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AERONAUTICAL ENGINEERING

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WITH INDEXES

Supplement 34

AUGUST 1973

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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NASA SP-7037(34)

AERONAUTICAL ENGINEERING

A Special Bibliography

Supplement 34

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 July 1973 in

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

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INTRODUCTION

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

This supplement to *Aeronautical Engineering—A Special Bibliography* (NASA SP-7037) lists 462 reports, journal articles, and other documents originally announced in July 1973 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* or *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.

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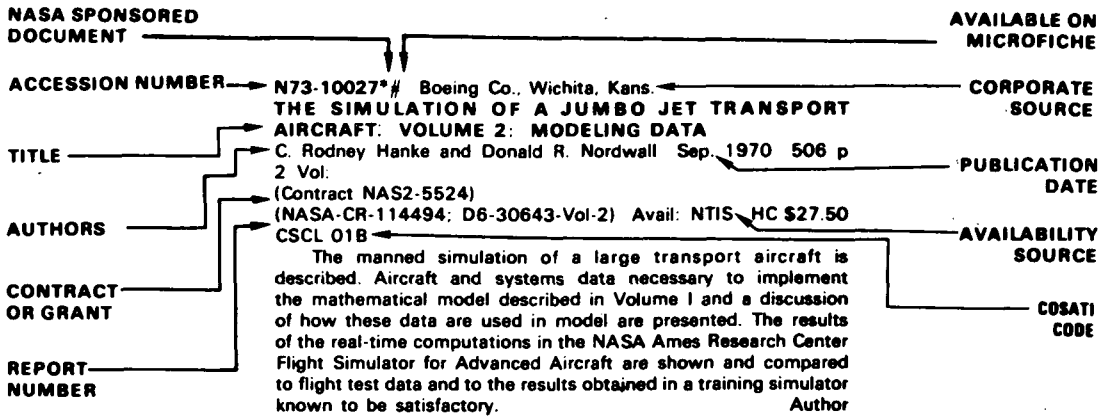

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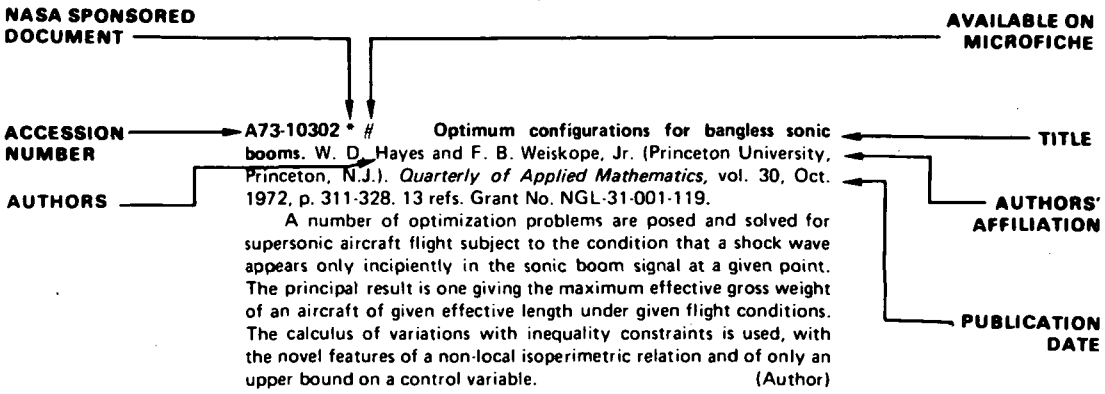

AERONAUTICAL ENGINEERING

A Special Bibliography (Suppl. 34) AUGUST 1973

IAA ENTRIES

A73-28026 # **The M-15 aircraft (Samolot M-15).** R. Legiecki. *Institut Lotnictwa, Biuletyn Informacyjny,* vol. 9, Nov.-Dec. 1972, p. 5, 6. In Polish.

The M-15 is an all-metal, semimonocoque, twin-tail-boom sesquiplane aircraft designed exclusively for agricultural support operations involving slow low-level flight. It is powered by a single AI-25 bypass turbojet engine used in the Yak-40 aircraft. Tanks for spraying chemicals are mounted between the lower and upper wings. Dimensions, weights, and performance data are tabulated. T.M.

A73-28027 # **An elastic wing (Sprezyste skrzydlo).** J. Wolf. *Institut Lotnictwa, Biuletyn Informacyjny,* vol. 9, Nov.-Dec. 1972, p. 13-17. In Polish.

Description of the structure and aerodynamic performance of a flexible cambered-profile wing that constitutes a modification of the Rogallo wing. The lifting surface is comprised by a stretched elastic fabric tied at four points to a light rigid frame structure. Low-speed flight applications in agriculture are discussed along with possible uses in providing variable-wing-geometry design solutions. T.M.

A73-28054 **The evolution and application of lofting techniques at Hawker Siddeley Aviation.** A. C. Freemantle and P. L. Freeman (Hawker Siddeley Aviation, Ltd., Hatfield, Herts., England). In: Curved surfaces in engineering: Computer methods for design and manufacture; Proceedings of the Conference, Cambridge, England, March 15-17, 1972. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1972, p. 49-56.

Aspects of lines layout are discussed together with the mould loft, the introduction of foil lofting, and the use of numerical geometry in engineering. Approaches of automatic draughting in the case of the A300B European airbus wing are considered along with surfaces with double curvature features and details of surface representation. Computer systems are mainly used as an aid in wing design problems, including surface design and surface manufacture. G.R.

A73-28075 # **Navigation in the vertical plane.** B. J. Calvert (British Overseas Airways Corp., London Airport, Hounslow, Middx., England). *Journal of Navigation,* vol. 26, Apr. 1973, p. 167-175.

The navigation of civil aircraft is currently carried out almost entirely in the horizontal plane. In the vertical plane aircraft maintain constant altitudes to provide vertical separation but no attempt is made to constrain them to particular paths when moving from one altitude to another. It is felt that the full benefit of area navigation will not be realized unless it is made three-dimensional so that climb and descent 'tubes' can be designed and cross-threaded to guarantee vertical separation in all parts of the airspace. The real difference between vertical and horizontal navigation is explored, giving attention to the determination of position, the definition of paths, and problems of guidance. G.R.

A73-28156 # **Concorde's Olympus 593.** *Aircraft Engineering,* vol. 45, Mar. 1973, p. 6-8.

The Olympus 593 is a conventional two-spool axial-flow turbojet engine producing 38,050 lbs of thrust at takeoff with reheat. The basic engine comprises low- and high-pressure compressors, each driven independently by a single-stage turbine. Combustion takes place in a fully annular combustion chamber. The rotating assembles are located in five main bearings, each provided with squeeze-film damping to minimize transmission of vibrations. Materials used throughout the engine reflect its supersonic application. Structural details are described for the variable-geometry intake and exhaust nozzles, noise abatement system, combustion chamber, gearing, and fuel system. T.M.

A73-28157 # **Swing wing - Modifications in variable geometry configuration concepts.** W. J. Bird (British Aircraft Corp., Ltd., Commercial Aviation Div., England). *Aircraft Engineering,* vol. 45, Mar. 1973, p. 12-14, 16.

Description of a swing-wing suspension system designed to overcome the handicaps which are inherent in the method so far employed for mounting the wings of variable configuration aircraft. It is argued that the conventional pin-and-lug joint requires a design compromise between an acceptable shift in center of pressure and the least amount of glove fairing. A more successful configuration is one where the center about which the wing pivots is a purely theoretical point; the wing in such a case is suspended within the fuselage along a curved rail permitting forward and aft sweeping motion by means of a bearing system. A conceptual design of such a joint is illustrated. T.M.

A73-28158 # **Kneeling landing gear - The C5 variable geometry development.** *Aircraft Engineering,* vol. 45, Mar. 1973, p. 18, 19, 24.

The C-5 aircraft is equipped with five landing gears (one nose gear and four main gears) designed to absorb shocks and bumps as high as six inches by the use of a double-acting shock strut. The secondary air chamber of this two-chamber strut reacts whenever the shock loads are greater than 1.25 G, thereby lessening wing bending and runway damage. Features described include the kneeling system which allows the aircraft to be lowered to a convenient level for loading and unloading, a crosswind system that can be operated to offset a crosswind during landing approach by moving all gears up to 18 deg to the right or left, and an antiskid system which smoothly controls the 24 main wheels. T.M.

A73-28159 # **Flight development of the European airbus.** *Aircraft Engineering,* vol. 45, Mar. 1973, p. 26-31, 33.

Description of flight tests and onboard instrumentation in the certification program for the A300B aircraft. Results attained since the first flight on Oct. 28, 1972 indicate no major technical obstruction to the achievement of European certification by the

target date of February 1974. The experienced and anticipated success is attributed both to the sound design of the aircraft and to proper management and planning of the test program. The flight deck layout is illustrated along with control and display panels incorporated specifically for flight testing purposes. T.M.

A73-28166 Wind tunnel interference on oscillating airfoils in low supersonic flow. M. F. Platzer (U.S. Naval Postgraduate School, Monterey, Calif.). *Acta Mechanica*, vol. 16, no. 1-2, 1973, p. 115-126. 7 refs.

Supersonic flow past a slowly oscillating two-dimensional airfoil in a wind tunnel with porous walls is considered. Starting from Sauer's solution for the slowly oscillating airfoil in an unbounded supersonic flow it is shown how this solution can be extended to take wall interference into account. This new and quite elementary theory is compared with an earlier analysis by Drake using Laplace-transform techniques and with a method of characteristics solution by Platzer and Pierce. (Author)

A73-28171 # Airborne fire protection equipment. R. W. J. Cockram. *Tech Air*, vol. 29, Apr. 1973, p. 2-4.

In airborne fire protection problems, conditions are complicated by high speed, close positioning of fire sources to fuels, high density occupancy conditions, and by crash or emergency landings. A high percentage of fatalities are known to be caused by smoke and hot vapors. Major attention is given to fuselage fire protection, protection of personnel, and cabin fire safety. It is suggested that a 10% payload allocation for safety equipment may well be found a minimum economic value for future aircraft. F.R.L.

A73-28177 Two approaches to aircraft development - The USA and Europe. R. Perry (Technology Service Corp., Santa Monica, Calif.). *Interavia*, vol. 28, Apr. 1973, p. 322-324.

Comparison of military-aircraft development, procurement, and production programs as practiced by major firms in the United States and in Europe. An attempt is made to correlate final costs of an aircraft with the organization and management of initial design and prototype-construction phases of the project. It is argued that the use of small, relatively cheap design and acquisition programs by European firms provides them with the capability of carrying out quick and inexpensive program modifications in response to unanticipated technical problems or changes in requirements. Larger American programs, manned by thousands of people and characterized by production commitments, are difficult and costly to slow or redirect. T.M.

A73-28178 Oceanic clearance for the SST. R. N. Harrison (Ferranti, Ltd., Bracknell, Berks., England). *Interavia*, vol. 28, Apr. 1973, p. 340, 341.

Flight requirements and restrictions expected in future transoceanic operations of Concorde SST aircraft are used to define the scope of relevant ATC functions and to delineate necessary computer hardware and software for these functions. Attention is given to aircraft separation standards, track allocation considerations, and flight mode (acceleration and cruising) specifications. Design requirements for a computer system are postulated, and categories of data to be processed are discussed along with general aspects of system operation. T.M.

A73-28179 The state of the art in light aircraft design. R. H. Wild. *Interavia*, vol. 28, Apr. 1973, p. 346-348.

Published technical data and performance specifications of more than one hundred different aircraft types were studied in an attempt to develop a simple method for comparative assessment of the design quality of light aircraft with widely varying performance characteristics. It was found that the main performance characteristics (such as cruise speed, stall speed, rate of climb, useful load, and basic aircraft cost) can be correlated to gross weight, wing area, and rated engine power by means of simple parameters. Comparison of these parameters affords a simple and rapid method for assessing the design quality of different aircraft models. T.M.

A73-28180 The outlook for metal alloys. I. Stambler. *Interavia*, vol. 28, Apr. 1973, p. 349-351.

Novel structural design concepts, better control and characterization of materials properties, and improved processing and assembly methods are discussed from the viewpoint of their effects on the use of aluminum alloys, steels, and superalloys by the aircraft industry in the near future. Attention is given to research aimed at improving the strength levels of particular alloys, and examples illustrate the use of diffusion bonding and isothermal forging techniques in aircraft construction. T.M.

A73-28245 # Computer graphics applied to production structural analysis. J. L. Tocher (Boeing Co., Military Airplane Systems Div., Seattle, Wash.) and C. A. Felippa (Boeing Co., Commercial Airplane Div., Renton, Wash.). In: High speed computing of elastic structures; Proceedings of the Symposium, Liège, Belgium, August 23-28, 1970. Volume 2.
Liège, Université de Liège, 1971, p. 521-545.

Review of high-speed digital computer applications in aircraft and spacecraft structural design and analysis. The need for computer-assisted data generation and display in production structural analysis is emphasized. It is shown that benefits from future increases in computing speed and from lower computing costs will be lost unless more efficient data generation and display techniques are developed. The merits of interactive structural languages using interactive graphics are discussed. The need is stressed to develop the generation of data with built-in data preprocessors, peripheral data preprocessors, and user-oriented input languages. Some sample generation concepts that can be easily implemented in the computer are outlined. M.V.E.

A73-28256 # An evaluation of finite difference and finite element techniques for analysis of general shells. K. Forsberg (Lockheed Research Laboratories, Palo Alto, Calif.). In: High speed computing of elastic structures; Proceedings of the Symposium, Liège, Belgium, August 23-28, 1970. Volume 2.
Liège, Université de Liège, 1971, p. 837-859. 11 refs.

A73-28468 A case of bonding in aviation - The elevons of the Concorde (Un cas de collage en aviation - Les élevons de 'Concorde'). P. Magnani (Société Nationale Industrielle Aérospatiale, Paris, France). *Revue Française de Mécanique*, 3rd Quarter, 1972, p. 11-23. In French.

The 12 elevons provide for pitch and roll control, must have a high degree of stiffness, and must resist severe mechanical and sonic fatigue conditions. The elevons are of a light alloy sandwich structure with a core with a side frame sandwiched between an upper and lower skin. All assemblies are bonded, with the exception of the fittings which carry concentrated loads. A modified epoxy adhesive was selected according to criteria dealing mainly with high temperature resistance and good aging characteristics. During manufacture great care is devoted to the inspection of the adhesive film, to the surface treatment prior to bonding, and to the actual polymerization. Ultrasonic inspection methods are routine and allow for detection of most defects. Bonding is considered to be a very advantageous assembly technique for thin parts, especially sandwich structures. F.R.L.

A73-28495 # **Laboratory simulation of development of superbooms by atmospheric turbulence.** H. S. Ribner, P. J. Morris, and W. H. Chu (Toronto, University, Toronto, Canada). *Acoustical Society of America, Journal,* vol. 53, Mar. 1973, p. 926-928. 12 refs. Research supported by the Canadian Transport Commission, Canadian Air Transportation Administration, Canadian Transportation Development Agency, National Aeronautical Establishment, National Research Council of Canada, and Air Canada; Grant No. AF-AFOSR-70-1885.

A jet flow was used to model roughly a localized region of atmospheric turbulence, simulating a single idealized 'eddy.' The jet was arranged in the UTIAS 80-ft sonic-boom generator horn so as to blow either against or with the direction of boom propagation. The two cases produced spiked and rounded boom signatures, respectively, qualitatively in accord with theory. The resemblance to signatures resulting from supersonic flight under turbulent atmospheric conditions was especially marked with the spiked 'superbooms.' (Author)

A73-28499 * **Role of commercial aircraft in global monitoring systems.** R. Steinberg (NASA, Lewis Research Center, Cleveland, Ohio). *Science,* vol. 180, Apr. 27, 1973, p. 375-380. 28 refs.

Discussion of the opportunity that the new wide-bodied commercial jet aircraft hold forth as platforms for a global monitoring system that could provide the atmospheric baseline and tropical meteorological data for which there is a pressing need. It is argued that there is no immutable technological impediment to the implementation of such a monitoring program, and that its realization could enhance our knowledge of atmospheric processes at an enormous saving in costs. M.V.E.

A73-28532 **M/W tube requirements for radar applications.** D. D. Hayes and S. V. Logan (Texas Instruments, Inc., Dallas, Tex.). *Microwave Journal,* vol. 16, Apr. 1973, p. 37-39, 42, 44.

Discussion of requirements for microwave transmitter tubes relative to surface-based and airborne radar applications in the next five- to ten-year period. Emphasis is placed on air-traffic control surface-based radars and surveillance/terrain-following types of airborne radar. The current status and desired improvements of performance are described in the areas of output power, stability, spectrum, size, weight, reliability, maintainability, and cost. T.M.

A73-28554 # **Can bad weather accidents be avoided (Sind Schlechtwetterunfälle vermeidbar).** E. Lattmann. *Aero-Revue,* Apr. 1973, p. 183-185. In German.

The reasons for the exposure of an aircraft to bad weather are examined. An incorrect assessment of the prevailing weather conditions by the pilot is an important factor in the occurrence of the accidents. Basic meteorological aspects are discussed, giving attention to air temperature, humidity, cloud formation, the occurrence of fog, haze, and precipitation. The deterioration of visibility due to weather conditions is a significant factor in many aircraft accidents. G.R.

A73-28555 # **A new compass for aeronautical navigation (Ein neuer Kompass für die Flugnavigation).** H. Bohli. *Aero-Revue,* Apr. 1973, p. 186-189. 6 refs. In German.

Conventional compass devices do not provide adequate service during turns of the aircraft to the north or to the south. The new compass system described is free from the deficiencies of the conventional compass. This is accomplished by a novel design which makes it possible for the magnetic needle to turn freely within certain limits around two orthogonal axes. It is pointed out that the new device is particularly suited for glider navigation applications. G.R.

