crossed-loop magnetic direction finding principles but which have been refined and improved to accurately locate lightning discharges to ground are reviewed. M.G.

N81-14567*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERONAUTICAL CONCERNS AND NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ATMOSPHERIC ELECTRICITY PROJECTS
William W. Vaughan *In its* Proc.: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 140-160
Avail: NTIS HC A13/MF A01 CSCL 04B
The phenomenology of lightning and lightning measurement techniques are briefly examined with a particular reference to aeronautics. Developments made in airborne and satellite detection methods are reported. NASA research efforts are outlined which cover topics including in-situ measurements, design factors and protection, remote optical and radio frequency measurements, and space vehicle design. M.G.

N81-14568*# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
MEASURING WEATHER FOR AVIATION SAFETY IN THE 1980'S
Robert W. Wedan *In* NASA. Marshall Space Flight Center Proc.: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 162-167

Avail: NTIS HC A13/MF A01 CSCL 04B
Requirements for an improved aviation weather system are defined and specifically include the need for (1) weather observations at all airports with instrument approaches, (2) more accurate and timely radar detection of weather elements hazardous to aviation, and (3) better methods of timely distribution of both pilot reports and ground weather data. The development of the discrete address beacon system data link, Doppler weather radar network, and various information processing techniques are described. M.G.

N81-14571*# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
THE MICROBURST: COMMON FACTOR IN RECENT AIRCRAFT ACCIDENTS
Fernando Caracena *In* NASA. Marshall Space Flight Center Proc.: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 186-200 refs

Avail: NTIS HC A13/MF A01 CSCL 04B
The phenomenology of one class of strong thunderstorm downdrafts, microbursts, is described. Several aircraft accidents are analyzed in which a microburst was involved and a concept for an early warning wind shear sensor is presented. M.G.

N81-14572*# National Center for Atmospheric Research, Boulder, Colo.
DOCTOR FUJITA'S MICROBURST ANALYSIS AT CHICAGO
John McCarthy *In* NASA. Marshall Space Flight Center Proc.: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems Mar. 1980 p 201-202

Avail: NTIS HC A13/MF A01 CSCL 04B
Doppler radar measurements of an intense wind shear occurance are discussed. The data suggest the presence of an incredibly strong low level jet outflow component of the microburst event, reaching 60 knots only 50 meters above the surface. Evidence also suggests that microbursts more typically occur in very weak thunderstorms that have hardly reached thunderstorm stage. M.G.

N81-14575# Weapons Systems Research Lab., Adelaide (Australia).
LOW-SPEED WIND-TUNNEL TESTS OF TWO WEATHER-COCKING SENSORS
D. P. Brown and R. I. Macleod Aug. 1980 29 p refs (WSRL-0171-TM; AR-002-036) Avail: NTIS HC A03/MF A01
Two blunt-nosed weathercocking wind direction sensors, one stabilized by a ring tail and the other by swept cruciform fins, were tested in a low-speed wind tunnel to investigate possible aerodynamic interference between these wind direction sensors and the vehicles in front of which they were to be mounted. In

these low speed tests, sensor support shaft diameter and vehicle nose tip geometry both caused significant errors in the ring-tailed sensor's alignment to the free stream when the vehicle was at angle of attack. A disk baffle placed on the shaft behind the sensor base was found to reduce sensor misalignment significantly at small angles of attack. Alignment errors for the cruciform sensor were much smaller than those of the ring-tailed sensor at small angles of attack, and these smaller errors were further reduced when a baffle was placed on the shaft. Author

N81-14601*# EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.
CATALOG OF SEA STATE AND WIND SPEED IN THE SOUTH ATLANTIC BIGHT
J. D. McMillan Jan. 1980 134 p refs
(Contract NAS6-2639)
(NASA-CR-156872) Avail: NTIS HC A07/MF A01 CSCL 08C

The GEOS 3 significant waveheight and ground wind speed estimation algorithms are derived and then applied to all GEOS 3 data in the South Atlantic Bight. The investigation area is divided into five geographical sectors and significant waveheight and wind speed histograms are presented in each sector by month and by season. In the discussion of the histograms, definite seasonal trends are identified and examined. Author

N81-14697*# Lockheed-Georgia Co., Marietta.
COMPONENT-ADAPTIVE GRID EMBEDDING
E. H. Atta *In* NASA. Langley Research Center Numerical Grid Generation Tech. 1980 p 157-174 ref

Avail: NTIS HC A24/MF A01 CSCL 12A

One of the major problems related to transonic flow prediction about realistic aircraft configuration is the generation of a suitable grid which encompasses such configurations. In general, each aircraft component (wing, fuselage, nacelle) requires a grid system that is usually incompatible with the grid systems of the other components; thus, the implementation of finite-difference methods for such geometrically-complex configurations is a difficult task. An approach was developed to treat such a problem. The basic idea is to generate different grid systems, each suited for a particular component. Thus, the flow field domain is divided into overlapping subdomains of different topology. These grid systems are then interfaced with each other in such a way that stability, convergence speed and accuracy are maintained. Author

N81-14708*# Aircraft Research Association Ltd., Bedford (England).
AN INVESTIGATION INTO GRID PATCHING TECHNIQUES
C. R. Forsey, M. G. Edwards, and M. P. Carr *In* NASA. Langley Research Center Numerical Grid Generation Tech. 1980 p 265-294 Sponsored in part by the Ministry of Defence, England

Avail: NTIS HC A24/MF A01 CSCL 12A

In the past decade significant advances were made using flow field methods in the calculation of external transonic flows over aerodynamic configurations. It is now possible to calculate inviscid transonic flow over three dimensional configurations by solving the potential equation. However, with the exception of the transonic small disturbance methods which have the advantage of a simple cartesian grid, the configurations over which it is possible to calculate such flows are relatively simple. The major reason for this is the difficulty of producing compatibility between grid generation and flow equation solutions. The main programs in use, use essentially analytic transformations for prescribed configurations and, as such, are not easy to extend. While there is work in progress to extend this type of system to a limited extent, the long term effort is directed towards a more general approach. This approach should not be restricted to producing grid systems in isolation but rather a consideration of the overall problem of flow field solution. E.D.K.

N81-14714*# Boeing Co., Seattle, Wash.
GRID GENERATION FOR GENERAL THREE-DIMENSIONAL CONFIGURATIONS
K. D. Lee, M. Huang, N. J. Yu, and P. E. Rubbert *In* NASA. Langley Research Center Numerical Grid Generation Tech. 1980 p 355-366
Avail: NTIS HC A24/MF A01 CSCL 12A

A suitable grid system for complex three dimensional configurations such as wing/body/nacelle shape for the solution of nonlinear transonic flow problems was constructed. Two approaches were explored based on Thompson's body fitted coordinate concept. The most general approach was to divide the computational domain into multiple rectangular blocks where the configuration itself was also represented by a set of blocks whose structure follows the natural lines of the configuration. The block structured grid system was adaptable to complex configurations and gives good grid quality near physical corners. However, it introduced algorithm issues for the flow solution concerning the treatment of nonanalytic grid block boundaries and nonstandard grid cells. These issues were explored in relation to the grid generation. A more limited approach treats a wing/body configuration with only a single rectangular block in computational space. The issues involving nonstandard cells were avoided, but other limitations on grid resolution appear. Both a linear and a nonlinear system of grid generation equations were developed including methods of grid control. R.C.T.

N81-14788*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ASSESSMENT OF GROUND EFFECTS ON THE PROPAGATION OF AIRCRAFT NOISE: THE T-38A FLIGHT EXPERIMENT
William L. Willshire, Jr. Dec. 1980 128 p refs
(NASA-TP-1747; L-13765) Avail: NTIS HC A07/MF A01 CSCL 20A

A flight experiment was conducted to investigate air to ground propagation of sound at gazing angles of incidence. A turbojet powered ariplane was flown at altitudes ranging from 10 to 160 m over a 20-microphone array positioned over grass and concrete. The dependence of ground effects on frequency, incidence angle, and slant range was determined using two analysis methods. In one method, a microphone close to the flight path is compared to down range microphones. In the other method, comparisons are made between two microphones which were equidistant from the flight path but positioned over the two surfaces. In both methods, source directivity angle was the criterion by which portions of the microphone signals were compared. The ground effects were largest in the frequency range of 200 to 400 Hz and were found to be dependent on incidence angle and slant range. Ground effects measured for angles of incidence greater than 10 deg to 15 deg were near zero. Measured attenuation increased with increasing slant range for slant ranges less than 750 m. Theoretical predictions were found to be in good agreement with the major details of the measured results. Author

N81-14789*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
PREDICTION OF SOUND RADIATED FROM DIFFERENT PRACTICAL JET ENGINE INLETS Semiannual Status Report, 2 Jun. - 30 Nov. 1980
B. T. Zinn and W. L. Meyer 1980 41 p refs
(Grant NAG3-67; Contract F49620-77-C-0066)
(NASA-CR-163824) Avail: NTIS HC A03/MF A01 CSCL 20A

Existing computer codes for calculating the far field radiation patterns surrounding various practical jet engine inlet configurations under different excitation conditions were upgraded. The computer codes were refined and expanded so that they are now more efficient computationally by a factor of about three and they are now capable of producing accurate results up to nondimensional wave numbers of twenty. Computer programs were also developed to help generate accurate geometrical representations of the inlets to be investigated. This data is required as input for the computer programs which calculate the sound fields. This new geometry generating computer program considerably reduces the time required to generate the input

data which was one of the most time consuming steps in the process. The results of sample runs using the NASA-Lewis QCSEE inlet are presented and comparison of run times and accuracy are made between the old and upgraded computer codes. The overall accuracy of the computations is determined by comparison of the results of the computations with simple source solutions. A.R.H.

N81-14792# National Physical Lab., Teddington (England). Acoustics Unit.
THE RATING OF HELICOPTER NOISE: DEVELOPMENT OF A PROPOSED IMPULSE CORRECTION
B. F. Berry, H. C. Fuller, A. J. John, and D. W. Robinson Dec. 1979 45 p refs
(NPL-AC-93; ISSN-0143-7143) Avail: NTIS HC A03/MF A01

Efforts to the scale of effective perceived noise level (EPNL) to account for the subjective effects of impulsive helicopter noise are reported. Psychoacoustical studies of the annoyance of recorded and simulated helicopter noises are described and an objective descriptor of impulsiveness is developed. This descriptor forms the basis of a draft standard for an impulse correction to EPNL. M.G.

N81-14793# Rolls-Royce Ltd., Derby (England).
EXHAUST NOISE IN FLIGHT: THE ROLE OF ACOUSTIC INSTALLATION EFFECTS
I. S. Southern Apr. 1980 14 p refs
(PNR-90029) Avail: NTIS HC A02/MF A01

The acoustic installation effect on engine exhaust noise due to the presence of a wing or high tailplane is discussed for both the static and flight cases. A simple theoretical model for reflection and edge diffraction using ray theory is introduced and compared with experimental results. The model is used to predict full scale installation effects where, due to the low directivity of engine noise, reflection is dominant and the effect generally less than 3 dB. This suggests that the so called static to flight anomaly cannot be explained in terms of acoustic installation effects. Some alternative possibilities are reviewed. Author

N81-14795# Rolls-Royce Ltd., Derby (England).
THE MEASUREMENT OF AERO GAS TURBINE NOISE
L. R. Bentley 29 Jan. 1980 44 p refs
(PNR-90032) Avail: NTIS HC A03/MF A01

Equipment used in noise certification tests for gas turbine aircraft engines includes: (1) a microphone system, calibrated amplifier and tape recorder; (2) a means of relating aircraft position and the noise; and (3) an apparatus for determining the temperature and humidity conditions in the propagation space for the calculation of atmospheric attenuation. Techniques for obtaining flyover and static test bed measurements are examined and assessed. Future developments are considered with emphasis on the acquisition of digital data. A.R.H.

N81-14796# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
NOISE AND NOISE ABATEMENT IN FANS AND BLOWERS: A REVIEW
Wolfgang Neise Mar. 1980 148 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-80-16) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 22.50

Noise generation and its reduction industrial fans (ventilators) is addressed. A review is given of the fan types commonly in use and their practical applications, the mechanisms of the aerodynamic noise generation in fans, theoretical and empirical prediction methods for fan noise, acoustic similarity laws, and noise reduction methods by means of the fan construction and fan operation. Measurement procedures are discussed with respect to the noise radiated from different parts of a fan, e.g., from the fan inlet or outlet, from the fan casing, from the fan as a whole, and to the noise radiated into ducts connected to the fan. Finally, considerations are made, for which classes of fans noise standards can be defined to characterize the noise emission of the various fan types. M.G.

N81-14962*# National Aeronautics and Space Administration, Washington, D. C.
BIRD FLIGHT AND AIRPLANE FLIGHT
A. Magnan Dec. 1980 424 p refs Transl. into ENGLISH from Serv. Tech. de l'Aeron. (Paris), bull. 74, Jun. 1931 p 5-307 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75777) Avail: NTIS HC A18/MF A01 CSCL 01B

Research was based on a series of mechanical, electrical, and cinematographic instruments developed to measure various features of air current behavior as well as bird and airplane flight. Investigation of rising obstruction and thermal currents led to a theory of bird flight, especially of the gliding and soaring types. It was shown how a knowledge of bird flight can be applied to glider and ultimately motorized aircraft construction. The instruments and methods used in studying stress in airplanes and in comparing the lift to drag ratios of airplanes and birds are described. T.M.

N81-14964 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
TIME DEPENDENT NAVIER-STOKES SOLUTION OF A TURBULENT GAS JET EJECTED FROM A RECTANGULAR ORIFICE INTO A HIGH-SUBSONIC CROSSFLOW Ph.D. Thesis
William Charles Golbitz 1980 187 p
Avail: Univ. Microfilms Order No. 8028555

The high temperature (1500K) exhaust gases from an airborne chemical laser being forcibly ejected downwards at a jet to freestream dynamic pressure ratio (Q) of 0.15 from an aspect ratio 1.75 rectangular diffuser orifice aligned with the major axis parallel to the mach 0.7 ambient crossflow at the tropopause was successfully simulated using a modified donor-cell ICE (Implicit Continuous fluid Eulerian) algorithm formulated in primitive variables. The complete set of time dependent, three-dimensional Navier-Stokes equations and a species conservation equation were numerically solved for every cell in the computational domain. The diffusive flux effects caused by concentration gradients (Fick's Law) as well as variable transport and thermodynamic properties of the gas mixture were incorporated into the numerical model. Turbulence closure was achieved by employing a locally varying velocity defect eddy viscosity model. Chemical reactions between the exhaust gases and the ambient crossflow were proscribed. Dissert. Abstr.

N81-14966 Wichita State Univ., Kans.
AN ANALYTIC MODEL OF SUBSONIC FLOW AROUND AN AIRFLOW WITH A SPOILER Ph.D. Thesis
Neal Jay Pfeiffer 1980 103 p
Avail: Univ. Microfilms Order No. 8028606

A computer model was developed to simulate low speed two dimensional flow past the airfoil. Flow visualization and wind tunnel measurements provided insight into the basic physical features of this flow. The basis of the method was the matching of solutions for outer and inner regions. Once the inner and outer solutions were compatible, surface pressures were integrated to give values of lift, drag, pitching moment and spoiler hinge moment coefficients. Corrections for skin friction were included. Computations were made for two low speed airfoils for which detailed data exist for flow with spoilers. The comparisons covered ranges of spoiler deflection angles up to 60 deg and angles of attack from zero to full stall. T.M.

N81-14967* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SYSTEM FOR REFURBISHING AND PROCESSING PARACHUTES Patent
Russell T. Crowell, inventor (to NASA) Issued 30 Sep. 1980 8 p Filed 21 Dec. 1977 Supersedes N78-22026 (16 - 13, p 1654)

(NASA-Case-KSC-11042-1; US-Patent-4,224,810; US-Patent-Appl-SN-862878; US-Patent-Class-68-3R) Avail: US Patent and Trademark Office CSCL 13H

A method for refurbishing and processing parachutes is disclosed including an overhead monorail conveyor system on which the parachute is suspended for horizontal conveyance. The parachute is first suspended in partially open tented configuration wherein open inspection of the canopy is permitted. The parachute is transported by the monorail conveyor to a washing and drying station. Following drying of the parachute, the parachute is conveyed into an interior space where it is finally inspected and removed from the monorail conveyor and laid upon a table for folding. Following folding operations, the parachute is once again mounted on the conveyor in an elongated horizontal configuration and conveyed to a packing area for stowing the parachute in a deployment bag.

Official Gazette of the U.S. Patent and Trademark Office

N81-14968* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AERODYNAMIC SIDE-FORCE ALLEVIATOR MEANS Patent

Dhanvada M. Rao, inventor (Old Dominion Univ.) Issued 30 Sep. 1980 7 p Filed 12 Mar. 1979 Supersedes N79-17813 (17 - 09, p 1072) Sponsored by NASA

(NASA-Case-LAR-12326-1; US-Patent-4,225,102; US-Patent-Appl-SN-019541; US-Patent-Class-244-130; US-Patent-Class-102-56R; US-Patent-Class-102-92.1; US-Patent-Class-244-119) Avail: US Patent and Trademark Office CSCL 01A

An apparatus for alleviating high angle of attack side force on slender pointed cylindrical forebodies such as fighter aircraft, missiles and the like is described. A symmetrical pair of helical separation trips was employed to disrupt the leeside vortices normally attained. The symmetrical pair of trips starts at either a common point or at space points on the upper surface of the forebody and extends along separate helical paths along the circumference of the forebody.

Official Gazette of the U.S. Patent and Trademark Office

N81-14969# National Aerospace Lab., Amsterdam (Netherlands).