A73-28556 **Electronic developments for performance gliding. II (Elektronische Entwicklung für den Leistungssegelflug. II).** I. Westerboer. *(Organisation Scientifique et Technique Internationale du Vol à Voile, Congress, 13th, Vrsac, Yugoslavia, July 9-22, 1972.) Aero-Revue,* Apr. 1973, p. 212, 213. In German.

An electronic differentiator for onboard calculations of flight data is considered, giving attention to details of the compensation method used in the computations. Another instrument described indicates directly the vertical velocity of the air. This instrument has a number of advantages compared to the conventional device for the pilot, who previously had to calculate the vertical motion of the air by taking into account the polar vertical descent of the aircraft. G.R.

A73-28649 # **Design method of the axial-flow blade row on modified isolated aerofoil theory with interference coefficient. I.** Y. Nakashima and K. Shiramoto (Kumamoto University, Kumamoto, Japan). *JSME, Bulletin,* vol. 16, Mar. 1973, p. 541-548; Discussion, p. 548, 549; Authors' Closure, p. 549, 550. 12 refs.

A73-28785 # **Aerodyne testing.** W. Melzer. *Dornier-Post* (English Edition), no. 1, 1973, p. 16-19.

The object of the test program was to verify the good hover flight characteristics anticipated from the Aerodyne design. The vehicle is remotely controlled by radio. During hover flight the remote control pilot commands the flight vehicle attitude by means of a small control stick. Even during the maiden hover flight the flight attitude was maintained without any problems by the attitude control system. No failures were recorded during the total hover period (74 flights) of about one and one-half hours. F.R.L.

A73-28786 # **ERAF - Proposal for a European Earth Resources Aircraft.** H. Langefeld and J. Schauenburg. *Dornier-Post* (English Edition), no. 1, 1973, p. 20-23.

The aim of the study was to define an earth resources aircraft which would serve ESRO as a test support facility for sensor development in future earth resources satellites, and would be available to earth resources exploration institutes. ERAF (Earth Resources Aircraft Facility) is expected to be of value in the fields of oceanology, ecology, geography, geology, and hydrology. Of various aircraft evaluated, the Breguet Atlantic 1150 proved to be the most suitable. F.R.L.

A73-28789 # **Training activities at Dornier.** A. Brehm, G. Oehl, K. Schiller, and J. Schauenburg. *Dornier-Post* (English Edition), no. 1, 1973, p. 30-33.

The trouble-free introduction of aircraft systems by the user is no longer conceivable without the accompaniment of intensive training measures. Dornier has been engaged on didactical and technical training problems for some time past. The cost-effective employment of technically complex products requires soundly trained personnel for its operation and maintenance. This applies quite clearly to civil and military aircraft, as well as to most other kinds of military weapons systems. The result is a close link between development, logistic and training problems and necessarily an active commitment for manufacturers and systems companies in the matter of training. (Author)

A73-28802 # **Lifting-surface theory for a wing oscillating in yaw and sideslip with an angle of attack.** K. Isogai and T. Ichikawa (National Aerospace Laboratory, Tokyo, Japan). *AIAA Journal,* vol. 11, May 1973, p. 599-606. 17 refs.

A lifting-surface theory for a wing oscillating in yaw and sideslip with an angle of attack in incompressible flow is presented. This study is stimulated by the phenomenon of critical flutter speed of a T-tail depending on the angle of attack of the stabilizer. By introducing a new coordinate system oscillating in yaw and sideslip and employing a perturbation technique, the boundary-value problems are obtained. An integral equation for the calculation of the

load distribution due to the yawing and sideslip oscillation is derived from the second-order boundary-value problem while the first-order problem is that of a steady flight without yaw and sideslip. The peculiar load distributions are disclosed by solving the integral equation, which also requires a new technique for its numerical solution. The calculated rolling moments show a good agreement with the experimental results. (Author)

A73-28803 * # **Downwash-velocity potential method for oscillating surfaces.** J. K. Haviland and Y. S. Yoo (Virginia, University, Charlottesville, Va.). *AIAA Journal*, vol. 11, May 1973, p. 607-612. 15 refs. Grants No. NGL-47-005-108; No. NGL-47-005-098.

The application of the downwash-velocity potential method to the case of oscillating surfaces is developed, and calculated forces are given on rectangular airfoils of aspect ratio two rotating about midchord in subsonic flows. These are compared with other results published in the literature for reduced frequencies up to nine-tenths, and for Mach numbers up to nine-tenths. The concept of 'aerodynamic elements' is presented, the computed results representing three possible types of rectangular element. (Author)

A73-28805 # **Nitric oxide formation in gas turbine combustors.** R. Kollrack and L. D. Aceto (United Aircraft Corp., Pratt and Whitney Aircraft Div., East Hartford, Conn.). *AIAA Journal*, vol. 11, May 1973, p. 664-669. 17 refs.

The net nitric oxide (NO) formation is influenced not only by the thermodynamic (equilibrium) aspects of the combustion process but also by the detailed intermediate hydrocarbon reaction kinetics. An analytical study was made to obtain a representative combustion reaction mechanism for gas turbines. This mechanism was used to determine the OH, O, H, and N radical levels occurring during the combustion process. Simultaneously, the resulting NO formation was established. OH and O radical concentrations exceeding the equilibrium concentrations by up to two orders of magnitude were obtained with durations controlled by the combustion of raw fuel. This analysis, which covers premixed combustion, was extended to demonstrate the influences of droplet vaporization and staged fuel addition. The NO levels resulting from liquid fuel combustion were found to be up to two orders of magnitude larger than the NO levels of premixed combustion. (Author)

A73-28814 # **Linear theory of stall flutter.** J. D. Raggett (URS/John A. Blume and Associates, Las Vegas, Nev.). *AIAA Journal*, vol. 11, May 1973, p. 733-735. 9 refs.

A simple linear aerodynamic model is proposed for a qualitative description of stall flutter. The model incorporates only torsional oscillations about the midchord of a two-dimensional airfoil and is based on a study of torsional flutter in suspension bridges. Further theoretical studies and experiments are suggested to corroborate the conclusions of this study. V.Z.

A73-28817 # **An improved nonlinear lifting-line theory.** C.-T. Lan (Kansas, University, Lawrence, Kan.). *AIAA Journal*, vol. 11, May 1973, p. 739-742. 11 refs.

A method is formulated for span loading computations incorporating the nonlinear section characteristics at an accuracy one order higher than with the nonlinear Prandtl lifting-line theory. Mechanical high-lift devices of any kind can be analyzed by this method without theoretical difficulties. M.V.E.

A73-28818 * # **Effect of out-of-planeness of membrane quadrilateral finite elements.** R. T. Haftka and J. C. Robinson (NASA, Langley Research Center, Hampton, Va.). *AIAA Journal*, vol. 11, May 1973, p. 742-744. 11 refs.

Investigation of the effect of using plane quadrilateral membrane elements for modeling nonplanar structures. The effect is assessed by analyzing a simplified finite element model with the aid of the structure network analysis program. The results obtained indicate that the use of planar quadrilateral membrane elements for modeling bending problems can lead to large errors if the four points that define the quadrilateral are not in the same plane. M.V.E.

A73-28824 * # **Transonic flow past lifting wings.** H. Norstrud (Lockheed-Georgia Co., Marietta, Ga.). *AIAA Journal*, vol. 11, May 1973, p. 754-757. 7 refs. Contract No. NAS1-10665.

Work conducted by Norstrud (1971) has been extended to lifting flows with the inclusion of embedded continuous supercritical regions. The approach taken follows some fundamental steps proposed for two-dimensional flows by Oswatitsch (1950). The governing integral equation is replaced by a system of nonlinear algebraic equations. The method of parametric differentiation is applied to the solution of this system of equations. The analytical analysis is discussed together with a numerical analysis in the case of a wing configuration with arbitrary thickness distribution. G.R.

A73-28828 * # **Transonic flow about lifting configurations.** R. W. Barnwell (NASA, Langley Research Center, Hampton, Va.). *AIAA Journal*, vol. 11, May 1973, p. 764-766.

A transonic flow solution is presented for configurations with span-to-length ratios of order one. The angles of attack are sufficiently large to produce lift effects that are either dominant or comparable to the thickness effects. The analysis is performed with the aid of the method of matched asymptotic expansions. The results obtained are compared with data reported by Cheng and Hafez (1972). G.R.

A73-28829 # **Identification and optimization of aircraft dynamics.** K. S. Narendra (Yale University, New Haven, Conn.) and S. S. Tripathi (Quinnipiac College, Hamden, Conn.). *Journal of Aircraft*, vol. 10, Apr. 1973, p. 193-199. 5 refs. Contract No. N0014-67-A-0097-0020. NR Project 375-131.

A technique is described for the design of an adaptive controller for multivariable systems and is based on recently developed methods for identification and optimization. An application of the method to a helicopter system with time-varying parameters is considered in detail. The response of the adaptive system is compared with the corresponding response of a system with a fixed controller and a system using optimal control. The comparison reveals the almost optimal character of the adaptive system. (Author)

A73-28830 * # **Experimental landings in a spoiler-equipped light aircraft.** E. Seckel, D. R. Ellis (Princeton University, Princeton, N.J.), and J. W. Olcott. *Journal of Aircraft*, vol. 10, Apr. 1973, p. 220-226. Contract No. NAS2-5589.

This report presents the results of a flight test program to determine the effects on landings of wide variations in approach path angle and approach airspeed for different kinds of piloting technique. Over 400 landings were made at approach speeds from 60 to 120 mph and approach path angles from 3 to 18 deg. Several variations of pilot technique involving different operations of the throttle/spoiler control were investigated. It is shown that very large ranges of airspeed and approach path angle can be accommodated with rather moderate penalties in landing distance and difficulty. With the spoiler-equipped aircraft, the best approach speeds are considerably higher than would be usable without spoilers, and approach path angles can be used which are far beyond those normally possible without spoilers. (Author)

A73-28831 # **Some aircraft flight conditions relating to LO-LOCAT.** J. W. McCloskey (Dayton, University, Dayton, Ohio). *Journal of Aircraft*, vol. 10, Apr. 1973, p. 244-246. 6 refs.

A model for atmospheric turbulence is presented for the low level environment below 1000 ft alt which considers a wide range of meteorological and topographical conditions for possible influence upon the intensity of the turbulence encountered. While altitude has long been recognized as relating to atmospheric turbulence, it will be

shown that the low level environment is far more complicated in that a number of other conditions have been observed which have an even stronger influence upon turbulence. In particular, it was found that atmospheric stability defined as a function of temperature lapse rate had the strongest relationship to LO-LOCAT with such conditions as time of day, terrain type, season, and altitude also having a significant relationship to the turbulence encountered. (Author)

A73-28836 # **Fairings at wing fuselage junctions (Congés a l'emplanture d'une aile sur un fuselage).** R. G. Legendre. *La Recherche Aérospatiale,* Jan.-Feb. 1973, p. 1-4. 7 refs. In French.

The interest of establishing a compromise for designing fairings at wing-fuselage junctions is demonstrated. Available means of investigation for this work are surveyed. The mechanism of formation of rotational eddies is described in the simple case of a duct and is used as a basis for interpreting phenomena observed near a fairing at a wing root. Finally, some considerations on the unsteady character of the flow are presented. (Author)

A73-28837 # **Starting supersonic blade cascades (Amorçage des grilles d'aubes supersoniques).** G. Janssens (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) and J.-P. Guyot (Société Européenne de Propulsion, Puteaux, Hauts-de-Seine, France). *La Recherche Aérospatiale,* Jan.-Feb. 1973, p. 17-23. In French.

A theoretical and experimental study is presented for the starting conditions of supersonic annular blade cascades (guide vanes of supersonic turbines, impeller row, for supersonic cascade wind tunnels). A distinction is made between the case of velocity with subsonic or supersonic component normal to the cascade front. In the first case, the downstream flow, after starting, is uniform only for a unique value of the pressure ratio; in the second case, starting requires, downstream of the cascade, a diverging duct where a shock wave establishes itself, and uniform flow is obtained regardless of the pressure above the starting pressure. Experiments confirm and validate the conclusions of the theory. (Author)

A73-28884 # **Preliminary data concerning the changes in the electrical characteristics of stratiform clouds subjected to modification (Predvaritel'nye dannye ob izmenenii elektricheskikh kharakteristik sloistoobraznykh oblakov, podvergnutykh vozdeistviiu).** L. N. Mogila. In: Physics of clouds and seeding effects. Moscow, Gidrometeoizdat, 1972, p. 106-112. 7 refs. In Russian.

Solid carbon dioxide was seeded from aircraft at the upper boundary of stratiform clouds in cloud modification experiments initiated in 1970 in the Ukraine. Preliminary results of the experiments indicate that the electrical charges of aircraft and the mean potentials of electrical field gradients increased after cloud modification by this technique. V.Z.

A73-28901 **A flight evaluation of curved landing approaches.** T. C. McMurtry, S. W. Gee, and M. R. Barber (USAF, Flight Research Center, Edwards AFB, Calif.). *Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 3, 1973, p. 5-17. 5 refs.

A potential solution to some of the operational problems of STOL aircraft operations in the terminal area lies in the capability of making curved landing approaches under both visual and instrument flight conditions. Tests are described which were conducted with a twin-engine, light weight, general aviation aircraft. The advanced control system mode utilized during the curved approaches was an attitude command control system. Four curved patterns were investigated using a steep glide slope: two display configurations, and two flight control modes. When using the flight director display, curved approaches were not significantly different in difficulty and work load than straight approaches. F.R.L.

A73-28903 **Bell commercial automatic flight control system design and test.** R. G. Erhart (Bell Helicopter Co., Fort Worth, Tex.). *Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 3, 1973, p. 58-61.

The philosophy of the design of a helicopter automatic flight control system (AFCS) is discussed, and the testing and development of the commercial AFCS is summarized. The problem is complicated because helicopter stability is a difficult design problem. Due to the range of airspeed the control power has to be high, and there are no appreciable aerodynamic forces to give 'feel' to the flight control system. The stability and control augmentation system (SCAS) can be considered as a fast rate, limited authority system, while the attitude retention unit (ARU) is a slower rate, full authority, parallel system. A major portion of the flight testing was used to optimize gains and adjust the circuits to allow small delays before starting the parallel actuators in motion. F.R.L.

A73-28904 **The potential of VLF/Omega in area navigation /RNAV/ applications.** J. J. Tymczyszyn (FAA, Aircraft Engineering Div., Los Angeles, Calif.). *Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 3, 1973, p. 62-71.

The progress of the FAA's Western Region evaluation tests of a VLF/Omega digital airborne navigation system developed by the Global Navigation Co. is reviewed. Present and proposed Omega transmitting stations will provide worldwide navigation capability when the installations are complete in early 1974. These stations will ultimately have a 10-kw output, transmitting eight pulsed segments in a 10-sec time base, in which three consecutive pulses will use the frequencies of 10.2, 13.6, and 11.33 kHz. The remaining five segments or 'side frequencies' are not directly related to the Omega navigation format, but are fundamental to the Global Navigation Co. VLF/Omega concept. The performance of the system installed in a Cessna 411 airplane has shown excellent results during the testing to date. F.R.L.

A73-28905 **Pilot/automatic-relations, confidence, displays.** V. Wilckens. *(Society of Experimental Test Pilots, Annual Symposium, Zurich, Switzerland, Aug. 25-28, 1971.) Society of Experimental Test Pilots, Technical Review,* vol. 11, no. 3, 1973, p. 72-86. 10 refs.

The main problem of manual landing control is that the residual problems are primarily caused by the type of information offered to the pilot. Some comments are made on the fully automatic landing concept, the abilities and limitations of man, and the primary requirements to be fulfilled by displays. Many pilots are uncomfortable when delegating blind landing control to a 'full authority' autopilot. The lack of a self-optimizing tendency in man-controlled evolution is discussed, and a display concept is derived. F.R.L.

A73-28931 **The importance of processing technology in the future development of superalloys and the gas turbine.** L. P. Jahnke (GE Material Process Technology Laboratories, Cincinnati, Ohio). *(Metallurgical Society of AIME, International Symposium on Superalloys, 2nd, Seven Springs, Pa., Sept. 18-20, 1972.) Journal of Metals,* vol. 25, Apr. 1973, p. 15-19.

The trends and technical opportunities for superalloys as applied to gas turbines for aircraft propulsion are discussed, giving attention to the materials systems in the average modern jet engine of today and future developments predicted to appear in 1985. The superalloys of 1985 will be produced by a wider variety of processes, whose development is being motivated by pressures for lower costs and also for improved capabilities. The new engines being qualified in the period from 1978 to 1980 may well use eutectics and a high percentage of powder metallurgy alloys. Competitive eutectic systems are considered. These alloys represent the most promising approach to an increase of several hundred degrees in turbine blade material capability. G.R.

A73-28932 * # **Design and e: f combustors for reducing aircraft engine pollution.** R. E. Jones and J. Grobman (NASA,

Lewis Research Center, Cleveland, Ohio). *NATO, AGARD, Meeting, 41st, London, England, Apr. 9-13, 1973, Paper.* 18 p. 28 refs.

This report summarizes some of the NASA Lewis Research Center's recent efforts in reducing exhaust emissions from turbine engines. Various techniques employed and the results of testing are briefly described and referenced for detail. The experimental approaches taken to reduce oxides of nitrogen emissions include the use of: multizone combustors incorporating reduced dwell time, fuel-air premixing, air atomization, fuel prevaporization and gaseous fuel. Since emissions of unburned hydrocarbons and carbon monoxide are caused by poor combustion efficiency at engine idle, the studies of fuel staging in multizone combustors and air assist fuel nozzles have indicated that large reductions in these emissions can be achieved. Also, the effect of inlet-air humidity on oxides of nitrogen was studied as well as the very effective technique of direct water injection. The emission characteristics of natural gas and propane fuels were measured and compared with those of ASTM-A1 kerosene fuel. (Author)

A73-28950 The economy of air transportation (Economia del transporte aéreo). M. Cuesta Alvarez (Lineas Aéreas de España, Spain). *Revista de Aeronáutica y Astronáutica,* vol. 33, Mar. 1973, p. 173-185. 7 refs. In Spanish.