TRANSONIC WIND TUNNEL TESTS ON AN OSCILLATING WING WITH EXTERNAL STORE. PART 4: THE WING WITH UNDERWING: STORE Final Report, Feb. 1977 - Sep. 1979

H. Tijdeman, J. W. G. vanNunen, A. N. Draan, A. J. Persoon, R. Poestkoke, R. Roos, P. Schnippers, and C. M. Siebert Wright-Patterson AFB, Ohio AFFDL Sep. 1979 178 p refs

(Grant AF-AFOSR-3233-77)

(AD-A077370; AFFDL-TR-78-194-Pt-4; NLR-TR-78106-U) Avail: NTIS HC A09/MF A01 CSCL 01A

Detailed steady and unsteady pressure distributions were obtained over the wing, while on the store total aerodynamic loads were measured. The tests covered the Mach number range between Ma = 0.6 and Ma = 1.35, and reduced frequencies ranging up to k = 0.4 at Ma = 0.6 and to k = 0.2 at Ma = 1.35. Emphasis was put on the influence of the pylon and store on the wing loading and further on the loads acting on the pylon and store itself. A comparison is presented of experimental data and theoretical results obtained with the unsteady NLR1 and Doublet Lattice methods. T.M.

N81-14970*# Boeing Commercial Airplane Co., Seattle, Wash.

A SYSTEM FOR AERODYNAMIC DESIGN AND ANALYSIS OF SUPERSONIC AIRCRAFT. PART 1: GENERAL DESCRIPTION AND THEORETICAL DEVELOPMENT Final Report, Sep. 1978 - Aug. 1980

W. D. Middleton and J. L. Lundry Washington NASA Dec. 1980 101 p refs

(Contract NAS1-15534)

(NASA-CR-3351; D6-41840-1) Avail: NTIS HC A06/MF A01 CSCL 01A

An integrated system of computer programs was developed for the design and analysis of supersonic configurations. The system uses linearized theory methods for the calculation of surface pressures and supersonic area rule concepts in combination with linearized theory for calculation of aerodynamic force coefficients. R.C.T.

N81-14971*# Boeing Commercial Airplane Co., Seattle, Wash.

A SYSTEM FOR AERODYNAMIC DESIGN AND ANALYSIS OF SUPERSONIC AIRCRAFT. PART 3: COMPUTER PROGRAM DESCRIPTION Final Report, Sep. 1978 - Aug. 1980

W. D. Middleton, J. L. Lundry, and R. G. Coleman Washington NASA Dec. 1980 122 p refs

(Contract NAS1-15534)

(NASA-CR-3353; D6-41840-3) Avail: NTIS HC A06/MF A01 CSCL 01A

The computer program documentation for the design and analysis of supersonic configurations is presented. Schematics and block diagrams of the major program structure, together with subroutine descriptions for each module are included.R.C.T.

N81-14972*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

INVESTIGATION OF CONVERGENT-DIVERGENT NOZZLES APPLICABLE TO REDUCED-POWER SUPERSONIC CRUISE AIRCRAFT

Bobby L. Berrier and Richard J. Re Dec. 1980 218 p refs (NASA-TP-1766; L-13974) Avail: NTIS HC A10/MF A01 CSCL 01A

An investigation was conducted of isolated convergent-divergent nozzles to determine the effect of several design parameters on nozzle performance. Tests were conducted using high pressure air for propulsion simulation at Mach numbers from 0.60 to 2.86 at an angle of attack of 0 deg and at nozzle pressure ratios from jet off to 46.0. Three power settings (dry, partial afterburning, and maximum afterburning), three nozzle lengths, and nozzle expansion ratios from 1.22 to 2.24 were investigated. In addition, the effects of nozzle throat radius and a cusp in the external boattail geometry were studied. The results of this study indicate that, for nozzles operating near design conditions, increasing nozzle length increases nozzle thrust-minus-drag performance. Nozzle throat radius and an external boattail cusp had negligible effects on nozzle drag or internal performance. Author

N81-14973*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

BIBLIOGRAPHY OF SUPERSONIC CRUISE RESEARCH (SCR) PROGRAM FROM 1977 TO MID-1980

Sherwood Hoffman Dec. 1980 106 p

(NASA-RP-1063; L-13764) Avail: NTIS HC A06/MF A01 CSCL 01A

The supersonic cruise research (SCR) program, initiated in July 1972, includes system studies and the following disciplines: propulsion, stratospheric emission impact, structures and materials, aerodynamic performance, and stability and control. In a coordinated effort to provide a sound basis for any future consideration that may be given by the United States to the development of an acceptable commercial supersonic transport, integration of the technical disciplines was undertaken, analytical tools were developed, and wind tunnel, flight, and laboratory investigations were conducted. The present bibliography covers the time period from 1977 to mid-1980. It is arranged according to system studies and the above five SCR disciplines. There are 306 NASA reports and 135 articles, meeting papers, and company reports cited. E.D.K.

N81-14974*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LEADING-EDGE DEFLECTION OPTIMIZATION FOR A HIGHLY SWEPT ARROW WING CONFIGURATION

Paul L. Coe, Jr., Jarrett K. Huffman, and James W. Fenbert Dec. 1980 59 p refs

(NASA-TP-1777; L-13820) Avail: NTIS HC A04/MF A01 CSCL 01A

Tests were also conducted to determine the sensitivity of the lateral stability derivative C sub l sub beta to geometric anhedral. The optimized leading edge deflection was developed

by aligning the leading edge with the incoming flow along the entire span. Owing to the spanwise variation of upwash, the resulting optimized leading edge was a smooth, continuously warped surface. For the particular configuration studied, levels of leading edge suction on the order of 90 percent were achieved with the smooth, continuously warped leading edge contour. The results of tests conducted to determine the sensitivity of C sub l sub beta to geometric anhedral indicate values of delta C sub l sub beta/delta T which are in reasonable agreement with estimates provided by simple vortex lattice theories. T.M.

N81-14975*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

WIND-TUNNEL MEASUREMENTS AND COMPARISON WITH FLIGHT OF THE BOUNDARY LAYER AND HEAT TRANSFER ON A HOLLOW CYLINDER AT MACH 3

Robert L. Stallings, Jr., and Milton Lamb Dec. 1980 48 p refs

(NASA-TP-1789; L-14044) Avail: NTIS HC A03/MF A01 CSCL 01A

The wind tunnel tests were conducted both with and without boundary layer trips at Mach 3 and nominal free stream Reynolds numbers per meter ranging from 3.3 x 10 the 6th power. Instrumentation consisted of pressure orifices, thermocouples, a boundary layer pitot pressure rake, and a floating element skin friction balance. Measurements from both wind tunnel and flight were compared with existing engineering prediction methods. T.M.

N81-14976*# Detroit Diesel Allison, Indianapolis, Ind.

EXPERIMENTAL DETERMINATION OF UNSTEADY BLADE ELEMENT AERODYNAMICS IN CASCADES. VOLUME 2: TRANSLATION MODE CASCADE Final Report

R. E. Riffel and M. D. Rothrock Dec. 1980 183 p refs (Contract NAS3-20055)

(NASA-CR-165166; EDR-10361-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 01A

A two dimensional cascade of harmonically oscillating airfoils was designed to model a near tip section from a rotor which was known to have experienced supersonic translational model flutter. This five bladed cascade had a solidity of 1.52 and a setting angle of 0.90 rad. Unique graphite epoxy airfoils were fabricated to achieve the realistic high reduced frequency level of 0.15. The cascade was tested over a range of static pressure ratios approximating the blade element operating conditions of the rotor along a constant speed line which penetrated the flutter boundary. The time steady and time unsteady flow field surrounding the center cascade airfoil were investigated. Author

N81-14977*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FINITE ELEMENT ANALYSIS OF INVISCID SUBSONIC BOATTAIL FLOW

R. V. Chima and P. M. Gerhart (Akron Univ., Ohio) 1981 16 p refs Presented at the Nineteenth Aerospace Sci. Meeting, St. Louis, 12-15 Jan. 1981; sponsored by Am. Inst. of Aeronautics and Astronautics

(NASA-TM-81650; E-651) Avail: NTIS HC A02/MF A01 CSCL 01A

A finite element code for analysis of inviscid subsonic flows over arbitrary nonlifting planar or axisymmetric bodies is described. The code solves a novel primitive variable formulation of the coupled irrotationality and compressible continuity equations. Results for flow over a cylinder, a sphere, and a NACA 0012 airfoil verify the code. Computed subcritical flows over an axisymmetric boattailed afterbody compare well with finite difference results and experimental data. Interative coupling with an integral turbulent boundary layer code shows strong viscous effects on the inviscid flow. Improvements in code efficiency and extensions to transonic flows are discussed. Author

N81-14978*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SUPERSONIC STALL FLUTTER OF HIGH SPEED FANS

J. J. Adamczyk, W. Stevens, and R. Jutras (GE Co., Evendale, Ohio) 1981 15 p refs Proposed for presentation at 26th Ann. Intern. Gas Turbine Conf., Houston, 8-12 Mar. 1981; sponsored by Am. Soc. of Mech. Engr.

(NASA-TM-81613; E-612) Avail: NTIS HC A02/MF A01 CSCL 01A

An analytical model is developed for predicting the onset of supersonic stall bending flutter in axial flow compressors. The analysis is based on a modified two dimensional, compressible, unsteady actuator disk theory. It is applied to a rotor blade row by considering a cascade of airfoils whose geometry and dynamic response coincide with those of a rotor blade element at 85 percent of the span height (measured from the hub). The rotor blades are assumed to be unshrouded (i.e., free standing) and to vibrate in their first flexural mode. The effects of shock waves and flow separation are included in the model through quasi-steady, empirical, rotor total-pressure-loss and deviation-angle correlations. The actuator disk model predicts the unsteady aerodynamic force acting on the cascade blading as a function of the steady flow field entering the cascade and the geometry and dynamic response of the cascade. Calculations show that the present model predicts the existence of a bending flutter mode at supersonic inlet Mach numbers. This flutter mode is suppressed by increasing the reduced frequency of the system or by reducing the steady state aerodynamic loading on the cascade. The validity of the model for predicting flutter is demonstrated by correlating the measured flutter boundary of a high speed fan stage with its predicted boundary. This correlation uses a level of damping for the blade row (i.e., the log decrement of the rotor system) that is estimated from the experimental flutter data. The predicted flutter boundary is shown to be in good agreement with the measured boundary. Author

N81-14979*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOLUTION OF PLANE CASCADE FLOW USING IMPROVED SURFACE SINGULARITY METHODS

Eric R. McFarland 1981 14 p refs Presented for presentation at 26th Ann. Intern. Gas Turbine Conf., Houston 8-12 Mar. 1981; sponsored by Am. Soc. of Mech. Engr.

(NASA-TM-81589; E-568) Avail: NTIS HC A02/MF A01 CSCL 01A

A solution method was developed for calculating compressible inviscid flow through a linear cascade of arbitrary blade shapes. The method uses advanced surface singularity formulations which were adapted from those in current external flow analyses. The resulting solution technique provides a fast flexible calculation for flows through turbomachinery blade rows. The solution method and some examples of the method's capabilities are presented. Author

N81-14980*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FULL POTENTIAL SOLUTION OF TRANSONIC QUASI-3-D FLOW THROUGH A CASCADE USING ARTIFICIAL COMPRESSABILITY

C. Farrell and J. Adamczyk 1981 40 p refs Presented at 26th Ann. Intern. Gas Turbine Conf., Houston, Tex., 8-12 Mar. 1981; sponsored by ASME

(NASA-TM-81637; E-574) Avail: NTIS HC A03/MF A01 CSCL 01A

The three-dimensional flow in a turbomachinery blade row was approximated by correcting for streamtube convergence and radius change in the throughflow direction. The method is a fully conservative solution of the full potential equation incorporating the finite volume technique on body fitted periodic mesh, with an artificial density imposed in the transonic region to insure stability and the capture of shock waves. Comparison of results for several supercritical blades shows good agreement with their hodograph solutions. Other calculations for these profiles as well as standard NACA blade sections indicate that this is a useful scheme analyzing both the design and off-design performance of turbomachinery blading. T.M.

N81-14981*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL AERODYNAMIC CHARACTERISTICS OF TWO V/STOL FIGHTER/ATTACK AIRCRAFT CONFIGURATIONS AT MACH NUMBERS FROM 0.4 TO 1.4

Walter P. Nelms, Donald A. Durston, and J. R. Lummus (General Dynamics, Fort Worth, Tex.) Dec. 1980 529 p refs
(NASA-TM-81234; A-8338) Avail: NTIS HC A23/MF A01 CSCL 01A

A wind tunnel test was conducted to measure the aerodynamic characteristics of two horizontal attitude takeoff and landing V/STOL fighter/attack aircraft concepts. In one concept, a jet diffuser ejector was used for the vertical lift system; the other used a remote augmentation lift system (RALS). Wind tunnel tests to investigate the aerodynamic uncertainties and to establish a data base for these types of concepts were conducted over a Mach number range from 0.2 to 2.0. The present report covers tests, conducted in the 11 foot transonic wind tunnel, for Mach numbers from 0.4 to 1.4. Detailed effects of varying the angle of attack (up to 27 deg), angle of sideslip (-4 deg to +8 deg), Mach number, Reynolds number, and configuration buildup were investigated. In addition, the effects of wing trailing edge flap deflections, canard incidence, and vertical tail deflections were explored. Variable canard longitudinal location and different shapes of the inboard nacelle body strakes were also investigated. E.D.K.

N81-14983# National Aerospace Lab., Tokyo (Japan).

A METHOD FOR OBTAINING SHOCKLESS TRANSONIC FLOWS PAST AIRFOILS, PARTIALLY MODIFIED FROM A GIVEN ARBITRARY AIRFOIL

Masayoshi Nakamura Aug. 1980 25 p refs
(NAL-TR-602T) Avail: NTIS HC A02/MF A01

A method for obtaining shockless transonic flows past two dimensional airfoils is described. The methods of calculations of transonic flows are roughly classified into two groups: the direct method, which yields the transonic flows past given arbitrary airfoils; and the inverse method, which determines shapes of airfoils. In the former method, the shock waves normally exist in the region of transonic flows, and some numerical methods are already known. In the latter, transonic flows with given pressure distribution are calculated, and several analytical methods also exist. The method described is a combination of the direct method yield, the shockless transonic flows past airfoils which are partially modified from a given arbitrary airfoil. If one puts an arbitrary airfoil into a region of free stream flows with a comparatively large free stream Mach number, the shock waves generally exist. R.C.T.

N81-14984# National Aerospace Lab., Tokyo (Japan).

AN INVESTIGATION OF SUPPORT-INTERFERENCE EFFECTS

Noboru Hashimoto, Koichi Hozumi, Tadao Koyama, Akira Yoshizawa, and Takashi Matsuzaki Aug. 1980 28 p refs In ENGLISH and JAPANESE
(NAL-TR-622) Avail: NTIS HC A03/MF A01

Base pressure and pressure distribution on the sting surface in the flow having a free stream Mach number of 7.1 and a free stream Reynolds number based on the unit length from 0.2 x 10 to the 5th power to 2.0 to x 10 to the 5th power/cm were measured. The oil flow observation on the sting surface was made at the same time. Avoiding the strong base pressure rise caused by the effect of strut, the sting flare corner effect was investigated. The experimental results showed that the base pressure depends upon the Reynolds number and is affected by the interaction of the base recirculating flow and the separated flow around the sting flare corner. This effect of the sting flare corner becomes smaller as the length of the sting increases and the standard length of a sting which has a sufficiently minimal effect on the base pressure was obtained. In order to predict the base pressure of the sting mounted models, the correlation of the base pressure with local flow properties, immediately preceding the base, is discussed for those cases where there is little effect from the sting flare and strut. T.M.

N81-14985# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

THE VELOCITY INDUCED BY THE WAKE OF A WIND TURBINE IN A SHEAR LAYER, INCLUDING GROUND EFFECT

Bo C. A. Johansson 17 Sep. 1980 51 p refs
(Contract NE-5061-013)
(FFA-TN-HU-2189-pt-3; ISSN-0081-5640; FFA-133) Avail: NTIS HC A04/MF A01

The turbine was approximated by a disk area of continuous distributions of thrust and force parallel to the disk plane. Its wake was represented by a semi-infinite cylinder of distributed vorticity. A numerical example was calculated. The theory is based upon assumptions strictly valid only for small perturbations of the undisturbed flow. However, the results may have a wider range of applicability. T.M.

N81-14986# Flow Research, Inc., Los Angeles, Calif.

DEVELOPMENT OF FINITE-VOLUME METHODS FOR THREE-DIMENSIONAL TRANSONIC FLOWS

John E. Mercer, Wen-Huei Jou, David A. Caughey, Anthony Jameson, and David Nixon Aug. 1980 110 p refs
(Contract N00014-78-C-0079)
(AD-A090829; FLOW-RR-166) Avail: NTIS HC A06/MF A01 CSCL 20/4

This report covers the Phase II progress in a two phase effort to develop the full potential finite volume algorithm for transonic flow over wing-body configurations. The work included investigations of grid-generation schemes, extension of the wing-body code to more complex configurations, and the effects of vortex wake modeling. The wing-body code was used to analyze a computer designed military aircraft wing which had been wind tunnel tested. Computed results agree quite well with the experimental data. A second test case was also run for a business jet aircraft. Unfortunately, experimental data for the test case were not available for comparison. GRA

N81-14987# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF ACCIDENTS INVOLVING COMMUTER AIR CARRIERS AND ON-DEMAND AIR TAXI OPERATIONS, U.S. GENERAL AVIATION 1978

5 Aug. 1980 193 p
(PB81-101701; NTSB-AMM-80-11) Avail: NTIS HC A09/MF A01 CSCL 01B

Included are 55 commuter air carrier and 216 on demand air taxi accident briefs. The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident. Additional statistical information is tabulated by type of operation, injuries, aircraft weight, and causes(s) and related factor(s). T.M.

N81-14988# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.

COMMUTER AIRLINE SAFETY Special Study, 1970 - 1979

22 Jul. 1980 53 p refs
(PB81-104267; NTSB-AAS-80-1) Avail: NTIS HC A04/MF A01 CSCL 01B

A review of the predominant safety issues which effect the commuter airline industry and a review of the relationship of the Federal regulations to the commuter airlines are presented. The Safety Board developed the basis of the study from its 1972 special study of air taxis, the Board's accident statistics, and accident investigation experience and from an extensive field survey. The operational maintenance, training, and regulatory areas of the industry are discussed and safety deficiencies are analyzed. A number of safety recommendations to the FAA designed to enhance the commuter airline industry are presented. T.M.

N81-14989*# Ohio Univ., Athens. Avionics Engineering Center.