The costs of air transportation are analyzed, giving attention to direct and indirect costs. Systems of cost analysis are considered together with the effect of individual parameters on the costs of operation. Attention is given to cruising speed, flight time, total operational time, aircraft design, and aircraft manufacture. A first estimation of operational costs has to take into account the weight of the aircraft, the weight of the fuel needed during the flight, the fuel reserve, and questions of the selection of one of three operational approaches in conducting the flight. Direct costs of the flight operation are discussed in detail together with expenses for maintenance, inspection, depreciation, and fuel costs. Indirect expenses include costs of administration, publicity, and airport charges. G.R.

A73-29005 # Two-dimensional cascade data. J. Citavy (Statni Vyzkumny Ustav Konstrukce Stroju, Bechovice, Czechoslovakia). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 1. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 1-9. 20 refs.

A brief review of some research results on the two-dimensional steady subsonic flow through airfoil cascades is presented. Both experimental and theoretical methods were employed to solve the direct (analytical) cascade problem. The basic data on the problem have been obtained from a set of low-speed experiments on compressor and turbine cascades having profiles of the SVUSS CT-series. The results are similar to those of the NCTE C4 profile but differ to some extent from the NACA 65-series. The potential flow through the cascades and boundary layer calculations represent a general source of cascade data which may be used for predicting performance of turbomachines. (Author)

A73-29006 # Effect of trailing edge thickness on the cascade performance of circular-arc blades. M. Inoue (Kyushu University, Fukuoka, Japan) and K. Kaneko (Saga University, Saga, Japan). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 1. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 21-30. 10 refs.

Because most of the blades used in axial flow turbomachinery do not have cusped trailing edges, but thickened ones, it is important to investigate the effect of the trailing edge thickness on cascade performance. In this investigation, two-dimensional cascade tests were carried out for circular arc blades by varying the trailing edge thickness from zero to the blade thickness. An approximate method of calculating the cascade performance for a profile with a thickened trailing edge is proposed according to the criterion introduced by Howarth (1935). It was found from tests in a cascade tunnel that increasing the trailing edge thickness ratio leads to a loss of efficiency. F.R.L.

A73-29008 # Secondary flow in blade cascades of axial turbomachines and the possibility of reducing its unfavourable effects. L. Belik (SKODA, Plzen, Czechoslovakia). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 1. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 41-49. 24 refs.

A73-29012 # A new approach to the problem of predicting the performance of centrifugal compressors. F. J. Wallace (Bath, University, Bath, England) and A. Whitfield. In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 1. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 225-236. 23 refs.

Based on one-dimensional treatments for performance prediction of inward radial flow turbines involving thermodynamic modeling of rotor incidence losses, a treatment has been developed to cover centrifugal compressors. These procedures are designed to provide the basis for full performance predictions of engine-compressor-turbine combinations including the effect of variable guide vane or diffuser geometry. The compressor geometry is specified by channel depths and mean angles at successive stations - i.e., inlet guide vane, impeller, vaneless diffuser, vaned diffuser, and exit scroll. Skin friction, leakage and blade loading losses are defined by empirical coefficients obtained in certain cases from the literature. The incidence losses at impeller and vaned diffuser and vaned diffuser entry are obtained by thermodynamic modeling. A blockage factor is applied as a further empirical factor to the impeller channel. A full computer program has been written and applied to a number of existing centrifugal compressors. (Author)

A73-29020 # Low speed of sound modeling of a high pressure ratio centrifugal compressor. J. A. Block, P. W. Runstadler, Jr., and R. C. Dean, Jr. (Creare, Inc., Hanover, N.H.). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 141-149. 10 refs. Army-supported research.

Experiments were carried out to demonstrate the feasibility and correctness of a technique for testing high-pressure-ratio centrifugal compressor models at reduced shaft speeds, using a gas with a speed of sound lower than that of air. The air compressor performance map and detailed aerodynamics throughout the compressor were very well duplicated when Freon 13B1 (CBrF3) was used as such a gas. V.Z.

A73-29021 # Curved supersonic diffusers. R. Yamane and Y. Tomita (Tokyo Institute of Technology, Tokyo, Japan). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 151-159. 11 refs.

Experiments at Mach number 1.6 show that the generation and decay of oblique shock waves in a curved supersonic diffuser depend largely on the properties of the boundary layer. Diffuser design recommendations are given for quenching oblique shock waves and for other approaches to diffuser performance improvement. V.Z.

A73-29024 # Unstable operation and rotating stall in axial flow compressors. J. Fabri and J. Surugue (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 183-190. 14 refs.

Two types of flow unsteadiness in axial flow compressors are described: the pressure perturbations due to the wake interaction between adjacent stages and the flow fluctuations due to rotating stall. Water table experiments are described: they are used for analyzing the detail of wake interaction issued from a moving linear cascade with the downstream stator blade cascade and also for the description of the structure of the rotating stall cell. Theoretical analysis of the stall limit of an axial compressor is given and the various flow configurations obtained at mass flow rates below the stall limit are given. Structure of the steady flow and of the stalled flow in an isolated rotor is analyzed by means of hot wire anemometer and by smoke injection in a low speed compressor. (Author)

A73-29026 # **Unsteady induced velocities in a cascade.** H. Yeh (Pennsylvania, University, Philadelphia, Pa.) and H. Naumann (PMC Colleges, Chester, Pa.). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 201-207.

Calculation of unsteady air flow velocities at various distances from a rotor blade subjected to periodic gusts and periodic wakes. The amplitudes of induced velocities decreased steeply with the distance from the rotor blade both for sinusoidal gusts and for periodic wakes of reduced frequencies. It is concluded that the cascade effect is very much less for the unsteady portion of the flow than for the steady portion. V.Z.

A73-29027 # **Theoretical investigation on stall flutter of an aerofoil /the case of trailing edge stall/.** K. Shinohara, H. Tanaka, and Y. Hanamura (Tokyo, University, Tokyo, Japan). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 209-218.

For the purpose of investigating stall flutter, we analyze the aerodynamic force acting on a thin vibrating aerofoil with flow separation from a prescribed point on the upper surface (trailing edge stall). Two vortex sheets trail downstream, one from the trailing edge and the other from the point of separation. If the incidence is high enough, the flow will separate from the leading edge and the theory includes this limiting case. The effect of disturbance in the wake is taken into consideration, but the unsteady aerodynamic force due to the Karman vortex sheet is neglected and the separation point is assumed to be fixed during the oscillation. Formulas for the pressure distribution and unsteady moment about the midchord are obtained, and the effect of flow separation on the damping derivative is illustrated in a number of graphs. (Author)

A73-29028 # **Experimental study by resonance method of unsteady aerodynamic forces acting on cascading blades.** N. Ukeguchi, H. Sakata, and S. Takahara (Mitsubishi Heavy Industries, Ltd., Aero-Hydraulics Research Laboratory, Nagasaki, Japan). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 219-224. 13 refs.

For the problem of turbomachine blade vibration, the compressibility of the gas is a very important factor. Therefore, when unsteady aerodynamic forces acting on an oscillating blade are experimentally measured in a wind tunnel, the wind velocity must necessarily be made the same order as that in the actual machine. The frequency of the model must also be made the same order in order to adjust the dynamic similarity law, because the scale of the model is restricted by the wind tunnel. High frequencies can be easily obtained by the resonance method using a usual electromagnetic exciter. In this study, considerations are given to the modification of the resonance method for measurement of aerodynamic forces in the case of a two-dimensional model. (Author)

A73-29029 # **A semi-empirical approach to stall flutter.** F. Sisto and P. V. K. Perumal (Stevens Institute of Technology, Hoboken, N.J.). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 225-231. 8 refs. Contract No. N00014-67-A-0202-0016.

A general semiempirical method is proposed for predicting the unsteady lift and moment which act on an oscillating airfoil in the stall regime. The method requires that a certain separation function which gives the periodic time history of separation point movement on the suction side be specified beforehand. An experimental correlation must be obtained for this purpose before the method can be applied for flutter prediction. Some lift results which agree well with experience are computed by this method with the aid of a simple form of this separation function. Aerodynamic moments due to torsion and also the cross-coefficients may also be calculated by this technique. V.Z.

A73-29030 # **Aerodynamic noise of the propeller fan.** K. Morita (Hitachi, Ltd., Mechanical Engineering Research Laboratory, Tokyo, Japan). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 2. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 285-294. 5 refs.

The sonic field of a small low-speed electric fan was investigated in a study of the noise generation mechanism in small low-speed propellers as distinguished from that of high-speed aircraft propellers. Experiments showed that the noise levels due to rotation were higher by roughly 20 dB in a small propeller fan than those predicted by the aircraft propeller noise theories. The effect of 'pseudosound' generation by a rotating aerodynamic pressure field was established in the rotating blade zone of a small low-speed propeller fan. (Author)

A73-29047 # **The use of averaged flow equations of motion in turbomachinery aerodynamics.** J. H. Horlock (Cambridge University, Cambridge, England) and H. Marsh (Durham, University, Durham, England). In: Fluid machinery and fluidics; Proceedings of the Second International Symposium, Tokyo, Japan, September 4-9, 1972. Volume 4. Tokyo, Japan Society of Mechanical Engineers, 1972, p. 1-14. 18 refs.

The use of pitch-averaged equations of motion in turbomachinery aerodynamics is illustrated by several examples involving steady two-dimensional and three-dimensional flows, unsteady flows, boundary layers, and secondary flows. It is shown that the averaged equations become the same as those of the many bladed cascade only for low blade loadings, and care must be taken in using the averaged equations in boundary layer and secondary flow analyses. T.M.

A73-29100 **A flight control simulator - A computer system for the training of flight control personnel (Flugsicherungs-simulator - Ein Rechensystem für die Ausbildung von Flugsicherungs-Kontrollpersonal).** W. Schaaf. *AEG-Telefunken, Technische Mitteilungen,* vol. 63, no. 2, 1973, p. 85-87. In German.

Description of a new improved procedure for training flight control personnel which involves the use of a radar simulator featuring a computer which generates synthetic air traffic situations. The new radar simulator makes it possible to allot a greatly increased tube time (time spent in front of the radar screen) in the total training of the student controller, while reducing so-called on-the-job training which can interfere with normal flight control operations. The new simulator also possesses a playback feature, so that exercises can be repeated and errors can be analyzed and corrected. A.B.K.

A73-29101 **Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973.** Conference sponsored by the American Society of Civil Engineers. New York, American Society of Civil Engineers, 1973. 210 p. $5.00.

The papers deal with such topics as the promotion of safe and efficient airport planning and design, the identification of airport problems and their solution, and the appraisal of the future role of airports in the overall transportation system. Among the problems discussed are passenger and baggage transit systems, pavement evaluation methods, advanced noise reduction methods, and problems facing airport management. V.P.

A73-29102 # **Projections of the U.S. airline fleet in the early 1980's.** R. Horonjeff (California, University, Berkeley, Calif.) and R. Coykendall (United Air Lines, Inc., San Francisco, Calif.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 1-17. 7 refs.

An attempt is made to predict the evolution over the period to 1985 of such aircraft and airport characteristics as speed, noise, size, polution, aircraft types, market demand, and runway length. Considerations indicate that, with exception of the SST, there will be no appreciable increase in the cruising speed of jet airliners, nor in the length of current runways. Aircraft noise and pollution will certainly not escalate, and probably will diminish. Small increases in overall weight and small changes in dimensions (to increase range) may be expected, however, take-off weights in excess of 1,000,000 lb are doubtful. A high demand for very large aircraft is not foreseen. Two- and three-engine aircraft will compose three quarters of the airline fleet. All turbojet (non-fan) aircraft will be retired from service. Nearly one half of the fleet will be composed of 707-300B, 300C, and DC-8 fan engine aircraft. More than one third of the fleet will be (two- and three-engine) wide bodied jets. The number of SST's in service will be relatively small. V.P.

A73-29103 # **Status of airport research and development program.** P. L. Melville (FAA, Airports Service, Washington, D.C.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 19-42. 15 refs.

The airport is considered from its functional status - the safe and efficient movement of passengers and goods from a downtown terminal to an airborne position and vice versa. The need for engineering research and development to achieve efficient operation in terms of safety, cost, value, and to omit costly errors is demonstrated. V.P.

A73-29104 # **Recent advances in aircraft noise reduction.** R. P. Skully (FAA, Office of Environmental Quality, Washington, D.C.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 43-53.

Some technological and operational inovations aimed at noise reduction, which have been recently implemented in the United States, are discussed. These include new quieter power plants, as well as noise reduction by improved flight procedures aimed at gaining the greatest altitude in the shortest distance. Generally adopted new climb and approach procedures which greatly reduce noise impact on the ground are reviewed. V.P.

A73-29105 # **Role of the air line pilot in air transportation.** W. T. Alford (Braniff Airways, Inc., Dallas, Tex.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 55-61.

It is shown that the role of an airline pilot is one of continuous education and training in order to keep abreast with increasing aircraft sophistication and aviation developments. Far from being limited to aircraft operation, the airline pilot's role includes constructive criticism of inovations and aircraft operations, participation in the origination and passage of legislation and regulations to increase passanger safety, and accounting for the deficiencies of existing airways/airport systems. V.P.

A73-29106 # **Modern pavement evaluation techniques.** B. A. Vallerga (Materials Research and Development, Inc., Oakland, Calif.) and R. G. Lee (San Francisco International Airport, San Francisco, Calif.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 63-85. 10 refs.

The pavement evaluation method described is applicable to any type of pavement structure. It is based on the use of analytical methods (e.g., elasticity theory) to determine the mechanical state (stress-strain relation) in the structural section, and a combination of theoretical and empirical relations to establish performance-related failure criteria. The individual steps of the method are outlined, and its effectiveness and reliability are demonstrated by an example application at the San Francisco International Airport. V.P.

A73-29107 # **Land use planning.** H. L. Newman (FAA, Washington, D.C.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 87-94.

The history of Dallas/Fort Worth Regional Airport planning is reviewed with particular reference to land use. The efforts that were required to assure compatibility of this airport and its neighbors are discussed. It is shown how adequate distribution of airspace to provide effective service to all the communities concerned was achieved by early land use planning. V.P.

A73-29108 # **Status of short haul air transportation.** In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 107-130.

The history of the development of the short-haul air transportation system is reviewed. The current status of the system is assessed in the light of some recent developments in aircraft technology and air transportation service. The results of a market study that shed light on the potential for short-haul transportation are examined. Particular attention is given to STOL aircraft development, but other aircraft concepts, such as the QTOL (quiet takeoff and landing) and the RTOL (reduced takeoff and landing) are also considered. V.P.

A73-29109 # **Why regional airports.** J. D. Downey (Dallas-Fort Worth Airport, Tex.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 153-163.

Considerations in support of the regional airport are presented, defining the latter as a large capacity airport, central to a region of material production and/or population growth. The airport and its missions are designed to assimilate, disperse, and transfer freight and passengers between various modes of transport as well as various units of the same mode. It is shown that the existing airport solution is not acceptable to any city that anticipates economic growth in the future, whereas the multiple airport solution involves multiple problems. It is argued that a central regional airport will cost far less for the value received, will cost less in the long run to operate and maintain, and will be environmentally solvable and more convenient in passenger service. V.P.

A73-29110 # **Engineering management for the Dallas/Fort Worth Airport.** G. T. McCarthy (Tippetts-Abbett-McCarthy-Stratton, New York, N.Y.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 165-179.

Engineering management concepts are outlined, whose application ensured sound management of the Dallas/Fort Worth Airport project. This activity included a site selection study, a financial feasibility study, an airport master plan report, and an airport layout plan report. The recommendations contained in these reports (which were part of some forty planning and design studies accomplished between 1965 and 1969) are generally embodied in the airport project, and have provided the basic parameters for the present airport design and construction programs. Using these engineering concepts, the management knows where the project stands at all times in terms of time and money, and also knows the reasons for any deviation from the schedule, should it occur. V.P.

A73-29111 # **Trends in airport planning.** R. J. Sutherland (American Airlines, Inc., New York, N.Y.). In: Airports: Challenges of the future; Proceedings of the Airports Specialty Conference, Dallas, Tex., March 7-9, 1973. New York, American Society of Civil Engineers, 1973, p. 193-213.

Some of the principal problems that must be considered in the planning of future airport facilities are discussed, and airport planning trends based on recent experience at many major airports are examined. Among the important advances is the application of systems analysis to the solution of planning problems, and the use of sound engineering principles (rather than empirically derived charts) in airport pavement design. Another trend is the designing of terminal facilities on a modular basis. Major problems are airport costs, which have escalated to the point where economic self-sufficiency may no longer be achievable. V.P.

A73-29145 # **A nonlinear effect in gyroscopes (Ob odnom nelineinom effekte v giroskopakh).** E. A. Zhuravleva (Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR). *Priborostroenie,* vol. 16, no. 2, 1973, p. 73-75. In Russian.

The action on the bearings of a force applied to the center of mass of a gyromotor rotor perpendicularly to its axis is studied, assuming that the gyromotor is of symmetrical design. Expressions for calculating the changes in the initial axial load on the ball bearings and the changes in the axial rigidity of the gyromotor are derived. The extension of these expressions to the case where the applied force is not normal to the rotor axis is examined. V.P.