DC-TO-DC POWER SUPPLY FOR LIGHT AIRCRAFT FLIGHT TESTING

Stephen R. Yost Dec. 1980 7 p ref
(Grant NGR-39-009-017)
(NASA-CR-163850; TM-76) Avail: NTIS HC A02/MF A01 CSCL 17G

The power supply unit was developed to serve as the power source for a Loran-C receiver. The power supply can be connected directly to the aircraft's electrical system, and is compatible with

either 14 or 28 volt electrical systems. Design specifications are presented for the unit along with a description of the circuit design. T.M.

N81-14991*# California Polytechnic State Univ., San Luis Obispo.
FLIGHT EVALUATION OF THE TERMINAL GUIDANCE SYSTEM
Doral R. Sandlin 1981 65 p refs
(Grant NsG-4022)
(NASA-CR-163859) Avail: NTIS HC A04/MF A01 CSCL 17G

The terminal guidance system (TGS) is avionic equipment which gives guidance along a curved descending flight path to a landing. A Cessna 182 was used as the test aircraft and the TGS was installed and connected to the altimeter, DME, RMI, and gyro compass. Approaches were flown by three different pilots. When the aircraft arrives at the termination point, it is set up on final approach for a landing. The TGS provides guidance for curved descending approaches with guideslopes of 6 deg which required, for experienced pilots, workloads that are approximately the same as for an ILS. The glideslope is difficult to track within 1/2 n.m. of the VOR/DME station. The system permits, for experienced pilots, satisfactory approaches with a turn radius as low as 1/2 n.m. and a glideslope of 6 deg. Turn angles have little relation to pilot workload for curved approaches. Pilot experience is a factor for curved approaches. Pilots with low instrument time have difficulty flying steep approaches with small turn radius. Turbulence increases the pilot workload for curved approaches. The TGS does not correct to a given flight path over the ground nor does it adequately compensate for wind drift. E.D.K.

N81-14992# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugzeugsteuerung und -Regelung.
APPLICATED TECHNIQUES FOR THE CONTROL OF APPROACH TRAFFIC
Albrecht Seyfried (Tech. Univ., Brunswick), Manfred Schubert, and Uwe Voelckers (Tech. Univ., Brunswick) Oct. 1979 31 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-668)
(DFVLR-Mitt-79-20) Avail: NTIS HC A02/MF A01

The achievement of a regular distributed aircraft arrival rate at the TM borders and the smooth integration of different flows of traffic are the main objects of flow control in the approach area. With respect to these goals some fundamental flow control measures normally being applied in a selected near terminal area were investigated by the analysis of real traffic recordings as well as by controller interviews. The effects of certain flow control principles on the entry and exit distribution and on the further evolution of traffic within the TMA are explained. Finally it is discussed to which degree such different flow control techniques should be considered in a future computer assisted ATC system. Author

N81-14993*# Lockheed-Georgia Co., Marietta.
A SURVEY OF NEW TECHNOLOGY FOR COCKPIT APPLICATION TO 1990'S TRANSPORT AIRCRAFT SIMULATORS Final Report, Jul. 1979 - Jan. 1980
A. P. Holt, Jr., D. O. Noneaker, and L. Walthour Dec. 1980 118 p refs
(Contract NAS1-15546)
(NASA-CR-159330; LG81ER0074) Avail: NTIS HC A06/MF A01 CSCL 01C

Two problems were investigated: inter-equipment data transfer, both on board the aircraft and between air and ground; and crew equipment communication via the cockpit displays and controls. Inter-equipment data transfer is discussed in terms of data bus and data link requirements. Crew equipment communication is discussed regarding the availability of CRT display systems for use in research simulators to represent flat panel displays of the future, and of software controllable touch panels. T.M.

N81-14994*# Lockheed-Georgia Co., Marietta.
ADVANCED FLIGHT DECK/CREW STATION SIMULATOR FUNCTIONAL REQUIREMENTS Final Report, Oct. 1979 - Feb. 1980
R. L. Wall, J. L. Tate, and M. J. Moss Dec. 1980 145 p refs
(Contract NAS1-15546)
(NASA-CR-159331; LG80ER0035) Avail: NTIS HC A07/MF A01 CSCL 01C

This report documents a study of flight deck/crew system research facility requirements for investigating issues involved with developing systems, and procedures for interfacing transport aircraft with air traffic control systems planned for 1985 to 2000. Crew system needs of NASA, the U.S. Air Force, and industry were investigated and reported. A matrix of these is included, as are recommended functional requirements and design criteria for simulation facilities in which to conduct this research. Methods of exploiting the commonality and similarity in facilities are identified, and plans for exploiting this in order to reduce implementation costs and allow efficient transfer of experiments from one facility to another are presented. Author

N81-14995# Oak Ridge Y-12 Plant, Tenn.
F-111 WINDSCREEN MACHINING Final Report
H. L. Gerth and R. J. Brown 22 Sep. 1980 22 p refs
(Contract W-7405-eng-26)
(Y-2232) Avail: NTIS HC A02/MF A01

The feasibility of improving the optical image transmitted through a military aircraft windscreen by using single-point diamond turning is studied. Reduced warpage (waviness) of the windscreen surfaces ensures that a more accurate optical image is presented to the aircraft pilot. Machining the acrylic surface was accomplished with slightly impared image transmissibility. The use of this technique as a potential production process is discussed. DOE

N81-14996*# New Mexico Univ., Albuquerque. Technology Application Center.
REMOTELY PILOTED VEHICLES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1980
Samuel C. Mauk Sep. 1980 59 p Supersedes NTIS/PS-79/0875/9 Sponsored in part by NASA and NTIS
(NASA-CR-163864; NTIS/PS-79/0875/9; PB80-815921) Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

These citations from the international literature cover various aspects of remotely piloted vehicles. Included are articles concerning aircraft design, flight tests, aircraft control, cost effectiveness, automatic flight control, automatic pilots, and data links. Civil aviation applications are included, although military uses of remotely piloted vehicles are stressed. This updated bibliography contains 224 citations, 43 of which are new additions to the previous edition. GRA

N81-14997*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATOR STUDY OF CONVENTIONAL GENERAL AVIATION INSTRUMENT DISPLAYS IN PATH-FOLLOWING TASKS WITH EMPHASIS ON PILOT-INDUCED OSCILLATIONS
James J. Adams Dec. 1980 55 p refs
(NASA-TP-1776; L-13785) Avail: NTIS HC A04/MF A01 CSCL 01D

A study of the use of conventional general aviation instruments by general aviation pilots in a six degree of freedom, fixed base simulator was conducted. The tasks performed were tracking a VOR radial and making an ILS approach to landing. A special feature of the tests was that the sensitivity of the displacement indicating instruments (the RMI, CDI, and HSI) was kept constant at values corresponding to 5 n. mi. and 1.25 n. mi. from the station. Both statistical and pilot model analyses of the data were made. The results show that performance in path following improved with increases in display sensitivity up to the highest sensitivity tested. At this maximum test sensitivity, which corresponds to the sensitivity existing at 1.25 n. mi. for the ILS glide slope transmitter, tracking accuracy was no better

than it was at 5 n. mi. from the station and the pilot aircraft system exhibited a marked reduction in damping. In some cases, a pilot induced, long period unstable oscillation occurred. Author

N81-14998* Beam Engineering, Inc., Sunnyvale, Calif.
STATIC SOURCE LOCATIONS FOR FOUR NOZZLES MOUNTED ON A J-85 ENGINE Final Report
Leif E. Hoglund Jan. 1979 236 p refs
(Contract NAS2-9399)
(NASA-CR-152401) Avail: NASA. Ames Research Center CSCL 21E

The test nozzles included a round 17.5 in. diameter variable flap ejector (VFE) nozzle, a round 'stovepipe' nozzle, and a 104 tube suppressor nozzle operated both with and without an ejector shroud. The velocities tested ranged from 600 to 1600 fps at an approximate total temperature of 1400 R. The axial position of the noise sources during static operation was determined by jet velocity, Strouhal number, and direction of propagation. The velocity dependence was more evident for the 104 tube suppressor nozzle than for the conical nozzles tested. The results for both the VFE conical nozzle and the stovepipe conical nozzle indicate source locations to be much closer to the jet exit plane than expected. Corrections for near field effects were found to differ slightly for each nozzle tested. The corrections presented are simply the differences between the measured near field levels and the required near field levels if spherical spreading is assumed from source to far field. Author

N81-14999* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURVED CENTERLINE AIR INTAKE FOR A GAS TURBINE ENGINE Patent
William C. Ruehr (GE, Cincinnati), James L. Younghans (GE, Cincinnati), and Edwin B. Smith, inventors (to NASA) (GE, Cincinnati) Issued 2 Sep. 1980 6 p Filed 14 May 1979 Sponsored by NASA
(NASA-Case-LEW-13201-1; US-Patent-4,220,171; US-Patent-Appl-SN-038980; US-Patent-Class-137-15.1; US-Patent-Class-181-214) Avail: US Patent and Trademark Office CSCL 21E

An inlet for a gas turbine engine was disposed about a curved centerline for the purpose of accepting intake air that is flowing at an angle to engine centerline and progressively turning that intake airflow along a curved path into alignment with the engine. This curved inlet is intended for use in under the wing locations and similar regions where airflow direction is altered by aerodynamic characteristics of the airplane. By curving the inlet, aerodynamic loss and acoustic generation and emission are decreased.

Official Gazette of the U.S. Patent and Trademark Office

N81-15000*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT EVALUATION OF A SIMPLIFIED GROSS THRUST CALCULATION TECHNIQUE USING AN F100 TURBOFAN ENGINE IN AN F-15 AIRPLANE
Frank J. Kurtenbach and Frank W. Burcham, Jr. Jan. 1981 21 p refs
(NASA-TP-1782; H-1118) Avail: NTIS HC A02/MF A01 CSCL 21E

A simplified gross thrust calculation technique was evaluated in flight tests on an F-15 aircraft using prototype F100-PW-100 engines. The technique relies on afterburner duct pressure measurements and empirical corrections to an ideal one-dimensional analysis to determine thrust. In-flight gross thrust calculated by the simplified method is compared to gross thrust calculated by the engine manufacturer's gas generator model. The evaluation was conducted at Mach numbers from 0.6 to 1.5 and at altitudes from 6000 meters to 13,700 meters. The flight evaluation shows that the simplified gross thrust method and the gas generator method agreed within plus or minus 3 percent. The discrepancies between the data generally fell within an uncertainty band derived from instrumentation errors and recording system resolution. A.R.H.

N81-15001*# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
APPLICATION OF THE MNA DESIGN METHOD TO A NONLINEAR TURBOFAN ENGINE Final Report
Gary Leininger Jan. 1981 107 p refs
(Grant NsG-3171)
(NASA-CR-163855) Avail: NTIS HC A06/MF A01 CSCL 21E

Using nonlinear digital simulation as a representative model of the dynamic operation of the QCSEE turbofan engine, a feedback control system is designed by variable frequency design techniques. Transfer functions are generated for each of five power level settings covering the range of operation from approach power to full throttle (62.5% to 100% full power). These transfer functions are then used by an interactive control system design synthesis program to provide a closed loop feedback control using the multivariable Nyquist array and extensions to multivariable Bode diagrams and Nichols charts. A.R.H.

N81-15003*# Spectron Development Labs., Inc., Costa Mesa, Calif.
FUEL INJECTOR CHARACTERIZATION STUDIES Final Report
Michael J. Houser and William D. Bachalo Oct. 1980 54 p refs
(Contract NAS3-21288)
(NASA-CR-165200; SDL-80-2122-13F) Avail: NTIS HC A04/MF A01 CSCL 21E

The atomization of several general aviation piston engine manifold port fuel injectors was investigated. The injectors were installed in a test rig and operated under simulated conditions. Laser interferometric techniques were used to optically probe the spray droplet fields for droplet size and velocity at numerous spatial locations throughout the field. R.C.T.

N81-15004*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
AERODYNAMIC STABILITY ANALYSIS OF NASA J85-13/PLANAR PRESSURE PULSE GENERATOR INSTALLATION
K. Chung, W. M. Hosny, and W. G. Steenken Nov. 1980 168 p refs
(Contract NAS3-21259)
(NASA-CR-165141; R80AEG429) Avail: NTIS HC A08/MF A01 CSCL 21E

A digital computer simulation model for the J85-13/Planar Pressure Pulse Generator (P3 G) test installation was developed by modifying an existing General Electric compression system model. This modification included the incorporation of a novel method for describing the unsteady blade lift force. This approach significantly enhanced the capability of the model to handle unsteady flows. In addition, the frequency response characteristics of the J85-13/P3G test installation were analyzed in support of selecting instrumentation locations to avoid standing wave nodes within the test apparatus and thus, low signal levels. The feasibility of employing explicit analytical expression for surge prediction was also studied. J.M.S.

N81-15005*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
TF34 ENGINE COMPRESSION SYSTEM COMPUTER STUDY
W. M. Hosny and W. G. Steenken Jun. 1979 93 p refs
(Contract NAS3-20599)
(NASA-CR-159889; R78AEG612) Avail: NTIS HC A05/MF A01 CSCL 21E

The stability of the fan and the compressor components was examined individually using linearized and time dependent, one dimensional stability analysis techniques. The stability of the fan core integrated compression system was investigated using a two dimensional compression system model. The analytical equations on which this model was based satisfied the mass, axial momentum, radial momentum, and energy conservation equations for flow through a finite control volume. The results gave an accurate simulation of the flow through the compression system. The speed lines of the components were

reproduced: the points of instability were accurately predicted; the locations where the instability was initiated in the fan and the core were indicated; and the variation of the bypass ratio during flow throttling was calculated. The validity of the analytical techniques was then established by comparing these results with test data and with results obtained from the steady state cycle deck. J.M.S.

N81-15006*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

COST/BENEFIT ANALYSIS OF ADVANCED MATERIALS TECHNOLOGIES FOR FUTURE AIRCRAFT TURBINE ENGINES Final Report

G. E. Stephens Aug. 1980 49 p refs
(Contract NAS3-20072)
(NASA-CR-165225; PWA-5755) Avail: NTIS HC A03/MF A01 CSCL 21E

The materials technologies studied included thermal barrier coatings for turbine airfoils, turbine disks, cases, turbine vanes and engine and nacelle composite materials. The cost/benefit of each technology was determined in terms of Relative Value defined as change in return on investment times probability of success divided by development cost. A recommended final ranking of technologies was based primarily on consideration of Relative *Values with secondary consideration given to changes in other* economic parameters. Technologies showing the most promising cost/benefits were thermal barrier coated temperature nacelle/ engine system composites. T.M.

N81-15007# Texas Univ. at Arlington.. Dept. of Aerospace Engineering.

A PURE DIRECT FORCE/MOMENT CONTROL FOR COAXIAL COUNTERROTATING ROTORS

Aspi Rustom Wadia (AiResearch Mfg. Co., Phoenix, Ariz.) and Jack E. Fairchild [1980] 19 p refs
Avail: NTIS HC A02/MF A01

A simple first harmonic analysis using Fourier series is presented for the control of rigid coaxial and counterrotating helicopter rotors in hover. It it shown that by a particular combination of cyclic controls on each rotor, pure moments or forces can be generated in any direction. Such controls could give the helicopter maneuvering capabilities not possible in conventional machines. An elementary cockpit control configuration is suggested to implement the control strategy. E.D.K.

N81-15009# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

THE RESONANCE FREQUENCIES OF VENTILATED WIND TUNNELS

D. G. Mabey London Apr. 1978 52 p refs Supersedes RAE-TR-78038; ARC-37974
(ARC-R/M-3841; BR73233; RAE-TR-78038; ARC-37974) Avail: NTIS HC A04/MF A01; HMSO £8 PHI

Experiments suggest that the theory widely used to predict the transverse resonance frequencies in slotted tunnels is in error in the Mach number range from 0 to 0.5. One reason for the error is that the theory is based on an unrepresentative wall boundary condition. Moreover, the theory implies that the plenum chamber surrounding the working section is large, whereas the plenum chamber depth is generally less than twice the tunnel height. An improved theory was developed, which shows that the resonance frequencies of ventilated tunnels are influenced by the depth of the plenum chamber for Mach numbers up to about M = 0.6. Although the theory is approximate, it agrees well with experiments for slotted and perforated walls (with both normal and 60 deg inclined holes). The results are consistent with other experiments which show that plenum chamber design can influence the flow unsteadiness within the working section of a ventilated tunnel. Author

N81-15072# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Centrale.

THE RESISTANCE OF TANK PROTECTIVE MEASURES TO MICROORGANISMS [RESISTANCE DES PROTECTIONS DE FONDS DE RESERVOIRS AUX MICROORGANISMES]

G. Dallemagne Paris 16 Sep. 1980 18 p refs In FRENCH Presented at 4eme Journees du Vieillissement des Polymeres, Station de Bandol, 19 Sep. 1980
(SNIAS-801-551-107) Avail: NTIS HC A02/MF A01

Various paints, pigments, and varnishes were studied to determine their effectiveness in protecting JPI/H2O against biocontamination by Cladiosporium resinae. In order of decreasing resistance, they were found to be: (1) PU: a varnish polymerized at 60 C and promers inhibited by ZnCrO4 and SrCrO4; (2) a cured epoxy/amine primer, inhibited by BaCrO4; and (3) epoxide/amide and epoxide/amine-amide primers inhibited by SrCrO4. Of the systems examined, it is advisable not to use NBR varnish, with and without inhibitors, and epoxide/amine-amide primers inhibited by BaCrO4 in biodeteriorating milieu. Transl. by A.R.H.

N81-15148# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Development Div.

TOOL FORCE EVALUATION OF LATHE MACHINED HIGH EXPLOSIVES

Gary L. Flowers Apr. 1980 44 p
(Contract DE-AC04-76DP-00487)
(MHSMP-80-20; Endeavor-302) Avail: NTIS HC A03/MF A01

A procedure to determine the effects of machining properties upon tool forces encountered during lathe machining of high explosives is evaluated. Transducers fit between the tool holder and the tool post and interface to existing signal conditioners. All forces on the cutter were evaluated during machining of two types of high explosives at four cutter radii, four feed rates, three depths of cut, and two cutting speeds. Findings indicate that the transducer design is inadequate to allow accurate force vector separation at all reasonable attack angles. Problems concerning instrument drift, tool chatter, and detection levels are also found. M.G.