A73-29150 Feedback analysis details hydromechanical servo response. H. Z. Scott and W. C. Wilde (General Dynamics Corp., Convair Aerospace Div., Fort Worth, Tex.). *Hydraulics and Pneumatics,* vol. 26, Apr. 1973, p. 95-99.

To gain a better understanding of high-gain servo systems consisting of multi-spring, mass-damped systems, a transfer function was developed using the actuating system of an airplane control surface as an example (the F-111 variable-sweep wing airplane). Block diagram servo feedback technology was used to describe the behavior of the systems within the feedback loop of this servo-mechanism. With this type of analysis response characteristics can be determined with a high degree of accuracy and confidence. This feedback theory approach was used for designing the actuation systems for all primary flight control surfaces, with results exceeding initial expectations. F.R.L.

A73-29172 # **Effects of sweepback angle and unit Reynolds number on boundary layer transition at supersonic velocities (Vliianie ugla strelovidnosti i edinichnogo chisla Reinol'dsa na perekhod pogranichnogo sloia pri sverkhzvukovykh skorostiakh).** S. V. Kalinina and V. I. Kornilov. *PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki,* Jan.-Feb. 1973, p. 159-162. 6 refs. In Russian.

A73-29192 # **Some results of studies of the boundary atmospheric layer and AN-2 aircraft flight conditions in a forest fire area (Nekotorye rezul'taty issledovanii pogranichnogo sloia atmosfery i uslovii poleta samoleta AN-2 v zone lesnykh pozharov).** D. A. Konovalov (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Institut Eksperimental'noi Meteorologii, Obninsk, USSR). *Meteorologiia i Gidrologiia,* Sept. 1972, p. 47-52. 9 refs. In Russian.

A73-29204 Construction of fuel and oil quantity sensors for high-performance aircraft. J. A. Warburton (General Electric Co., Wire and Cable Products Dept., Lowell, Mass.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-9, Mar. 1973, p. 177-182.

This paper describes the materials and methods of construction of fuel and oil quantity sensors designed to be used in the severe environments of todays high-performance aircraft. The sensors are based on the use of magnetically activated reed switches suitably compensated by resistors. In order to provide physical and electrical protection, the switches and resistors are encapsulated in a fuel and oil resistant electrical insulation formed of alternate layers of polyimide film and compatible fluorocarbon polymers. (Author)

A73-29210 Automatic checkout and monitoring in the AN TPQ-27 radar system. H. Brockman (RCA, Moorestown, N.J.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-9, Mar. 1973, p. 219-224.

This paper describes automatic monitoring equipment built in to a precision tracking radar system to detect and isolate faults. The purpose of the monitoring equipment is to minimize the mean time to repair faults and to exercise the overall system for pre-mission alignment and calibration. In addition, it is used to periodically check for performance degradation in key areas of the system. The paper describes the design approach used to meet the above requirements. Three types of signals are monitored: analog, digital, and switch closure. A list of each type is given and the technique used to monitor each is described. The design approach for pre-mission alignment and calibration is outlined. (Author)

A73-29212 A decision-directed adaptive tracker. R. J. McAulay and E. Denlinger (MIT, Lexington, Mass.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-9, Mar. 1973, p. 229-236. FAA-USAF-sponsored research.

Statistical decision theory concepts are applied to derive an optimal test procedure for detecting an aircraft maneuver with the aid of an adaptive tracker. A more practical suboptimal test is deduced from the optimal test for use in air traffic control. A simpler filter, based on a constant-velocity model, is used for aircraft tracking when a maneuver is not declared. The tracker is reinitiated by using stored data and updated to the present time to resume a normal tracking when a maneuver is detected. Simulation data indicate a significant improvement in tracking performance when the decision-directed adaptive tracker is used. V.Z.

A73-29217 Optimal aircraft go-around and flare maneuvers. G. Buell (North American Rockwell Corp., Autonetics Div., Anaheim, Calif.) and C. T. Leondes (California, University, Los Angeles, Calif.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-9, Mar. 1973, p. 280-289. 6 refs. Grant No. AF-AFOSR-699-67.

This paper analyzes in detail two of the critical aircraft maneuvers associated with approach and landing: the go-around maneuver and the flare maneuver. Optimal solutions that include state and control variable constraints are obtained for both problems. Two algorithms are given for computation of the minimum and

maximum altitude loss associated with the pilot-controlled go-around maneuver. A matrix operator is obtained that can be used for in-flight computation of the altitude loss on a small general-purpose digital computer. The flare optimization presented is for a cost functional that includes both the longitudinal touchdown dispersion and the normal acceleration. A closed-loop mechanization is given that approximates the optimal trajectory. (Author)

A73-29270 # ***Visualization of unsteady flow over oscillating airfoils.*** G. H. Ruiter, H. M. Nagib, and A. A. Fejer (Illinois Institute of Technology, Chicago, Ill.). In: Turbulence in liquids; Proceedings of the Symposium, Rolla, Mo., October 4-6, 1971. Rolla, Mo., University of Missouri, 1972, p. 195-202; Discussion, p. 202. 21 refs. NSF Grant No. GK-17748; Contract No. F44620-69-C-0022.

The complex nature of flow separation occurring on airfoils oscillating in a uniform flow field at low Reynolds numbers was studied by continuous direct observation in a water tunnel using various flow visualization techniques. Observations were made of the effects exercised on the flow field by changes in system parameters such as mean flow velocity, angle of attack, mean angle of attack, amplitude of oscillation, and location of the support point. Two basic forms of leading edge separation have been observed. At low values of reduced frequency, the separation resembles leading edge separation on stationary airfoils with the separated flow remaining detached from the upper surface. Above a higher critical value of reduced frequency, a strong vortex (roller) is formed at the leading edge with the flow reattaching downstream from it. T.M.

A73-29274 **Hydrolytic reversion of elastomeric potting compounds.** F. H. Gahimer (U.S. Navy, Naval Avionics Facility, Indianapolis, Ind.). *SAMPE Quarterly*, vol. 4, Apr. 1973, p. 35-39. 7 refs.

A study of one hydrolysis-prone potting compound used on the electrical system of military aircraft has revealed the role of diffusion and internal heating in increasing its rate of reversion in humid environments. Methods for monitoring the condition of the material in present equipment and for predicting its remaining service life are discussed. (Author)

A73-29310 # **Impact mechanics as a new technology.** J. G. Avery and R. J. Bristow (Boeing Co., Seattle, Wash.). *Society for Experimental Stress Analysis, Fall Meeting, Seattle, Wash., Oct. 17-20, 1972, Paper.* 23 p.

It is shown how the science of predicting and modifying (increasing or decreasing) the damage resulting from the impact of bodies or media has emerged as an independent technology. Impact testing facilities are described, together with their application to problems involving hypervelocity weapons, meteoroides, rain erosion, nuclear blast debries, containment of bomb and engine-burst fragments, hail and bird impact, and impact of debries from runways. V.P.

A73-29313 **Protective coating systems for Navy aircraft turbine engines.** J. E. Newhart (U.S. Navy, Naval Air Propulsion Test Center, Trenton, N.J.). *National Association of Corrosion Engineers, International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Anaheim, Calif., Mar. 19-23, 1973, Paper 113.* 10 p. $1.50.

In order to fully utilize the physical advantages of new superalloys whose chromium content has been reduced and replaced with elements such as tantalum, columbium, molybdenum, or titanium, it is imperative to develop coatings and coating systems to provide environmental protection. For reliability the coating must form an integrally bonded alloy on the substrate surface. As these various coatings have permitted higher performance and thus increased turbine temperatures, hot corrosion or sulfidation has become increasingly more of a problem. Military sponsored coating investigations are discussed in detail. A table summarizes important current coatings processes for superalloys. F.R.L.

A73-29315 **Corrosion performance of new fastener coatings on operational military aircraft.** F. H. Meyer, Jr. (USAF, Materials Laboratory, Wright-Patterson AFB, Ohio) and E. J. Jankowsky (U.S. Naval Material Command, Naval Air Development Center, Warminster, Pa.). *National Association of Corrosion Engineers, International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Anaheim, Calif., Mar. 19-23, 1973, Paper 115.* 5 p. $1.50.

A program initiated in 1969 as an expansion of an earlier program (1964) to evaluate high purity aluminum coatings on standard aircraft fasteners is described. It appears that those anticorrosion candidates based on aluminum coatings deposited by either an electrodeposition from an ether-based process or ion vapor deposition show a marked superiority over 'standard' cadmium plate in survivability. Minimum coating thicknesses of 0.4 mil appears to be desirable for consistent performance. F.R.L.

A73-29316 **Compatible coatings for corrosion resistant aerospace fasteners.** E. Taylor (Standard Pressed Steel Co., Jenkintown, Pa.). *National Association of Corrosion Engineers, International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Anaheim, Calif., Mar. 19-23, 1973, Paper 116.* 8 p. 11 refs. $1.50.

There is some hesitation in specifying a coating for a material which is resistant to corrosion, even though the degree of resistance varies widely with alloys labelled 'corrosion resistant.' Coatings for fasteners have generally been sacrificial in nature so that the base metal is prevented from corroding or breaking. Magnesium, the metal most likely to protect aluminum structure, is uneconomical to produce as a fastener coating, is very reactive, and is rapidly consumed in corrosive environments. Laboratory evidence overwhelmingly reveals the desirability of corrosion-resistant high strength fastening alloys as a replacement for the corrosion-prone plated alloy steels. F.R.L.

A73-29317 **Critical properties of exterior aircraft finish systems to protect fastener areas.** A. E. Hohman (Vought Aeronautics Co., Dallas, Tex.). *National Association of Corrosion Engineers, International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Anaheim, Calif., Mar. 19-23, 1973, Paper 117.* 9 p. $1.50. Navy-sponsored research.

From a functional viewpoint the protection of fastener areas is the most needed development for the exterior finish system. This requirement leads to the necessity for several critical properties, along with the traditional requirements of adequate adhesion, gloss retention after long sunshine exposure, ease of application, and resistance to polymeric degradation when exposed to humidity and the fluids used on the aircraft. A successful approach is to design the system so that rupture does not occur when the aircraft undergoes maximum loading at the lowest operating temperatures, and to combine coatings which electrically reduce ion transport through the films. F.R.L.

A73-29318 **New inhibited elastomeric finish system designed by corrosion engineers to solve acute corrosion problems on military aircraft.** D. J. Hazen (USAF, Robins AFB, Ga.) and W. A. Boggs (Lockheed-Georgia Co., Marietta, Ga.). *National Association of Corrosion Engineers, International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Anaheim, Calif., Mar. 19-23, 1973, Paper 118.* 11 p. $1.50.

A73-29332 # **Atmospheric optical MTF measurements from an airborne platform.** D. Kelsall (MIT, Lexington, Mass.). *Optical Society of America, Spring Meeting, Denver, Colo., Mar. 13-16, 1973, Paper.* 15 p. USAF-supported research.

Description of a ruggedized shearing interferometer for MTF measurements with two alternate modes of operation. The interferometer has a Michelson-type configuration with a piezoelectric scanner which changes the path length of one arm. Lateral scanning of each beam is produced by a plane parallel micrometer plate in

each arm, and total light in the resultant sheared interferogram is collected onto a photomultiplier. The interferometer measures the MTF over the propagation path and can be effectively operated from an airborne platform with laser or white light sources. V.Z.

A73-29344 * Conference on General Aviation-Business Flying, University of Tennessee, Tullahoma, Tenn., August 17-19, 1972, Proceedings. Conference sponsored by the University of Tennessee, Federal Aviation Administration, Aircraft Owners and Pilots Association, General Aviation Manufacturing Association, and NASA. Tullahoma, Tenn., University of Tennessee, 1972. 162 p. $5.25.

The papers deal with safety measures, commuter airlines, charter and lease flying, pleasure flying and private travel, technology for the next decade, avionics, and the airport network. Attention is given to transfer between general and commercial terminals, airport standards, traffic control, increasing training effectiveness through simulation, proposed revision of Part 61 of FAA regulations, and accident prevention.

F.R.L.

A73-29345 # Avionics. J. A. Kerns (Teledyne, Inc., Los Angeles, Calif.). In: Conference on General Aviation-Business Flying, Tullahoma, Tenn., August 17-19, 1972, Proceedings. Tullahoma, Tenn., University of Tennessee, 1972, p. 28-34.

It is suggested that the coming decade will witness increased attention to the development and application of flight instrumentation to better facilitate flight control and navigation in the vertical plane. The Inertial-lead Vertical Speed Indicator (IVSI) was designed to provide the pilot with an instrument that would allow positive manual control of vertical speed in addition to indicating steady-state vertical speeds. IVSI has been used very successfully as an aid to capturing and maintaining the glide slope during an ILS approach. The display includes both command and advisory information.

F.R.L.

A73-29346 * # Materials - Fiber composites. G. W. Brooks (NASA, Langley Research Center, Hampton, Va.). In: Conference on General Aviation-Business Flying, Tullahoma, Tenn., August 17-19, 1972, Proceedings. Tullahoma, Tenn., University of Tennessee, 1972, p. 42-59.

Fiber composite materials, their properties, their state of technical advancement, and the plans underway to further the development and application of these materials for efficient flight structures are reviewed. It is considered that the costs of composite materials will drop sharply as the volume and manufacturing expertise is increased. The tailorability of structural elements and unique applications requiring high stiffness seem to be particularly attractive features. A good measure of the state of the technology is the sophistication of the structures being built and flown. Several examples are cited. F.R.L.

A73-29347 # Airport standards. W. J. Robinson. In: Conference on General Aviation-Business Flying, Tullahoma, Tenn., August 17-19, 1972, Proceedings. Tullahoma, Tenn., University of Tennessee, 1972, p. 76-83.

The airport standards directly related to the community pertain to airport land requirements, height restrictions under imaginary surfaces, and to noise exposure and compatible land use. The standards discussed are for publicly owned airports with federal grant agreements. In order to meet long-range needs, it is necessary to project the airport layout and plan so that each stage of development is a logical and economical move toward meeting the ultimate aeronautical demand. F.R.L.

A73-29348 * # Fundamental advancements of the future. R. L. Winblade (NASA, Office of Aeronautics and Space Technology, Washington, D.C.). In: Conference on General Aviation-Business Flying, Tullahoma, Tenn., August 17-19, 1972, Proceedings. Tullahoma, Tenn., University of Tennessee, 1972, p. 121-130.

General aviation encompasses all aviation except air carrier and military. This includes a broad spectrum of aircraft types ranging from amateur-built aircraft to jet transports, and includes missions such as transportation of people and freight, firefighting, power line patrol, agricultural, racing, and police patrol. The time span from discovery to broad utilization is such that for the next decade the majority of the innovations that will show up in the general aviation fleet will be derived from today's research efforts. A second area that has high potential is the modification of technology developments for military and transport aircraft to the needs of general aviation requirements of cost, complexity, and reliability. F.R.L.

A73-29349 # Accident prevention. G. P. Bates, Jr. (FAA, Washington, D.C.). In: Conference on General Aviation-Business Flying, Tullahoma, Tenn., August 17-19, 1972, Proceedings. Tullahoma, Tenn., University of Tennessee, 1972, p. 134-146.

According to a breakdown of accident investigations there appear to be many people, licensed, who do not have sufficient intelligence to fly. Aside from pilots' errors of judgment, it is also suggested that factory errors of judgment can occur because controls or instruments may not have been placed in optimum positions. The problems of skill degradation, training characteristics, design-induced pilot error, lightning, structures, and the possible use of the air bag to avoid contact injuries are discussed. F.R.L.

A73-29380 The noise characteristics of a large 'clean' rotor. J. W. Leverton. *(NATO, AGARD, Specialists' Meeting on Aerodynamics of Rotary Wings, Marseille, France, Sept. 13-15, 1972.) Journal of Sound and Vibration*, vol. 27, Apr. 8, 1973, p. 357-376. 10 refs. Research supported by the Ministry of Defence.

A two-bladed 56-ft-diam rotor was run on a tower in an inverted mode so that the problem of recirculation and the difficulties of measuring noise directivity characteristics could be overcome. The analysis procedure used is outlined, and the detailed results obtained are presented. From a practical point of view rotor noise can be considered to consist of rotational or discrete frequency noise, low-frequency broadband noise, and high-frequency broadband noise. The spectrum characteristics and the directivity patterns of each of these sources have been examined as a function of the blade tip speed, the total rotor thrust, and the measurement angle relative to the rotor disk plane. The trends associated with the overall noise, which is dependent on the relative magnitude of the individual sources, have also been studied. These results have been compared, where possible, with the trends given by theoretical and semiempirical prediction methods. Time history traces are also included; these show that even under ideal conditions rotor noise is impulsive in nature. (Author)

A73-29382 Vortex induced helicopter blade loads and noise. L. T. Filotas (Ministry of Transport, Civil Aviation Branch, Ottawa, Canada). *Journal of Sound and Vibration*, vol. 27, Apr. 8, 1973, p. 387-398. 14 refs.

The fluctuating lift on a helicopter rotor blade passing close to a tip vortex shed from a preceding blade may generate an intense cyclic banging noise, called blade slap, which is one of the most offensive of all helicopter noises. Such blade/vortex interactions are modeled by a finite aspect ratio wing flying at uniform speed over a carpet of equally spaced, infinitely long, line vortices. By using linearized lifting surface theory, the harmonic blade loads are expressed as a Fourier series with coefficients involving the same 'sinusoidal gust transfer function' that figures prominently in the analysis of aircraft response to atmospheric turbulence. An established theory (Lowson and Ollerhead, 1969) can be used to calculate the radiated noise harmonics in terms of the Fourier coefficients.