N81-15156# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.

HEAVE INSTABILITIES OF AMPHIBIOUS AIR CUSHION SUSPENSION SYSTEMS

M. J. Hinchey Nov. 1980 135 p refs Sponsored by Transport Canada Research and Development Centre and National Research Council of Canada
(UTIAS-246; ISSN-0082-5255) Avail: NTIS HC A07/MF A01

Attempts to ascertain the accuracy with which analytical models can be used to predict the onset of heave instabilities are described with emphasis on relatively simple configurations in which important effects are uncoupled. For the basic element of multicell systems, even relatively short supply ducting can have a very large effect, especially at low flows or hover-gaps where the duct-cushion system tends to behave as a Helmholtz resonator. For loop and segment systems, it is concluded that duct effects would be small. Internal flow effects associated with jets and vortices within the basic cushion volume are shown to be relatively unimportant at practical flow rates, although they are important at very high flow rates. Nonlinear phenomena, and procedures for controlling or quenching limit cycle amplitudes are explored. Suggestions for future work are included. A.R.H.

N81-15310# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. of Computational Fluid Dynamics.

COMPUTATIONAL FLUID DYNAMICS, VOLUME 2

1980 380 p refs Lecture held in Rhode-Saint-Genese, Belgium, 24-28 Mar. 1980 2 Vol.
(VKI-LS-1980-5-Vol-2) Avail: NTIS HC A17/MF A01

Several aspects of computational fluid dynamics are discussed. Theoretical methods are developed for computing the aerodynamic flow of aircraft configurations.

N81-15311# Jenkins (Gwilym) and Partners Ltd., Lancaster (England).

AN ECONOMIC AND VERSATILE PANEL METHOD FOR AIRCRAFT AND AIRCRAFT/STORE CONFIGURATIONS.

AN OUTLINE OF THE PRINCIPAL FEATURES OF THE MATHEMATICAL MODELING AND NUMERICAL IMPLEMENTATION OF THE BRITISH AEROSPACE (WARTON) MK II PANEL METHOD

W. G. Semple *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1980 70 p refs Prepared in cooperation with British Aerospace Aircraft Group, Preston, England

Avail: NTIS HC A17/MF A01

The principal features of the mathematical modeling and numerical implication of the MK 11 panel method are outlined. The geometric structure, conventions and terminology of MK11 are given. The method of solution of the linear equations for the source and doublet weights are described. A brief review of results from the method is given and the possible avenues of future development are summarized. R.C.T.

N81-15313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VORTEX METHODS FOR TWO- AND THREE-DIMENSIONAL FLOW SIMULATIONS

A. Leonard *In* Von Karman Inst. for Fluid Dyn. Computational Fluid Dyn., Vol. 2 1980 52 p refs

Avail: NTIS HC A17/MF A01

The point vortex and vortex blob methods for two dimensional flows are presented. Several results are discussed concerning the numerical analysis of the latter scheme, e.g., the preservation of globally conserved quantities and the analysis of the spatial discretization error resulting from the convection of fixed blobs of vorticity. An application to the two dimensional mixing layer is briefly described. The contour dynamics method is also discussed. The simulation of three dimensional flows with vortex methods is discussed. A natural way to represent the vorticity is in the form of closed tubes of filaments of vorticity, although other schemes are examined. Applications to aircraft trailing vortices and to a turbulent spot in a laminar boundary layer are presented. Hybrid schemes that use an Eulerian mesh to solve the Poisson equation for the velocity field are discussed. The goal of these schemes is to avoid the high cost of the Biot-Savart integration if many vortex elements are used while enjoying most of the advantages of pure Lagrangian schemes. R.C.T.

N81-15362 Texas A&M Univ., College Station.

PROBABILISTIC ANALYSIS OF FOUNDATION FORCES FOR A CLASS OF UNBALANCED ROTATING MACHINES Ph.D. Thesis

Lola Boyce 1980 105 p

Avail: Univ. Microfilms Order No. 8101577

The rotor-housing is modeled as a three degree-of-freedom system wherein the principal modes of vibration are a vertical translation in the direction of the machine supports and a rolling and pitching motion of the rotor. The equations of motion for the system are derived using analytical methods, solved, and related to the foundation force. For a selected machine class, all parameters are constant except for rotor mass eccentricity, the distance from the center of mass of the rotating mass to the bearing axis. The deterministic analysis requires the selection of some representative value of eccentricity from the data available for a number of rotors. The corresponding foundation force is calculated. No measure of the error associated with the foundation force is available. The probabilistic analysis requires the calculation of the mean value of the foundation force and includes some measure for its error. The classical probabilistic method accounts for foundation force error by employing the propagation of errors formula to calculate variance. Dissert. Abstr.

N81-15397*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECTS OF ANGLE OF ATTACK AND VENTRAL FIN ON TRANSONIC FLUTTER CHARACTERISTICS OF AN ARROW-WING CONFIGURATION

Robert V. Doggett and Rodney A. Ricketts Dec. 1980 29 p (NASA-TM-81914; L-14114) Avail: NTIS HC A03/MF A01 CSCL 20K

Experimental transonic flutter results are presented for a simplified 1/50 size, aspect ratio 1.77, wind tunnel model of an arrow wing design. Flutter results are presented for two configurations; namely, one with and one without a ventral fin mounted at the 0.694 semispan station. Results are presented for both configurations trimmed to zero lift and in a lifting condition at angles of attack up to 4 deg. The results show that the flutter characteristics of both configurations are similar to those usually observed. Increasing angle of attack reduces the flutter dynamic pressure by a small amount (about 13 percent maximum) for both configurations. The addition of the fin to the basic wing increases the flutter dynamic pressure. Calculated results for both configurations in the nonlifting condition obtained by using subsonic doublet lattice unsteady aerodynamic theory correlate reasonably well with the experimental results. Calculated results for the basic wing obtained by using subsonic kernal function unsteady aerodynamic theory did not agree as well with the experimental data. Author

N81-15401# Instituut TNO voor Werktuigkundige Constructies, Delft (Netherlands).

EXPERIMENTAL ANALYSIS AND METHODS TO DETERMINE THE DYNAMIC BEHAVIOR OF PROPULSION SHAFTING SYSTEMS

L. J. Wevers *In* Ned. Akoestisch Genootschap Vibration Tech. Jan. 1980 p 13-35 refs In DUTCH; ENGLISH summary

Avail: NTIS HC A03/MF A01

The dynamic bending properties of propeller shaftings were investigated. Measurements were taken at a full size laboratory facility and onboard ships. The aim of the measurements was to verify the results of a numerical calculation method with a finite element program developed to face lateral vibration problems in an early stage of the design of a ship's propulsion system. R.C.T.

N81-15414# Westinghouse Electric Corp., Concordville, Pa. Combustion Turbine Systems Div.

COMPRESSOR CONFIGURATION AND DESIGN OPTIMIZATION FOR THE HIGH RELIABILITY GAS TURBINE Final Report

R. E. Strong Sep. 1980 128 p refs

(Contract DE-AC03-79ET-15332)

(DOE/ET-15332/T1) Avail: NTIS HC A07/MF A01

An advanced compressor for use in the high reliability combustion turbine engine was investigated. Advanced design concepts based on low aspect ratio aircraft engine compressor technology were utilized to define three compressor configurations with 11, 13 and 15 stages. The results were applied to compressors with 14:1 pressure ratio, 800 lbs/sec (360 kg/sec) airflow and operating at 3600 rpm to match the requirements of heavy duty power generation combustion turbine engines. Typical, front, middle and last stages of these three compressors were studied to evaluate their aerodynamic and mechanical feasibility and to determine the influence of the number of stages, and stage loadings on their overall efficiency. The 11 stage compressor was selected for further mechanical analysis to verify its structural constraints and define in greater detail its mechanical configuration. Cost of this compressor was estimated for comparison with the present 19 stage high reliability reference compressor derived from the Westinghouse W-501 engine. R.C.T.

N81-15467# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.

ROTOR MODEL FOR VERIFICATION OF COMPUTATION METHODS [ROTORMODELL ZUR VERIFIZIERUNG VON RECHENVERFAHREN]

J. H. Argyris, W. Aicher, F. Karl, W. Kuemmerle, and M. Mueller 1979 58 p refs In GERMAN; ENGLISH summary

(Contract BMFT-ET-4086-A)

(ISD-262; ISSN-0170-6071) Avail: NTIS HC A04/MF A01

In order to prove the quality of idealization and the validity of computation for windmills, a driven model of a windmill with a 7.4 m diameter rotor was constructed. New data acquisition and data transmission systems with 16 channels and digitization

in the rotating system were developed and tested. The dynamic response of the rotor blades to the cyclic loading of gravity was taken to compare measurements and computations. For the measurements and evaluation which were performed by a measurement system and a computer, the necessary software was built. T.M.

N81-15579*# National Aeronautics and Space Administration, Washington, D. C.
THE ANNOYANCE CAUSED BY NOISE AROUND AIRPORTS Final Report
Josse Jul. 1980 114 p refs Transl. into ENGLISH of "la Gene causee par le Bruit Autour des Aeroports" Rept. D.G.R.S.T./C.S.T.B.-63-FR-138 Centre Sci. et Tech. du Batiment, Paris, 1 Mar. 1968 p 1-219 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75784; DGRST/CSTB-63-FR-138) Avail: NTIS HC A06/MF A01 CSCL 13B

A comprehensive study of noise around selected airports in France was performed. By use of questionnaires, the degree of annoyance caused by aircraft noise was determined. Three approaches used in the study were: (1) analytical study on the influence of noise on sleep; (2) sociological study on the satisfaction of occupants of buildings which conform to laws which are supposed to guarantee sufficient comfort; and (3) statistical study of correlations between external noises and psychological and pathological disturbances in residences. E.D.K.

N81-15580# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
AIRCRAFT ANNOYANCE EVALUATIONS USING FIELD AND LABORATORY SIMULATION TECHNIQUES
G. W. Johnston and A. A. Haasz Dec. 1980 60 p refs Sponsored in part by Transport Canada
(UTIAS-248; ISSN-0082-5255) Avail: NTIS HC A04/MF A01

A series of aircraft noise annoyance evaluation tests were performed under controlled conditions in a laboratory. Jurors drawn from nominal 30-35 NEF zones were exposed to aircraft noise events previously recorded near their homes in the vicinity of the Toronto International and Oshawa General Aviation Airports. Comparison of test results indicates that under optimum simulation conditions both Toronto and Oshawa observers consistently rate the International Airport noise exposure as considerably more disturbing/annoying than that at the General Aviation Airport sites. The laboratory test results were also compared with conventional field interview annoyance data obtained for the same group of jurors in a previous study conducted by McMaster University. Author

N81-15648*# New Mexico Univ., Albuquerque. Technology Application Center.
LIGHTNING. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1980
Samuel C. Mauk Sep. 1980 73 p Supersedes NTIS/PS-79/0832/0 Sponsored in part by NASA and NTIS
(NASA-CR-163857; PB80-815947) Copyright. Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

These citations from the international literature concern various aspects of lightning. Articles covering aircraft hazards, aircraft safety, radio meteorology, circuit protection, electromagnetic pulses, and electromagnetic radiation are included. Articles concerning atmospheric electricity and thunderstorms are stressed. This updated bibliography contains 304 citations, 95 of which are new additions to be previous edition. GRA

N81-15649*# New Mexico Univ., Albuquerque. Technology Application Center.
CLEAN AIR TURBULENCE. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jul. 1980
Samuel C. Mauk Sep. 1980 61 p Supersedes NTIS/PS-79/0858/5 Sponsored by NASA and NTIS
(NASA-CR-163863; PB80-815889; NTIS/PS-79/0858/5) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

These citations from the international literature describe all aspects of clear air turbulence (CAT). Articles covering research and analysis, theories and experiments, detection and measurement equipment, simulation modeling, and CAT accidents involving aircraft are included. This updated bibliography contains 237 citations, 116 of which are new additions to the previous edition. GRA

N81-15702*# Duke Univ., Durham, N. C. Dept. of Computer Sciences.
VALIDATION METHODS RESEARCH FOR FAULT-TOLERANT AVIONICS AND CONTROL SYSTEMS SUB-WORKING GROUP MEETING. CARE 3 PEER REVIEW
Kishor S. Trivedi, ed. and James B. Clary, ed. (Research Triangle Inst., Research Triangle Park, N.C.) Dec. 1980 30 p refs Meeting held at Research Triangle Park, N.C., 15-16 Sep. 1980 (Grant NAG1-70)
(NASA-CP-2167; L-14215) Avail: NTIS HC A03/MF A01 CSCL 12A

A computer aided reliability estimation procedure (CARE 3), developed to model the behavior of ultrareliable systems required by flight-critical avionics and control systems, is evaluated. The mathematical models, numerical method, and fault-tolerant architecture modeling requirements are examined, and the testing and characterization procedures are discussed. Recommendations aimed at enhancing CARE 3 are presented; in particular, the need for a better exposition of the method and the user interface is emphasized. M.G.

N81-15729# Computer Sciences Corp., Orlando, Fla.
COMPUTER GENERATED IMAGERY (CGI) CURRENT TECHNOLOGY AND COST MEASURES FEASIBILITY STUDY Final Technical Report, 22 Apr. - 26 Sep. 1980
Leonard T. Suminski, Jr. and Paul H. Hulin 26 Sep. 1980 189 p refs
(Contract N61339-79-D-0008)
(AD-A091636; CSC/TR-80/6008; PM-TRADE-RE-0012) Avail: NTIS HC A09/MF A01 CSCL 09/2

The primary purpose of this report is to determine the feasibility of developing a cost/performance, cost estimating model for CGI visual systems. In doing so, vendor surveys were made and an analysis of current and future technology/techniques was conducted. The report makes recommendations for some costing efforts to be conducted by PMTRADE, along with recommendations for other efforts. GRA

N81-15768*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF PRESSURE SPECTRA MEASUREMENTS IN A DUCTED COMBUSTION SYSTEM Ph.D. Thesis - Toledo Univ.
Jeffrey Hilton Miles Nov. 1980 138 p refs
(NASA-TM-81583; E-558) Avail: NTIS HC A07/MF A01 CSCL 20A

Combustion noise propagation in an operating ducted liquid fuel combustion system is studied in relation to the development of combustion noise prediction and suppression techniques. The presence of combustor emissions in the duct is proposed as the primary mechanism producing the attenuation and dispersion of combustion noise propagating in an operating liquid fuel combustion system. First, a complex mathematical model for calculating attenuation and dispersion taking into account mass transfer, heat transfer, and viscosity effects due to the presence of liquid fuel droplets or solid soot particles is discussed. Next, a simpler single parameter model for calculating pressure auto-spectra and cross-spectra which takes into account dispersion and attenuation due to heat transfer between solid soot particles and air is developed. Then, auto-spectra and cross-spectra obtained from internal pressure measurements in a combustion system consisting of a J-47 combustor can, a spool piece, and a long duct are presented. Last, analytical results obtained with the single parameter model are compared with

the experimental measurements. The single parameter model results are shown to be in excellent agreement with the measurements. J.M.S.

N81-15769*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

IMPROVED METHODS FOR FAN SOUND FIELD DETERMINATION

D. E. Cicon, T. G. Sofrin, and D. C. Mathews Jan. 1981 180 p refs

(Contract NAS3-21391)

(NASA-CR-165188; PWA-5635-43) Avail: NTIS HC A09/MF A01 CSCL 20A

Several methods for determining acoustic mode structure in aircraft turbofan engines using wall microphone data were studied. A method for reducing data was devised and implemented which makes the definition of discrete coherent sound fields measured in the presence of engine speed fluctuation more accurate. For the analytical methods, algorithms were developed to define the dominant circumferential modes from full and partial circumferential arrays of microphones. Axial arrays were explored to define mode structure as a function of cutoff ratio, and the use of data taken at several constant speeds was also evaluated in an attempt to reduce instrumentation requirements. Sensitivities of the various methods to microphone density, array size and measurement error were evaluated and results of these studies showed these new methods to be impractical. The data reduction method used to reduce the effects of engine speed variation consisted of an electronic circuit which windowed the data so that signal enhancement could occur only when the speed was within a narrow range. T.M.

N81-15819*# Institut Franco-Allemand de Recherches, St. Louis (France).

APPLICATION OF OPTICAL METHODS TO THE STUDY OF JET NOISE AND TURBULENCE [APPLICATION DES METHODES OPTIQUES, EN PARTICULIER A L'ETUDE DE LA TURBULENCE ET DU BRUIT DES JETS]

P. G. Sava and J. Haertig 1 Aug. 1980 16 p refs In FRENCH Presented at Journees sur les Methodes Optiques a la Mecanique des Fluides, Orsay, France, 26-27 Nov. 1979

(ISL-CO-201/80) Avail: NTIS HC A02/MF A01

Optical methods are generally applied in fluid mechaics for either visualization or measurement. The use of a laser anemometer to study flow velocity in a jet and its relaton to the sound radiated is described. The same acoustic emission phenomenon is also measued by combining the signals from four Schlieren systems with that from an interferometer. The use of an optical Fourier transformation approach with real time analysis to determine the spatio-temporal structure of a field of mass volume such as a waveguide or free jet is also examined.

Transl. by A.R.H.

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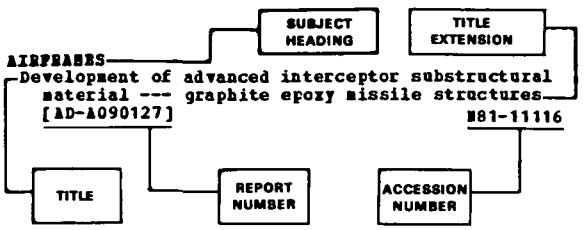

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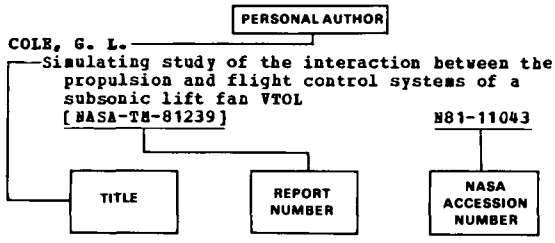

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