Consideration of the noise propagated to the far field of a blade-fixed reference frame indicates that blade slap noise is only weakly influenced by aspect ratio. For a blade passing over the vortices at fixed height, acoustic power generation is proportional to the inverse third power of the height and is efficient only if the vortex spacing is about five times the height. (Author)

A73-29383 The changing shape of air transport in the 1970s /28th British Commonwealth Lecture/. A. Thomson (British Caledonian Airways, Ltd., Horley, Surrey, England). *Aeronautical Journal*, vol. 77, Mar. 1973, p. 121-129.

Consideration of the impact of general developments of this decade on the business-oriented aspects of commercial aviation in Great Britain and worldwide. The topics include revenues, inflation, passenger traffic statistics and forecasts, operational profits, charter and regular operations, and fare levels. The problems associated with the future growth of air transport are pointed out. V.Z.

A73-29384 The management of the MRCA /16th Henson and Stringfellow Memorial Lecture/. W. Stewart (Ministry of Defence, London, England). *Aeronautical Journal*, vol. 77, Mar. 1973, p. 130-135.

Discussion of the managerial aspects of the Multi-Role Combat Aircraft Program, a joint project of the UK, Germany and Italy, undertaken in 1969 under a NATO charter. The remarkable extent to which the staffs of the three countries have merged into an international team in their cooperativeness is noted. V.Z.

A73-29385 Design and simulation of an aircraft brake using a digital computer. J. S. Claridge (Dunlop Holdings, Ltd., England). *Aeronautical Journal*, vol. 77, Mar. 1973, p. 136-146.

A theoretical basis is set forth for a simulation program in developing an aircraft brake design with the aid of a digital computer. Simulation is based on the numerical analysis of a set of linear and differential equations describing the motion of a braked wheel and a flywheel test machine. The application of this technique to designing an aircraft brake by computer from a customer's requirement specification is discussed. V.Z.

A73-29413 # Simulated flight tests of a digitally autopiloted STOL-craft on a curved approach with scanning microwave guidance. F. D. Farrington (Ohio Northern University, Ada, Ohio) and R. E. Goodson (Purdue University, Lafayette, Ind.). *(American Society of Mechanical Engineers, Paper 73-Aut-L, 1973.) ASME, Transactions, Series G - Journal of Dynamic Systems, Measurement, and Control*, vol. 95, Mar. 1973, p. 55-63. 16 refs.

A work is described which studied the capabilities of a STOL aircraft equipped with digital minicomputer serving as an autopilot making a curved approach to a runway. The work involved the development of an ATC scheme for effectively generating a flyable curved approach path and specifying such a path to the aircraft being served. The paths produced are made up of alternating straight and circular segments along which the plane is to maintain prescribed constant airspeeds. The digital autopilot functions include navigation, control trimming, anticipatory calculations, generation of control commands based on utilization of linear optimal state-feedback control theory, filtering (including Kalman techniques) of state measurements, and estimation of prevailing winds. A complete simulation of such a system aboard a McDonnell-Douglas 188/Breguet 941 STOL transport, with realistic winds, turbulence, and measurement noise, was created and exercised on the Purdue University CDC 6500 computer system, and showed the capability of excellent adhesion of the aircraft to the commanded flight path. (Author)

A73-29551 # Generalized relations for the parameters at the flow separation boundary in compressor cascades (Obobshchennye zavisimosti dlia parametrov na granitse sryva potoka v kompressornykh reshetkakh). E. Z. Madorskii. *Energomashinostroenie*, vol. 19, Feb. 1973, p. 39, 40. 8 refs. In Russian.

Expressions relating the design and gasdynamic parameters of axial-flow compressor cascades to the separation boundary are derived. General relations for calculating the inlet blade angles at the separation boundary are proposed. V.P.

A73-29552 # Features of flow-parameter measurement by a cylindrical probe in the vaneless diffuser of a small centrifugal compressor (Osobennosti izmereniia parametrov potoka tsilindricheskim zondom v bezlopatochnom diffuzore malorazmernogo tsentrobezhnogo kompressora). E. N. Zaichenko and E. V. Aboltin. *Energomashinostroenie*, vol. 19, Feb. 1973, p. 41-43. In Russian.

A73-29573 # Evaluation of logistics support in five dimensions. J. M. Perkins (U.S. Navy, Naval Missile Center, Point Mugu, Calif.). In: Society of Logistics Engineers, Annual Convention, 7th, Long Beach, Calif., August 21-23, 1972, Proceedings. Los Angeles, Society of Logistics Engineers, 1972, p. 58-65.

The five dimensions describing the effectiveness of the logistic support include manhours (shipboard), space (shipboard), availability/operational, logistic operating costs, and availability/inventory. The steps necessary to transform logistic characteristics into these five dimensions involve a system evaluation, a real-world definition, and a systems analysis. It is pointed out that the application of computer technology combined with the experience and knowledge of the practical logistician can provide a measurement of the effectiveness of the logistic support stated in real-life meaningful terms. G.R.

A73-29585 Long-life, high energy Ni-Cd aerospace cells. C. Tanis (USAF, Materials Laboratory, Wright-Patterson AFB, Ohio) and J. J. Lander (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio). In: Power Sources Symposium, 25th, Atlantic City, N.J., May 23-25, 1972, Proceedings. Red Bank, N.J., PSC Publications Committee, 1972, p. 55-57. 10 refs.

Nickel-cadmium aircraft battery cell designs have employed cellophane as one of the separator materials. The cellophane provides a semipermeable barrier, but it is chemically unstable in the cell environment. The calendar in-service life of these batteries is from one to three years, depending on usage, and evidence is accumulating that the cells fail to a large extent by short circuiting. Test data presented in this paper indicate that the service life can be increased by a factor of three or more by replacing the cellophane layer with a layer of P-2291 (cross-linked, methacrylic acid-grafted, low-density polyethylene), while maintaining good high-rate discharge performance in cold temperatures. T.M.

A73-29589 Sealed aircraft battery with integral power conditioner. T. A. McWhorter and W. S. Bishop (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio). In: Power Sources Symposium, 25th, Atlantic City, N.J., May 23-25, 1972, Proceedings. Red Bank, N.J., PSC Publications Committee, 1972, p. 89-91.

Description of development efforts, laboratory tests, and flight trials with an aircraft battery system consisting of 21 sealed nickel-cadmium cells, each containing 13 positive plates, 14 negative plates, and a third electrode. The sealed cells are physically and electrically integrated with an electronics section containing logic functions and power control/conditioning circuits. The system is intended to provide power only when the bus loads cannot be sustained by other power generation devices. Testing of the final development version indicated that reliable low-maintenance operation can be expected in aircraft for a life of three to five years. T.M.

A73-29638 Investigations of turbine-vane vibrations, allowing for vibration phase shift. A. A. Kaminer and N. Ia. Nastenko (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti,

Kiev, Ukrainian SSR). *(Problemy Prochnosti,* vol. 4, July 1972, p. 122, 123.) *Strength of Materials,* vol. 4, no. 7, Apr. 1973, p. 897, 898. Translation.

Discussion of a technique for turbine-vane vibration tests in the case of vibration phase shifts. Block diagrams are given for testing assemblies with phase shift generation. Line-drawings of the basic circuit of a lamp-type phase inverter and of a setup for testing vanes are also included. V.Z.

A73-29651 Reduction of aircraft noise during stationary runs (Verringerung des Flugzeuglärms bei Standläufen). G. Vogel (Arbeitsgemeinschaft Deutscher Verkehrsflughäffen, Stuttgart, West Germany). *VDI-Z,* vol. 115, no. 5, Apr. 1973, p. 339-341. In German.

Description of measures which have been taken to reduce the noise level during stationary engine running after repair work on jet aircraft. Among the measures discussed in this connection are the use of sound-deflecting and sound-absorbing walls (with additional grids, if required), the use of movable or stationary tubular sound absorbers, and the use of soundproof buildings. A.B.K.

A73-29731 # Meteorological radar and the WILM landing aid (Radar de météorologie et d'aide à l'atterrissage WILM). R. Gendreu (Thomson-CSF, Division Equipements Avioniques et Spatiaux, Malakoff, Hauts-de-Seine, France). *Revue Technique Thomson - CSF,* vol. 5, Mar. 1973, p. 159-178. In French.

An onboard multipurpose radar for civil aircraft is described which is aided by three standard ground beacons. This radar, which can be substituted for the existing weather radar on an aircraft, without major modification, performs all-weather landing aid, ILS monitoring, and autonomous operation. It can also detect meteorological perturbations, perform ground mapping, and can provide ground collision avoidance. The underlying principle of the WILM (weather independent landing monitoring) function is described, and the results of flight tests with a radar model are indicated. Also given are the possibilities of an operational system combining these functions, and of extending the system. F.R.L.

A73-29770 Variable-pitch fans - Progress in Britain. D. G. M. Davis (Dowty Rotol, Ltd., Gloucester, England). *Flight International,* vol. 103, Apr. 19, 1973, p. 615-617.

The results of recent research work in variable-pitch fans are reviewed. It is shown that a high-bypass-ratio variable-pitch fan has the following advantages: inherently low noise levels, because of high bypass ratio and low fan tip speeds; rapid thrust response, allowing thrust modulation for accurate rate of descent control on the approach and maximum use of reverse thrust during the landing run; reverse thrust available without the weight or maintenance penalty associated with reversers and spoilers; high ratio of take-off to cruise thrust, well matched to the needs of short-range STOL aircraft; good cycle efficiency and specific fuel consumption; and wide engine operating margins. In addition, it has many of the advantages of the turboprop, while avoiding vibration, ground and fuselage clearance problems and allowing better matching with higher cruise speeds. V.P.

A73-29771 Variable-pitch fans - Hamilton Standard and the Q-fan. M. Wilson. *Flight International,* vol. 103, Apr. 19, 1973, p. 617-619.

Some engineering aspects of two variable-pitch fan projects are discussed. One is a 4-ft 6-inch unit driven by a Lycoming T-55 gas-generator. The other is a 6-ft fan driven by electric motor. Tests with a full-scale Q-fan built to assess noise levels and compatibility of the fan and its Lycoming gas-generator are discussed. Quietness and thrust reversibility are currently seen to be the most desirable qualities of such fans. V.P.

A73-29876 Overview - The role of communication systems in air traffic management. L. W. Roberts (U.S. Department of Transportation, Transportation Systems Center, Cambridge, Mass.), G. E. Lundquist (FAA, Washington, D.C.), and D. E. Findley (U.S. Department of Transportation, Washington, D.C.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 346-363.

This paper considers the fundamental and pervasive role of communications in the operation of the current air traffic control system and in the planning of the advanced systems of the future. The authors discuss the evolution of the present system through its successive generations and present the major features of the proposed upgraded third-generation system, with emphasis on the communications requirements imposed by the elements of the upgraded third. Advanced systems concepts, both satellite and ground based, applicable to oceanic as well as continental service, are discussed. The overview concludes with a discussion of communications in relation to automation. (Author)

A73-29877 Historical development of the Air Traffic Control System. G. A. Gilbert (Glen A. Gilbert and Associates, Washington, D.C.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 364-375.

In 1933 instrument flying commenced, and by 1935 several airlines jointly established the first Airway Traffic Control centers to safeguard their aircraft against midair collisions. In 1936, this preliminary effort was transferred to the Federal Government, and the first-generation Air Traffic Control (ATC) System was born. The advent of radar in the early 1950's marked the inauguration of the second-generation system, which carried on, expanded, and improved the accomplishments of the first generation, and brought into operational use radar and direct center/pilot communication capability. In the early 1960's the third generation came into being with the introduction of automation. Recognizing the need to develop a more comprehensive approach to solving the requirements of ever increasing air traffic volume, an upgraded third-generation system was postulated in 1969. The third/upgraded third generations will merge during the 1970's. From this base, the ATC System will transition to a fourth generation, with initial implementation commencing perhaps in the early 1980's. (Author)

A73-29878 Formulation of the air traffic system as a management problem. W. B. Cotton (Sky-Paltz, Ltd., New Paltz, N.Y.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 375-382. 6 refs.

The functioning of the national air traffic management system is postulated using aircraft operating economies and mission flexibility as the primary goals. The management functions of enroute separation, sequencing for landing, and spacing of aircraft are discussed in an environment of near universal area navigation capability and rapid discreet communications. (Author)

A73-29879 Structure of the airspace. F. C. Holland, R. A. Rucker, and B. M. Horowitz (Mitre Corp., McLean, Va.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 382-398. U.S. Department of Transportation Contract No. FA70WA-2448.

This paper provides an overview of the current airspace structure, describes some of the new concepts to be implemented over the next ten years, and describes the expected airspace structure to be introduced in the 1980's. Alternative control concepts are compared, and the air/ground data link requirements needed to support the traffic densities anticipated in the Los Angeles basin in 1995 are estimated. (Author)

A73-29880 Air-ground communications - History and expectations. F. C. White (Air Transport Association of America, Operations and Airports Dept., Washington, D.C.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 398-407. 10 refs.

The development of civil and related military air-ground communications in the United States is traced from its beginning in the late 1920's to the present time. The alternative methods of information exchange between the ground and aircraft, radar beacon transponders, and digital communications are reviewed from their conceptual identification to their current state of development. An estimate is made of the probability of implementation of the discrete address beacon system (DABS) and the RTCA endorsed universal data link. (Author)

A73-29881 The development of the ATC radar beacon system - Past, present, and future. P. R. Drouilhet, Jr. (MIT, Lexington, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 408-421. 6 refs. FAA-sponsored research.

A73-29882 A synchronized discrete-address beacon system. T. S. Amlie (FAA, Washington, D.C.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 421-426.

A measure of discipline must be imposed on the ground-based interrogator complex if a new discrete-address beacon system is to be compatible when introduced into the present air traffic control system. It is postulated that this discipline, if imposed in a certain manner, will provide a surveillance system that will provide several additional benefits and services to the aircraft operator at minimum cost and complexity. (Author)

A73-29883 Operation of current navigation aids and future prospects. G. W. Casserly and D. W. Richardson (Champlain Technology, Inc., West Palm Beach, Fla.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 427-435. 27 refs.

This paper is designed as a survey document to be used as an overview and introduction to the various concepts and levels of complexity of current and future aids to air navigation. Major emphasis is placed on identifying those technical and operational characteristics of each system concept and/or mechanization that have a significant impact upon both cockpit and ground-based communications and data processing. A representative bibliography is included to provide the reader the ability to pursue the subject further from an operational as well as a technical viewpoint. The object of this paper is to identify the relationship of air navigation aids to the flow and utilization of information in air navigation and air traffic control (ATC). (Author)

A73-29884 Instrument Landing Systems. L. L. Sanders and V. J. Fritch, Jr. (ITT Gilfillan, Inc., Van Nuys, Calif.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 435-454. 66 refs.

The inadequacies of the current Instrument Landing System (ILS) are detailed and the various efforts of special committees to define an eventual replacement system are described. A five-year national plan for development of a Microwave Landing System (MLS) is being carried out under the leadership of the FAA. The goals of the MLS program are stated and discussed. A number of the fundamental issues on system requirements and system design that were decided by the RTCA are described with their alternates. These issues include the use of air-derived data for extracting aircraft position data; the use of precision distance measuring equipment (DME); the requirement to provide flare-out guidance; and the establishment of a two-band approach using frequencies in the C and Ku bands. (Author)

A73-29885 Ground communications networks for aeronautical operations. R. F. Decker (FAA, Washington, D.C.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 454-472. 5 refs.

Three digital communications networks of the FAA performing essential services in support of the National Air Space System (NAS) are described and discussed. Designated as the Aeronautical Fixed Telecommunications Network (AFTN), the combined Weather Teletypewriter Networks A, C, and O, and the Service B Teletypewriter Network, respectively, these systems carry national and international digital message traffic in support of air traffic control operations and aeronautical weather services. These data are exchanged among the Air Traffic Control Centers, Airport Terminal Facilities, and Flight Service Stations of the FAA and in the case of weather data, with offices of the National Weather Service Military Weather and Flight Operations Offices, airlines, and other commercial and industrial interests. Recent and planned modernization programs resulting in the introduction of major computerized electronic message switching centers are also discussed. (Author)

A73-29886 The role of the computer in the ATC environment. G. E. Mellen (Sperry Rand Corp., Univac Div., St. Paul, Minn.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 472-488. 27 refs.

Computers, and digital techniques in general, have become pervasive in the technology of air traffic control (ATC). So much so that it is difficult to discover an area, application, or function in which automation is not involved, if only at the conceptual level. Rather than describing a single role for the computer, this paper examines some typical uses of computers in relation to the various functional organizations and facilities of the ATC system. One conclusion reached is that present and near-term computer technology is sufficiently capable to meet the needs of at least the next decade of air traffic. (Author)

A73-29887 Improvements in Airport Surface Traffic Control surveillance. A. L. Borelli and H. Huebscher (Hazeltine Corp., Greenlawn, N.Y.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 489-493. 5 refs.

An Airport Surface Traffic Control (ASTC) system is intended to expedite the safe movement of aircraft and vehicles on the airport surface (runways, taxiways, etc.). This paper describes the present ASTC system and discusses potential improvements in its surveillance function, with particular emphasis on multilateration techniques for aircraft/vehicle position determination and identification. (Author)

A73-29888 Oceanic aeronautical satellite systems. P. T. Astholz (FAA, Aeronautical Satellite Div., Washington, D.C.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 493-500. 12 refs.

This paper provides a summary of the oceanic air traffic control problems and a description of the use of satellite technology that offers solutions to some of the problems. An outline of the current experimentation and evaluation programs is discussed together with the possible use of an international program for a dedicated aeronautical satellite system. Included is a brief system description of the proposed technical requirements for this system. (Author)

A73-29889 The military and air traffic control. D. R. S. McColl (USAF, Washington, D.C.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 501-516.

This paper discusses the roles of the military, both as a user and operator of ATC systems and as a developer of ATC related systems and equipments. The different areas of the NAS in which interfaces exist between the civil and military are defined. These areas include operations, organizational interfaces, and equipment and facility interfaces and in many cases are covered by formal agreements. By way of illustration, two typical military flights are used to show the combined interaction of a military aircraft with both civil and military ground facilities. Communications, navigation, and surveillance requirements are discussed with respect to the various phases of the example flights. (Author)

A73-29890 Signal design for aeronautical channels. L. A. Frasco and H. D. Goldfein (U.S. Department of Transportation, Transportation Systems Center, Cambridge, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 534-547. 39 refs.

This paper surveys areas of communication technology that relate to civilian air traffic control system development from the present through the 1990's. A major portion of the paper consists of a series of examples that surveys communication analyses for the ATC systems. They support the need for the development of ATC radio channel models as an important prerequisite to the communications analysis of ATC systems. (Author)

A73-29891 **Aeronautical channel characterization.** P. A. Bello (CNR, Inc., Newton Upper Falls, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 548-563. 43 refs.

This paper is concerned with characterizing the link between an airplane and a satellite. Attention is focused on the effect of indirect paths scattered from the surface of the earth. Applicable propagation-theoretic and system function-theoretic work is reviewed and integrated. Some new and some known expressions for channel correlation functions are presented for the 'steepest descent' channel model. (Author)

A73-29892 **Effect of multipath on ranging error for an airplane-satellite link.** P. A. Bello and C. J. Boardman (CNR, Inc., Newton Upper Falls, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 564-576. 8 refs. U.S. Department of Transportation Contract No. TSC-516.

An exact analysis is carried out on the effects of noise and surface scatter multipath on the one-way ranging errors of a single-sideband tone ranging modem used in an airplane-satellite link. With appropriate redefinition of parameters the results are shown to apply approximately to double-sideband tone ranging modems at high signal/noise and signal/multipath ratios. The theoretical results are applied to obtain numerical results on ranging error for typical system geometries and sea states and for a representative hemispherical-coverage aircraft antenna. Multipath is shown to cause larger ranging errors than previously indicated. The need for additional channel measurements is pointed out. (Author)

A73-29893 **Multiple-access considerations - A satellite example.** I. G. Stiglitz (MIT, Lexington, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 577-582. 30 refs. U.S. Department of Transportation Contract No. TSC-241.

Increased air traffic coupled with the proliferation of sophisticated avionics can be expected to stimulate increased demand for air traffic control (ATC) services over the next few decades. New challenges for the design of communication, surveillance, and navigation subsystems are an anticipated consequence. Since it is unlikely that significantly larger frequency bands will become available, it will be necessary to exploit more efficient multiple-access techniques. The design of a multiple-access technique for a particular application will depend on a broad range of system issues. A predetermined procedure based on general characteristics of the various techniques will have but limited value. An example of an ATC satellite surveillance system is used to illustrate some of the broad ranging systems issues that can be expected to influence the selection of the multiple access technique. (Author)

A73-29894 **The use of specialized antenna technology for air traffic control and communications.** J. J. Maune and R. J. Giannini (Hazeltine Corp., Greenlawn, N.Y.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 583-590. 9 refs.

The implementation of new antenna techniques will contribute significantly to the success of air traffic control and communication development programs. Three new antenna developments that incorporate advanced techniques are described, including an electronically scanned array for an air traffic control radar beacon system, a hybrid-scan array for aircraft/satellite communications at SHF, and a small antenna for aircraft/satellite communications at UHF. (Author)

A73-29895 **Radar technology applied to air traffic control.** W. W. Shrader (Raytheon Co., Wayland, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 591-605. 18 refs.

Use of primary radars for air traffic control (ATC) is discussed. The location and the parameters of various ATC radars are described. The clutter environment (land clutter, birds, automobiles, and weather) has had a major impact on the configuration of these radars. Signal-processing techniques and antenna techniques utilized to cope with the clutter are described. Future signal-processing techniques for the ATC radars are postulated. (Author)

A73-29896 **Dissemination of system time.** C. E. Ellingson and R. J. Kulpinski (Mitre Corp., Bedford, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 605-624. 29 refs. Contract No. F19628-71-C-0002.

This paper considers the problem of estimating the offset in timing of like events at geographically separated locations as a basis for establishing common knowledge of time and, hence, system synchronism. Configurations discussed involve interrogation and reply between a user and a single donor, and one-way propagation between a user and the multiple sites of a reference system. The latter category includes navigation systems, which are shown to be appropriate means for disseminating time. Further ramifications of time dissemination are discussed, including the characteristics of clocks suitable for airborne application. Variables and their relationship and solution are defined for stationary and moving users, and for users of atomic and crystal clocks. (Author)

A73-29897 **The role of the airborne traffic situation display in future ATC systems.** M. E. Connelly (MIT, Cambridge, Mass.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 624-638. 37 refs.

The historical evolution and current status of the airborne traffic situation display concept is presented as well as a survey of related technological developments in collision-avoidance systems, area navigation equipment, and data links. Two alternative ATSD systems configurations are discussed: one deriving aircraft positions from ATC surveillance, the other deriving aircraft positions from air-to-air data exchanges. Based on the results of a Massachusetts Institute of Technology simulation study of airborne traffic situation display capabilities, a review of the many possible applications of the device is presented. (Author)

A73-29898 **Satellite-aircraft multipath and ranging experiment results at L band.** R. W. Sutton, E. H. Schroeder, A. D. Thompson, and S. G. Wilson (Boeing Commercial Airplane Co., Seattle, Wash.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 639-647. 13 refs. U.S. Department of Transportation Contract No. FA69WA-2109.

Results of a flight test program involving a KC-135 jet airplane, the synchronous ATS-5 L-band satellite, and a ground station are presented. Tests included over-ocean multipath measurements and one-way tone ranging within the 1545-1655 MHz frequency band. Amplitude characteristics, polarization, power spectral density, and selective fading properties were measured for sea-reflected and composite signal channels. CW tone-ranging performance was determined in both the thermal noise and multipath environments. Comparison of experimental results with theoretical expectation is given. (Author)

A73-29899 * **An efficient multiplexing approach for adaptive aircraft communications via a relay satellite.** C. Devieux (COMSAT Laboratories, Clarksburg, Md.) and J. J. Bisaga (Computer Sciences Corp., Falls Church, Va.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 647-652. 5 refs. Contract No. NAS5-21590.

Description of a coherent wide-angle multiplexing approach which is 4 to 8 dB more efficient in the utilization of satellite power as compared to a multicarrier transmission accessing a single TWT amplifier transponder. The wide-angle multiplexing approach achieves this performance by efficiently trading the modulation

power improvement against backoff at the satellite earth terminal phase modulator. A simple addition of an amplitude clipper at the modulator input is critical to the proper operation of the system. A.B.K.

A73-29900 * Multibeam satellite EIRP adaptability for aeronautical communications. G. V. Kinal and J. J. Bisaga (Computer Sciences Corp., Falls Church, Va.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 653-655. Contracts No. NAS5-21590; No. NAS5-21695.

EIRP enhancement and management techniques, emphasizing aeronautical communications and adaptable multibeam concepts, are classified and characterized. User requirement and demand characteristics that exploit the improvement available from each technique are identified, and the relative performance improvement of each is discussed. It is concluded that aeronautical satellite communications could benefit greatly by the employment of these techniques. (Author)

A73-29902 * Multipath modeling for aeronautical communications. J. H. Painter (NASA, Langley Research Center, Hampton, Va.), S. C. Gupta (Southern Methodist University, Dallas, Tex.), and L. R. Wilson (LTV Aerospace Corp., Hampton, Va.). *IEEE Transactions on Communications,* vol. COM-21, May 1973, p. 658-662. 19 refs.

One of the fundamental technical problems in aeronautical digital communications is that of multipath propagation between aircraft and ground terminal. This paper examines in detail a model of the received multipath signal that is useful for application of modern detection and estimation theories. The model treats arbitrary modulation and covers the selective and nonselective cases. The necessarily nonstationary statistics of the received signal are determined from the link geometry and the surface roughness parameters via a Kirchhoff solution. (Author)

A73-29936 Potential applications of acoustic matched filters to air-traffic control systems. P. M. Grant, J. H. Collins, B. J. Darby, and D. P. Morgan (Edinburgh, University, Edinburgh, Scotland). *IEEE Transactions on Sonics and Ultrasonics,* vol. SU-20, Apr. 1973, p. 206-218. 68 refs. Research supported by the Science Research Council and Ministry of Defence of England.

Consideration of the long-term applications of acoustic matched filters to the field of civil and military air traffic control (ATC) systems. Current ATC systems in the United States, Great Britain, and Europe are reviewed, and their basic deficiencies are noted. The significant and unique features of acoustic matched filters are enumerated, and their performance status as devices and in modem usage is discussed. Envisaged ATC systems which are necessary to meet forecast traffic requirements are described, emphasizing those systems most affected by acoustic technology. A.B.K.

A73-29996 Q-fan use on business aircraft studied. E. J. Bulban. *Aviation Week and Space Technology,* vol. 98, Apr. 23, 1973, p. 65-67.

A multibladed shrouded fan (the Q-Fan) matched to piston or rotary combustion engines is being developed by the Hamilton Standard Division of United Aircraft as a new propulsion system for light and medium class business aircraft in the 1980-time frame. The new application for the Q-Fan offers benefits in noise reductions on the order of 18 to 20 pndb over the same class of conventional propeller-engine propulsion systems, cleaner, lower-drag airframes, costs and weights comparable to conventional systems, and improved styling because of aft-mounted engines. F.R.L.

A73-30067 Dispersed systems as commercial materials for aerospace application. W. Bunk. *(American Society for Metals, Materials Engineering Congress, Cleveland, Ohio, Oct. 16-19, 1972.) Journal of Metals,* vol. 25, May 1973, p. 26-32. 16 refs.

The probable future applications in the aerospace industry of such materials as precipitation and dispersion hardened alloys, fiber reinforced composites, and d.s. eutectics are evaluated on the basis of opinions of scientists working in this field. Advances in these materials and new fabricating methods are examined. It is shown that preference is given to precipitation hardened alloys in almost any application. Dispersion hardened materials are attractive for use in jet engines. Fiber composites are candidate materials for use at medium and low temperatures, while d.s. eutectics are well suited for high-temperature applications. V.P.

A73-30173 Three-dimensional turbulent boundary layers - A report on EUROMECH 33. H. Fernholz (Berlin, Technische Universität, Berlin, West Germany). *Journal of Fluid Mechanics,* vol. 58, Mar. 20, 1973, p. 177-186. 42 refs.

General discussion of numerical prediction methods and experimental results described in papers presented at the 33-rd EUROMECH colloquium on three-dimensional turbulent boundary layers. Differential methods of calculation are evaluated along with integral methods where the number of dimensions is reduced from three to two by first integrating across the complete boundary layer before seeking a solution. Experiments considered include measurements on infinite swept wings, on a slender wing, and in different flow configurations. Discussions on measurements of flow direction, wall shear stress, static pressure profiles, and shear stress profiles are briefly outlined. T.M.

A73-30174 Vibrational relaxation effects in weak shock waves in air and the structure of sonic bangs. J. P. Hodgson (Manchester, Victoria University, Manchester, England). *Journal of Fluid Mechanics,* vol. 58, Mar. 20, 1973, p. 187-196. 5 refs.

A73-30201 Finite element analysis of a wing structure. T. Kawai (Tokyo, University, Tokyo, Japan) and Y. Tada (National Aerospace Laboratory, Tokyo, Japan). In: Advances in computational methods in structural mechanics and design; Proceedings of the Second U.S.-Japan Seminar, Berkeley, Calif., August 1972. Huntsville, Ala., UAH Press, 1972, p. 727-744. 8 refs.

A finite element solution procedure for sweptback wing structures, based on the modern engineering theory of beams, is presented. The procedure essentially consists of two steps. The first step is the replacement of the wing structure by equivalent beam elements, requiring evaluation of various sectional properties of a beam with arbitrary cross section. The second step comprises the formulation and solution of the overall stiffness equation of a given wing structure, including the restrained condition for sweptback boundary. Since the procedure for the first step has already been published, emphasis is placed on the procedure for the second step, with particular attention given to the development of the restrained condition for the sweptback boundary. (Author)

A73-30240 # The SOKO Galeb 3 trainer-fighter aircraft (Samolot treningowo-bojowy SOKO Galeb 3). J. Swidzinski. *Technika Lotnicza i Astronautyczna,* vol. 28, Mar. 1973, p. 7-13. In Polish.

Description of the structure, flight controls, landing gear, power plant, fuel system, avionics equipment, armament, and performance specifications of the two-seater Galeb 3 cantilever low-wing monoplane powered by a single Bristol Siddley Viper 20 turbojet engine. In comparison with earlier models of this aircraft, Galeb 3 features stronger structural elements, a higher-thrust engine, modernized avionics, a higher armament payload, and improved access for inspection and maintenance. The aircraft can be used in different applications as a two-seater trainer version, an aerobatics version, a long-range photographic reconnaissance aircraft, and a fighter. T.M.

A73-30241 # Laminate wing spar design (Obliczanie dzwigara laminatowego). W. Stafiej (Osrodek Badawczo-Rozwojowy Szybownictwa, Bielsko-Biala, Poland). *Technika Lotnicza i Astro-*

nautyczna, vol. 28, Mar. 1973, p. 14-16, 23-25. In Polish.

Description of the strength characteristics and elastic properties of fiberglass-reinforced plastic laminates used to manufacture aircraft structural elements in Poland. Tables list typical properties for laminates based on fiberglass roving and on fiberglass cloth with various weave patterns. A design procedure for laminate wing spars in gliders is described in detail. T.M.

A73-30242 # **Airport illumination. I (Oswietlenie lotnisk. I).** M. Pasek. *Technika Lotnicza i Astronautyczna*, vol. 28, Mar. 1973, p. 30-34. In Polish.

Various types of airport signal lights are described in terms of their location and functional purpose in takeoff and landing operations. Particular attention is given to the VASIS lighting system used to provide visual indication of the landing approach angle; installation, principles of operation, and typical utilization of this system are explained in detail. T.M.

A73-30293 **Legal consequences resulting from transportation in airline traffic in the case of missing, deficient or not coverage-equivalent contractual basis (Rechtsfolgen aus Beförderungen im Fluglinienverkehr bei fehlender, mangelhafter oder nicht deckungsgleicher vertraglicher Grundlage).** A. Rudolf. *Zeitschrift für Luftrecht und Weltraumrechtsfragen*, vol. 22, Apr. 1, 1973, p. 81-99. 55 refs. In German.

A73-30294 **Commercial air transportation in France - National administration and aviation enterprises (Der gewerbliche Lufrverkehr in Frankreich - Staatliche Verwaltung und Luftfahrtunternehmen).** M. A. Dauses (Ecole Nationale d'Administration, Paris, France). *Zeitschrift für Luftrecht und Weltraumrechtsfragen*, vol. 22, Apr. 1, 1973, p. 100-117. 82 refs. In German.

The objectives of the national administration of air transportation are examined, giving attention to the admission of air transportation enterprises and their supervision. The organization of the national air transportation administration is discussed together with national and private aviation companies. Attention is given to the characteristics of Air France as a national company, including provisions ensuring the control of the airline by the state. G.R.

A73-30302 **Study of the effect of technical factors on the fatigue limit of the working blades of gas turbine motors.** V. T. Troshchenko, B. A. Griaznov, S. S. Gorodetskii, A. B. Roitman, and Iu. S. Nalimov (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR). *(Problemy Prochnosti*, vol. 4, Aug. 1972, p. 8-12.) *Strength of Materials*, vol. 4, no. 8, May 1973, p. 906-911. Translation.

The influence of small deviations from the serial-production technology on the fatigue limit of the third stage of a gas-turbine engine is studied experimentally and theoretically. The deviations included microroughnesses, residual stresses, and microdefects. Tests on a resonance stand at 20 and 570 C showed that the fatigue limit is hardly affected by the deviations, but that the latter increase somewhat the spread of the blade test data. V.P.

A73-30353 # **General principles of designing control systems (Obshchie printsipy proektirovaniia sistem upravleniia).** O. A. Chembrovskii, Iu. I. Topcheev, and G. V. Samoilovich. Moscow, Izdatel'stvo Mashinostroenie, 1972. 415 p. 215 refs. In Russian.

General methods of designing aircraft, rocket, and spacecraft control systems are discussed with particular reference to methods based on statistical estimates of the performance characteristics. Ground and onboard control systems and methods of synthesizing them are examined. The effectivness of the control systems under various operating conditions is assessed. Formulas and graphs suitable for use in preliminary design are presented. V.P.

A73-30354 # **Dynamics of flight vehicle structures (Dinamika konstruktsii letatel'nykh apparatov).** I. V. Anan'ev, N. M. Kolbin, and N. P. Serebrianskii. Moscow, Izdatel'stvo Mashinostroenie, 1972. 416 p. 95 refs. In Russian.

Methods of calculating the vibrations of elastic systems of the type used in aircraft industry are outlined. Multiply connected vibrations of elastic systems are studied, and solutions to the differential equations of beams are obtained for various boundary conditions. Transcendental equations describing the natural frequencies of the flexural and torsional vibrations of beams are derived, and the roots of the equations are plotted. Graphs for assessing the influence of various parameters (concentrated forces, rigid supports, axial forces, etc.) on the natural vibrations of elastic structures are presented. The physical principles of dynamic damping of trusses and of solid systems with elastic constraints are outlined. A method for calculating the parameters of a shock absorber is proposed. V.P.

A73-30355 # **High-altitude equipment for passenger aircraft (Vysotnoe oborudovanie passazhirskikh samoletov).** L. T. Bykov, V. S. Ivlentiev, and V. I. Kuznetsov. Moscow, Izdatel'stvo Mashinostroenie, 1972. 332 p. 63 refs. In Russian.

A number of problems are discussed which relate to the choice of high-altitude equipment systems for passenger aircraft, the calculation of the main elements of these systems, and the determination of the parameters of the air in pressurized cabins. In particular, a study is made of the pressurization and ventilation of passenger cabins, air pressure control in the cabins, and temperature control and air conditioning of passenger cabins. The modeling of thermal and ventilation processes occurring in pressurized cabins is discussed, as well as the problem of ensuring reliable operation of high-altitude equipment for passenger aircraft. A.B.K.

A73-30357 # **Study of aeronautical electric and electronic materials (Aviatsionnoe elektroradiomaterialovedenie).** Sh. Ia. Korovskii. Moscow, Izdatel'stvo Mashinostroenie, 1972. 356 p. 38 refs. In Russian.

The properties of magnetic materials, dielectrics, conductors, semiconductors and other materials used in the aircraft industry are interpreted from the physical and chemical points of view. The influence of the composition and the electric and magnetic structure on the behavior of such materials in the presence of force fields is examined. Particular attention is given to the miniaturization and improvement of onboard electric and electronic devices with the aid of special high-quality materials, such as semiconductors, superconductors and high-polymer, ferrite, thin-film, and complex composite materials. Emphasis is placed also on the changes in the properties of materials under the effect of temperature, humidity, altitude, electromagnetic field parameters, and similar factors. V.P.

A73-30362 **International bibliography of air law 1900-1971.** W. P. Heere (Utrecht, Rijksuniversiteit, Utrecht, Netherlands). Leiden, A. W. Sijthoff International Publishing Co.; Dobbs Ferry, N.Y., Oceana Publications, Inc., 1972. 587 p. 10,100 refs. $30.

The bibliography is a collection of titles of books and articles in the fields of national and international air law. The material is classified under the headings of general subjects, organizations in the field of civil aviation, the administration of national and international aviation, the aviation industry, aircraft, aviation personnel, airports and air navigation facilities, air transport, damage to third parties, accidents (including towage and salvage), insurance, criminal law, acts on board aircraft, solution of disputes, and the laws of war and neutrality. Tables of contents in English, French, and Spanish are provided, and the same languages are used for the subject indexes. F.R.L.

A73-30429 **Turbocompressors (Turboverdichter).** B. Eckert (Motoren- und Turbinen-Union München GmbH, Munich,

West Germany). *VDI-Z*, vol. 115, no. 6, Apr. 1973, p. 497-512. 569 refs. In German.

Cascade design methods, which were first mainly based on empirical approaches, have been improved by mathematical-analytical computational procedures derived with the aid of fundamental aerodynamic studies. An iterative method makes it possible to calculate the parameters of axisymmetrical flow. A hodograph method can be used in the design of cascades. Axial turbocompressors are considered, giving attention to the subsonic, the transonic, and the supersonic domain. Advances in the design of radial compressors are also discussed. G.R.

A73-30444 'CORAIL' - Automatic runway surveillance equipment ('CORAIL' - Equipement de surveillance automatique des pistes). M. Davidson (Paris, Aéroport, Paris, France). *Navigation* (Paris), vol. 21, Apr. 1973, p. 176-187. In French.

Since Category II and Category IIIa have been authorized, it has become evident that the flying controller is not fully informed concerning aircraft movements on the runway. The CORAIL (Control by Radar on the Airport of Ground Incidents) system ensures, automatically, the surveillance of a runway and its immediate surroundings, as well as the approach path of aircraft. The system consists of a Doppler radar, a signal extractor, data processing equipment, an alarm and visualization device, a control platform, and an alarm recording assembly. F.R.L.

A73-30445 Evolution and actual aspect of air navigation (Evolution et aspect actuel de la navigation aérienne). P. Fombonne (Thomson-CSF, Paris, France). *Navigation* (Paris), vol. 21, Apr. 1973, p. 208-219. 45 refs. In French.

Medium distance air navigation is first discussed. In 1953, the essential air navigation devices were medium-frequency four-axis radio beacons and the nondirectional beacons used in conjunction with a an airborne radio compass. The competition between the VOR (VHF omnidirectional range) and Decca systems is reviewed. Attention is given to distance measuring equipment (DME), Tacan (tactical air navigation), and VOR-Doppler systems. Landing and navigation in the terminal zone is considered, with reference to the microwave landing system (MLS). F.R.L.

A73-30450 # The GTD-350 helicopter turbine engine (Smiglowcowy silnik turbinowy GTD-350). K. Okulicz. *Instytut Lotnictwa, Biuletyn Informacyjny*, vol. 10, Jan.-Feb. 1973, p. 10-12. In Polish.

Description of the compressor, combustion chamber, turbine assembly, reduction gearing, exhaust manifold, starting system, lubrication, deicing, and the fuel system in the GTD-350 gas turbine engine developed for the Soviet two-engine Mi-2 helicopter. The compressor consists of seven axial stages and one centrifugal stage followed by a vaneless diffuser. The drive turbine consists of two stages whose disks are bolted together; the second disk is integral with the drive shaft. The compressor turbine blades and the drive turbine blades are die forged and fixed to the disks by fir-tree roots. T.M.

A73-30469 * Meeting the challenge of advanced helicopters. M. W. Kelly (NASA, Ames Research Center, Large-Scale Aerodynamics Branch, Moffett Field, Calif.). *Vertiflite*, vol. 19, Mar.-Apr. 1973, p. 4-6, 8. 6 refs.

Wind tunnel tests that are conducted during the course of a typical aircraft development program are considered. The objectives of a test program are to reduce technical and financial risk and to improve product performance. Typical fixed-wing and rotary-wing aircraft development programs are compared. It is concluded that existing wind tunnel practice is not adequate in relation to the consequences from serious problems remaining undetected until flight test. In fact, the ultimate goal of the wind tunnel test program should leave nothing for the flight test program but the demonstration of the final product. F.R.L.

A73-30470 The helicopter is a necessary urban transport for the 1980s. T. R. Stuelpnagel (Hughes Aircraft Co., Culver City, Calif.). *Vertiflite*, vol. 19, Mar.-Apr. 1973, p. 18, 19, 22, 23.

It is contended that a sound economic growth of the urban community will require the use of helicopter transports in the 1980s, and that the helicopter will be to intracity transport in the next 30 years what fixed wing aircraft have been to intercity transport in the last thirty years. The concept proposed is a light twin engine helicopter with a 10-passenger capacity, equipped for IFR, incorporating quieting features capable of reducing noise by 80%. A helicopter system can be an effective alternative transportation system to alleviate traffic congestion in urban areas while offering a stimulus for sound economic development. F.R.L.

A73-30471 A proposal on automatic tracking of an aircraft for the radar. T. Iida (Tokyo, University, Tokyo, Japan). *Electronics and Communications in Japan*, vol. 55, July 1972, p. 99-107. 5 refs. Translation.

One problem in automatic aircraft tracking by the primary radar is the contamination of the reflected signal from the aircraft due to the presence of noise. This paper considers the search radar which requires stringent conditions for tracking and proposes a new automatic tracking system which is entirely different from the conventional alpha-beta system, assuming that the position information of the aircraft is given on the PPI. Specifically, in the preprocessing of the data the average value of the data or the predicted value is regarded as the observed value at that instant; in the tracking calculation, the concept of the Kalman filter is applied and a probability variable regarding the presence or absence of the input signal is introduced. Further, for the time constant of the state change in the state equation of the aircraft motion for the tracking calculation, we show that the nominal path of the aircraft, regarded as the larger time constant, can be determined from the traveling distance and direction of the aircraft, and that the fluctuation component, regarded as the smaller time constant, is closely related to the state equation of the aircraft motion. (Author)

A73-30649 # Certain criteria governing the flow in elements of the gas flow section of turbine machinery (Nekotorye kriterii, opredaliaiushchie techenie v elemantakh protochnoi chasti turbomashin). K. P. Seleznev and S. N. Shkarbul'. *Energomashinostroenie*, vol. 18, Sept. 1972, p. 19-22. 15 refs. In Russian.

Problems of flow similarity in individual ducts of gas turbines are examined, and attention is given to the choice of appropriate criteria for use in analysis of flow properties within turbines. Topics considered include the influence of Coriolis forces on the boundary layer on a rotating surface and various effects associated with the presence of a pressure gradient and with shear of the outer flow. T.M.

A73-30650 # Test data obtained with an experimental gas turbine operated with kerosene combustion products artificially contaminated by dust (Rezul'taty ispytaniia opytnoi GTU na iskusstvenno zapylennykh produktakh goreniia kerosina). K. V. Olesevich. *Energomashinostroenie*, vol. 18, Sept. 1972, p. 40-42. In Russian.

A73-30671 # The steady operational characteristics of bypass-turbojet propulsion systems involving jet mixing (Das stationäre Betriebsverhalten von Zweikreis-Turbostrahltriebwerken mit Strahlmischung). U. Simon. Stuttgart, Universität, Dr.-Ing. Dissertation, 1971. 176 p. 38 refs. In German.

The propulsion system characteristics are investigated for operational conditions between flight Mach number zero and the critical pressure ratio in the nozzle. Analytical approximate equations are proposed for the characteristics of component systems, giving attention to compressor, combustion chamber, turbine, and nozzle. Experiments involving two simple turbojet engines conducted with the aid of an altitude test installation confirm the correctness of

the mathematical approach. Differences in operational properties due to the arrangement of the shafts are discussed together with the thrust characteristics, questions of economics, and fuel consumption. G.R.

A73-30676 # **Influence of transient conditions on the overall service life of turbine blades (O vliianii neustanovivshikhsia rezhimov na obshchii resurs raboty turbinnykh lopatok).** G. N. Tret'iachenko (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR). *Problemy Prochnosti,* vol. 5, Mar. 1973, p. 3-6. In Russian.

It is shown that, in spite of their relatively short duration, transient modes of operation of the type occurring during takeoff, landing, and engine tests have a tremendous effect on the service life of turbine blades. In view of this, it is suggested to carry out accelerated tests by determining the time to failure at steady modes of operation on the basis of data obtained with cylindrical samples, and at transient modes of operation, on the basis of tests performed with actual blades under simulated operating conditions. V.P.

A73-30679 # **Selecting a method of determining the resistance to fracture on the basis of expert opinions (Vybor metoda opredeleniia viazkosti razrusheniia na osnove ekspertnykh otsenok).** G. S. Pisarenko, A. P. Iastrebov, I. K. Chernenko, and V. P. Naumenko (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR). *Problemy Prochnosti,* vol. 5, Mar. 1973, p. 18-24. 6 refs. In Russian.

A procedure is proposed for solving the problem of selecting the optimal method of determining the resistance to fracture of rotors and turbine disks operating at high temperatures, using plane-strain fracture toughness as the fracture criterium. The rank correlation method is used to process and correlate the opinions of experts concerning the validity of solutions to some problems in experimental fracture mechanics and concerning the selection of the best method of determining the plane-strain fracture toughness of the rotor and disk materials. Some results obtained by this approach are discussed. V.P.

A73-30777 **Modelling and identification theory - A flight control application.** A. V. Balakrishnan (California, University, Los Angeles, Calif.). In: Theory and applications of variable structure systems; Proceedings of the Seminar, Sorrento, Italy, April 4-7, 1972. New York, Academic Press, Inc., 1972, p. 1-24. Grant No. AF-AFOSR-68-1408.

Problems involving the identification of system parameters on the basis of measurements are considered. Attention is given to linear (and bilinear) dynamic systems in the presence of 'state' disturbance and measurement error. A general theory of identification is developed. The employment of the derived relations is illustrated by an application to a specific problem in flight control. The problem has all the canonical features which can occur in any identification problem. The theoretical results show excellent agreement with actual flight data. A 'white noise' approach as opposed to the 'Wiener process' is used in the analysis. G.R.

A73-30913 **Insulating houses against aircraft noise.** R. J. Donato (National Research Council, Div. of Building Research, Ottawa, Canada). *Acoustical Society of America, Journal,* vol. 53, Apr. 1973, p. 1025-1027.

A set of rules is devised whereby the component types of the envelope of a house or an apartment may be chosen from a knowledge of their acoustical properties, their relative areas, the degree of intrusive sound that may be tolerated, and the noise exposure forecast contours. (Author)

A73-30915 **Reduction of noise generated by flow of fluid over plate.** B. Pinkel and T. D. Scharton (Bolt Beranek and Newman, Inc., Canoga Park, Calif.). *Acoustical Society of America, Journal,* vol. 53, Apr. 1973, p. 1184, 1185.

This letter describes a method of reducing the noise generated by a fluid stream flowing subsonically over a plate and also presents some substantiating test data. This concept may prove useful for reducing the noise of STOL aircraft employing the externally blown flap or the augmenter wing, which configurations are now under exploratory development. (Author)

A73-30926 # **Optimising the shape.** P. Sartre (Société Nationale Industrielle Aérospatiale, Paris, France). *Aircraft Engineering,* vol. 45, Apr. 1973, p. 4-7.

Design considerations are given for an improved version of a supersonic aircraft, based on theoretical calculations and wind-tunnel tests. Specifications and diagrams are included for the fuselage and wing modifications introduced into a prototype of a new-generation supersonic civil aircraft. V.Z.

A73-30927 # **Changes in the flight deck transparencies.** W. Roberts and R. S. Bruce (Triplex Safety Glass Co., Ltd., London, England). *Aircraft Engineering,* vol. 45, Apr. 1973, p. 7-9.

Discussion of the design modifications introduced into the 16 flight deck transparencies during the production of the Concorde from prototype aircraft. Details are given on the changes made in the main pilots' windscreens, direct-vision and side windows, and visor glazings. V.Z.

A73-30928 # **Electronic safety test replaces radioactive test source.** D. W. Guerin (S. Davall and Sons, Ltd., Greenford, Middx., England). *Aircraft Engineering,* vol. 45, Apr. 1973, p. 10.

Description of an ionizing radiation and neutron detection system designed for use on Concorde aircraft. The system comprises silicon microcircuits, a stable-frequency oscillator, signal processing circuits, and an indicating unit which are activated by ionization pulses and neutron pulses from detectors. V.Z.

A73-30929 # **Generating, oxygen and other emergency systems.** *Aircraft Engineering,* vol. 45, Apr. 1973, p. 12, 13.

Description of an emergency system designed for installation on the Concorde. The three-element system comprises a hydraulic motor, a generator, and a control unit. The system supplies power for essential electrical services in the event of failure in all four channels of the main generating system. V.Z.

A73-30930 # **Reducing noise with type 28 nozzle.** *Aircraft Engineering,* vol. 45, Apr. 1973, p. 14-17.

Design improvements aimed at the reduction of noise levels in the Concorde are reviewed with particular attention to the development and testing of silencing devices. The use of thrust reverser buckets and retractable space silencers, and the increasing of the prime nozzle area in flyover and approach are indicated as new noise reduction techniques applied in Concorde aircraft. V.Z.

A73-30931 # **Power plant instrumentation.** *Aircraft Engineering,* vol. 45, Apr. 1973, p. 17, 18.

2ATI numeral/pointer engine instruments and Model S532.2.51 indicators of Concorde 02 are briefly described. The engine start cycle and the engine bay overheat detection system of the aircraft are discussed. Some details are given on the active element and control unit of the overheat detecting system. V.Z.

A73-30932 # **Hardware integration and improved operation of the flight control system.** D. G. Clews (Marconi-Elliott Avionic Systems, Ltd., Rochester, Kent, England). *Aircraft Engineering,* vol. 45, Apr. 1973, p. 20, 21.

Discussion of modifications incorporated in the prototype standard during the development of the production flight control system of Concorde. The production system includes a dual channel

three axis autostabilizer, a dual channel electric pitch trim, a dual channel integrated autopilot and flight director, a dual channel autothrottle, and dual channel safety flight control. V.Z.

A73-30933 # **A fourth air conditioning group.** R. B. Sherbourne (Hawker Siddeley Dynamics, Ltd., Hatfield, Herts., England). *Aircraft Engineering,* vol. 45, Apr. 1973, p. 22-24, 26.

The latest air conditioning system design of Concorde is discussed. Details are given on a fourth air conditioning group which was added to the initial three-group prototype system. The revision of prototype concerns the interconnection of the engine air bleeds of adjacent port and starboard groups, and the modification of the temperature control system to link starboard air conditioning group feeding rear cabin and provide control in some cases of failure. V.Z.

A73-30934 # **HS 1182 - Design for defence in the 1980's.** *Aircraft Engineering,* vol. 45, Apr. 1973, p. 28, 29.

Description of a single-engine two-seat multipurpose jet trainer selected by the RAF to replace other types in the future. The trainer has Martin Baker Type 10 zero-zero rocket ejection seats, hydraulically operated tail-plane and ailerons, an unreheated RT 172-06 Adour turbofan, and a structure designed for a safe fatigue life of 6,000 hr in flying and weapon training assignments. V.Z.

STAR ENTRIES

N73-21896*# Kansas Univ., Lawrence.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q-STABILITY DERIVATIVES
Jan Roskam and C. Lan Washington NASA Apr. 1973 106 p refs
(Grant NGR-17-002-071)
(NASA-CR-2117; CRES-FRL-72-002) Avail: NTIS HC $3.00 CSCL 01A

Summarized are the aerodynamic center, alpha and q-aeroelastic effects on fighter-type aircraft in the 18,700 N gross range. The results indicate that with proper tailoring of planform (fixed or variable sweep), stiffner and elastic axis location it is possible to minimize trim requirements between selected extreme conditions. The inertial effects were found to be small for this class of aircraft. Author

N73-21897*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATIVES. APPENDIX A: A COMPUTER PROGRAM FOR CALCULATING ALPHA- AND q- STABILITY DERIVATIVES AND INDUCED DRAG FOR THIN ELASTIC AEROPLANES AT SUBSONIC AND SUPERSONIC SPEEDS
J. Roskam, C. Lan, and S. Mehrotra Oct. 1972 175 p
(Grant NGR-17-002-071)
(NASA-CR-112229; CRINC-FRL-72-011-App-A) Avail: NTIS HC $10.75 CSCL 01A

The computer program used to determine the rigid and elastic stability derivatives presented in the summary report is listed in this appendix along with instructions for its use, sample input data and answers. This program represents the airplane at subsonic and supersonic speeds as (a) thin surface(s) (without dihedral) composed of discrete panels of constant pressure according to the method of Woodward for the aerodynamic effects and slender beam(s) for the structural effects. Given a set of input data, the computer program calculates an aerodynamic influence coefficient matrix and a structural influence coefficient matrix. Author

N73-21898*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATURES. APPENDIX B: METHOD FOR COMPUTING THE STRUCTURAL INFLUENCE COEFFICIENT MATRIX OF NONPLANAR WING BODY TAIL CONFIGURATIONS
J. Roskam, H. Smith, and G. Gibson Oct. 1972 29 p refs
(Grant NGR-17-002-071)
(NASA-CR-112230; CRINC-FRL-72-012-App-B) Avail: NTIS HC $3.50 CSCL 01A

The method used in computing the structural influence coefficient matrix of the computer program of Reference 1 (appendix A of the Summary Report) is reported. This matrix is computed for complete wing-body-tail configurations by assuming that all major airplane components can be structurally represented by a slender beam called the elastic axis. A structural influence coefficient is defined as the rotation about the Y-stability axis at panel j induced by a unit load on panel k. A description of how a structural breakdown is performed in detail is included. Author

N73-21899*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATIVES. APPENDIX C: METHOD FOR COMPUTING THE AERODYNAMIC INFLUENCE COEFFICIENT MATRIX OF NONPLANAR WING-BODY-TAIL CONFIGURATIONS
J. Roskam Oct. 1972 32 p refs
(Grant NGR-17-002-071)
(NASA-CR-112231; CRINC-FRL-72-013-App-C) Avail: NTIS HC $3.75 CSCL 01A

Expressions are derived for computing the aerodynamic influence coefficient matrix for nonplanar wing-body-tail configurations. An aerodynamic influence coefficient is defined as the load in lbs. induced on a panel as a result of a unit angle of attack on another panel. Fuselage, wing and tail thickness are assumed to be small with the result that the thickness effect on the flow-field is negligible. The method for determining the aerodynamic influence coefficient matrix is based on the lifting solution to the small perturbation, steady potential flow equation. Author

N73-21900*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, ALPHA- AND q- STABILITY DERIVATIVES. APPENDIX D: PROCEDURES USED TO DETERMINE THE MASS DISTRIBUTION FOR IDEALIZED LOW ASPECT RATIO TWO SPAR FIGHTER WINGS
J. Roskam, F. R. Hamler, and D. Reynolds Oct. 1972 15 p refs
(Grant NGR-17-002-071)
(NASA-CR-112232; CRINC-FRL-72-014-App-D) Avail: NTIS HC $3.00 CSCL 01A

The procedures used to establish the mass matrices characteristics for the fighter type wings studied are given. A description of the procedure used to find the mass associated with a specific aerodynamic panel is presented and some examples of the application of the procedure are included. Author

N73-21901*# Kansas Univ., Lawrence. Flight Research Lab.
A PARAMETRIC STUDY OF PLANFORM AND AEROELASTIC EFFECTS ON AERODYNAMIC CENTER, alpha- AND q-STABILITY DERIVATIVES. APPENDIX E: PROCEDURES USED TO DETERMINE THE STRUCTURAL REPRESENTATION FOR IDEALIZED LOW ASPECT RATIO TWO SPAR FIGHTER WINGS
J. Roskam, C. Lan, H. Smith, and G. Gibson Oct. 1972 18 p refs
(Grant NGR-17-002-071)
(NASA-CR-112233; CRINC-FRL-72-015-App-E) Avail: NTIS HC $3.00 CSCL 01A

An explanation is presented of the method used to locate the elastic axis and the method to determine the EI and GJ distributions along the elastic axes of wings with a 2-spar (front and rear) construction or a single torque-box construction. Author

N73-21903# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
LOW SPEED WIND TUNNEL MEASUREMENTS OF THE OSCILLATORY LONGITUDINAL DERIVATIVES OF A DELTA WING OF ASPECT RATIO 0.8
R. K. Cooper Dec. 1971 35 p refs
(ATN-7105) Avail: NTIS HC $3.75

The oscillatory longitudinal derivatives of a thin delta wing with 0.8 aspect ratio were measured over a range of incidence, frequency of oscillation, and wind speed. Some variation of the

derivatives with frequency was found, but this was of secondary importance compared with the variation of incidence. Reynolds' number effects were found to be significant but these were suppressed as far as possible by the use of boundary layer trip wires. Fair agreement between the oscillatory results and derivatives calculated from steady flow tests was obtained.
Author

N73-21904*# Bell Aerospace Co., Buffalo, N.Y.
FINITE ELEMENT APPROACH TO THE INTEGRATED POTENTIAL FORMULATION OF GENERAL UNSTEADY SUPERSONIC AERODYNAMICS
Kari Appa and G. C. C. Smith [1973] 38 p refs
(Contract NAS1-10880)
(NASA-CR-112296) Avail: NTIS HC $4.00 CSCL 01A

Analytical formulation of the integrated potential approach for general unsteady supersonic configurations is related to numerical solution approaches using an arbitrary finite element mesh. Work remains to be done on adequate numerical handling of singular integrals, discussed in an appendix. Limited results on a planar rectangular wing are presented. Author

N73-21906*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC WIND-TUNNEL TESTS OF A TRAILING-CONE DEVICE FOR CALIBRATING AIRCRAFT STATIC PRESSURE SYSTEMS
Frank L. Jordan, Jr. and Virgil S. Ritchie Washington May 1973 25 p refs
(NASA-TN-D-7217; L-8672) Avail: NTIS HC $3.00 CSCL 01C

A trailing-cone device for calibrating aircraft static-pressure systems was tested in a transonic wind tunnel to investigate the pressure-sensing characteristics of the device including effects of several configuration changes. The tests were conducted at Mach numbers from 0.30 to 0.95 with Reynolds numbers from (0.9 x one million to 4.1 x one million per foot). The results of these tests indicated that the pressures sensed by the device changed slightly but consistently as the distance between the device pressure orifices and cone was varied from 4 to 10 cone diameters. Differences between such device-indicated pressures and free-stream static pressure were small, however, and corresponded to Mach number differences of less than 0.001 for device configurations with pressure orifices located 5 or 6 cone diameters ahead of the cone. Differences between device-indicated and free-stream static pressures were not greatly influenced by a protection skid at the downstream end of the pressure tube of the device nor by a 2-to-1 change in test Reynolds number. Author

N73-21907*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND TUNNEL INVESTIGATION OF A SEMISPAN STOL JET TRANSPORT WING BODY WITH AN UPPER SURFACE BLOWN JET FLAP
Arthur E. Phelps, William Letko, and Robert L. Henderson Washington May 1973 41 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Fort Eustis, Va.
(NASA-TN-D-7183; L-8740) Avail: NTIS HC $3.00 CSCL 01A

An investigation of the static longitudinal aerodynamic characteristics of a semispan STOL jet transport wing-body with an upper-surface blown jet flap for lift augmentation was conducted in a low-speed wind tunnel having a 12-ft octagonal test section. The semispan swept wing had an aspect ratio of 3.92 (7.84 for the full span) and had two simulated turbofan engines mounted ahead of and above the wing in a siamese pod equipped with an exhaust deflector. The purpose of the deflector was to spread the engine exhaust into a jet sheet attached to the upper surface of the wing so that it would turn downward over the flap and provide lift augmentation. The wing also had optional boundary-layer control provided by air blowing through a thin slot over a full-span plain trailing-edge flap.
Author

N73-21908# Royal Aircraft Establishment, Teddington (England). Aerodynamics Dept.
THEORETICAL CALCULATION OF GENERALIZED FORCES AND LOAD DISTRIBUTION ON WINGS OSCILLATING AT GENERAL FREQUENCY IN A SUBSONIC STREAM
Doris E. Lehrian and H. C. Garner London Aeron. Res. Council 1973 73 p refs Supersedes RAE-TR-71147; ARC-33405 (ARC-R/M-3710; RAE-TR-71147; ARC-33405) Avail: NTIS HC $5.75; HMSO £2.65; PHI $10.40

A new linear theoretical method is developed to give improved accuracy and economy of operation on a KDF9 computer. The program covers the special cases of zero and very small frequency. It is general in planform and mode of oscillation, provided that these are smooth, and has no serious restrictions on chordwise or spanwise terms. The method is applied to elliptical, rectangular and tapered swept wings of small and large aspect ratio at Mach numbers up to 0.8; calculations cover a wide range of frequency parameter. Numerous independent checks on accuracy are included as well as studies of convergence and comparisons with current methods. Author (ESRO)

N73-21911# Oxford Univ. (England). Dept. of Engineering Science.
THE EFFECT OF A BEVELLED TRAILING EDGE ON VORTEX SHEDDING AND VIBRATION
M. E. Greenway and C. J. Wood 1973 30 p refs Sponsored by Ministry of Defence
(Rept-1052/73) Avail: NTIS HC $3.50

Flow induced vibrations of airfoils are associated with the presence of a blunt trailing edge which sheds an alternating trail of vortices into the wake. This shedding is associated with periodic fluctuations in circulation about the body and the corresponding fluctuations in the lift distribution are responsible for the excitation of various modes of structural or other vibration. Research has led to a growth of empirical knowledge about trailing edge shapes which are effective in reducing the vibration excitation. One of these shapes, the trailing edge bevel, is re-examined in an attempt to gain a clearer understanding of the mechanism by which it achieves satisfactory suppression of vibrations. ESRO

N73-21915 Georgia Inst. of Tech., Atlanta.
A COLLISION AVOIDANCE WARNING CRITERION FOR MANEUVERING AIRCRAFT Ph.D. Thesis
Roscoe McClendon Hinson, Jr. 1972 99 p
Avail: Univ. Microfilms Order No. 72-26306

An effective aircraft collision avoidance system must incorporate a means to discriminate between aircraft which pose a threat of collision and aircraft which do not. This problem of discrimination becomes especially difficult in areas where the aircraft densities are high and where aircraft maneuvers occur frequently. The purpose of this research was to develop a warning criterion suitable for this environment. The aircraft flight paths were considered to be stochastic processes and the warning criterion was therefore based on the probability of a collision.
Dissert. Abstr.

N73-21916 Dartmouth Coll., Hanover, N.H.
THE DESIGN OF A VERTICAL TAKEOFF AND LANDING AIRCRAFT FOR THE GENERAL AVIATION MARKET Ph.D. Thesis
John Craig Harding 1972 157 p
Avail: Univ. Microfilms Order No. 72-23515

Examination of the air transportation system of the United States indicates a trend in scheduled airline service toward longer routes between major population centers and abandonment of regional low density routes. It is left to general aviation to provide the remainder of the air transportation network. VTOL capability is presented as a means of enhancing the ability of general aviation aircraft to provide comprehensive regional air transportation. Specifications for a single-engine, four-place VTOL aircraft are generated with particular emphasis on noise and safety considerations. Evaluation of VTOL configurations leads to the

selection of a tilt-duct configuration as being the most compatible with the design requirements. A twin ducted propeller aircraft is designed which utilizes inertial energy storage to meet transient power demands and provide emergency vertical landing capability. Dissert. Abstr.

N73-21917# Aviation Advisory Commission, Washington, D.C.
THE LONG RANGE NEEDS OF AVIATION
1 Jan. 1973 256 p refs
Avail: NTIS HC $15.00

An investigation is made of a wide range of problems affecting civil aviation in the United States today. Among these are: the airport environment; air and ground congestion; the need for service to small communities; the role of private aviation; the multijurisdictional process; the ailing aerospace manufacturing industry; the ensnarled regulatory process; and safety. Recommendations aimed at equitable solutions for these problems are provided. J.M.M.

N73-21918# Federal Aviation Administration, Washington, D.C.
A LOOK AT A FORECAST, PART 4
R. B. Bratbak Dec. 1971 28 p
(Rept-72-02326) Avail: NTIS HC $3.50

A baseline scenario is provided in detail which forecasts air passenger trends over the North Atlantic to 1976. These projected trends are founded upon likely economic influences in both Europe and the United States during the next three years. The impact of the SST on tourist and business travel is also appraised. J.M.M.

N73-21919# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ATC CONCEPTS FOR V/STOL VEHICLES, PARTS 1 AND 2 Final Report, Mar. 1971 - Aug. 1972
Sidney B. Rossiter, John Maurer, and Paul J. Obrien Apr. 1973 65 p ref
(FAA Proj. 150-190)
(FAA-NA-72-95; FAA-RD-73-47) Avail: NTIS HC $5.25

Two dynamic simulations were conducted, using saturated STOL aircraft traffic sample inputs, to study the effects of various aspects of STOL aircraft operations within the air traffic control system. One investigated the effects of STOL aircraft operating at a downtown STOLport within the New York terminal area complex; the other investigated the effect of STOL aircraft operating on various configurations of STOL runways at a high-density, multirunway, conventional takeoff and landing (CTOL) airport. It was concluded that STOL operations can be accommodated at a downtown STOLport; however, where airspace is limited, intricate profiles requiring a high degree of aircraft performance may be required. The performance of these profiles should be an onboard responsibility using highly accurate area navigation equipments with the ATC facility serving as a monitor. The current method of controller speed commands can be used as an interim method of metering and spacing pending more sophisticated methods, but requires flexible aircraft speed parameters and close cooperation between pilot and controller. It was further concluded that the least effect on CTOL operations at a CTOL/STOL airport is achieved by a parallel system of STOL runways bordering upon the CTOL complex. Author

N73-21920# Advisory Group for Aerospace Research and Development, Paris (France).
HELICOPTER BLADE FLUTTER Revision of Part 3, Chapter 10 of AGARD Manual on Aeroelasticity
N. D. Ham (MIT, Cambridge) Jan. 1973 37 p refs
(AGARD-R-607) Avail: NTIS HC $4.00

Methods of analysis of helicopter blade flutter for both hinged and hingeless blades are presented. The major types considered are bending-torsion flutter, flap-lag flutter, and stall flutter. Both hover and forward flight are considered. Means of avoiding flutter are described. Author

N73-21921*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED AUGMENTOR-WING RESEARCH
Thomas N. Aiken Oct. 1972 11 p refs
(NASA-TM-X-62250) Avail: NTIS HC $3.00 CSCL 01B

Results of research on advanced augmentors are discussed. Research concerned with performance indicated that: (1) augmentors with lobe-type nozzles give higher thrust augmentation than those with slot-type primary nozzles; (2) the thrust of augmentor wings at forward speed is greater than that of internally blown flaps for the speed range of interest; and (3) the optimum augmentor geometry at forward speed may be different from the optimum static geometry. Analysis of augmentor-wing data shows that the data may be correlated by accounting for the augmentation and entrainment in defining a net thrust coefficient. Author

N73-21922*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OBLIQUE-WING SONIC BOOM
Raymond M. Hicks and Joel P. Mendoza Feb. 1973 17 p refs
(NASA-TM-X-62247) Avail: NTIS HC $3.00 CSCL 20A

An investigation was conducted to determine the magnitude of the groundtrack overpressure generated by an oblique-wing transport cruising at Mach 1.4 at 45,000 ft. A conventional swept-wing configuration was included in the study to provide a basis of comparison for the oblique-wing configuration. The results of the investigation have shown that the oblique-wing configuration produces less sonic boom overpressure at cruise lift coeffiicent than the swept-wing vehicle. Author

N73-21923*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF A SWEPT AUGMENTOR WING
David G. Koenig and Michael D. Falarski (Army Air Mobility R and D Lab., Moffett Field, Calif.) Oct. 1972 24 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62252) Avail: NTIS HC $3.25 CSCL 01B

A brief outline of augmentor wing research is presented and is followed by a discussion of large scale wind tunnel test results for a swept augmentor wing configuration. The results show that the augmentor wing can be applied to high speed swept wing designs with little adverse effect on either the basic performance of the augmentor or the longitudinal characteristics, including maximum lift and stall. Three lateral control devices were shown to be effective and ground effect was measured for several complete aircraft configurations. Author

N73-21924*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACOUSTIC CHARACTERISTICS OF LARGE-SCALE STOL MODEL AT FORWARD SPEED
Michael D. Falarski (Army Air Mobility R and D Lab., Moffett Field, Calif.), Kiyoshi Aoyagi, and David G. Koenig Oct. 1972 13 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62251) Avail: NTIS HC $3.00 CSCL 01C

Wind-tunnel investigations of the acoustic characteristics of the externally blown jet flap (EBF) and augmentor wing STOL concepts are dicussed. The large-scale EBF model was equipped with a triple-slotted blown by four JT15D turbofan engines with circular, coannular exhaust nozzles. The large-scale augmentor wing model was equipped with an unlined augmentor blown by a slot primary nozzle. The effects of airspeed and angle of attack on the acoustics of the EBF were small. At a forward speed of 60 knots, the impingement noise of the landing flap was approximately 2 db lower than in the static tests. Angle of attack increased the impingement noise approximately 0.1 decibels per degree. Flap deflection had a greater effect on the acoustics of the augmentor wing than did airspeed. For a nozzle pressure

ratio of 1.9, the peak perceived noise level of the landing flap was 3 to 5 PNdb higher than that of the takeoff flap. The total sound power was also significantly higher for landing indicating that turning in the augmentor generated acoustic energy. Airspeed produced a small aft shift in acoustic directivity with no significant change in the peak perceived noise levels or sound power levels. Author

N73-21925# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
SURVEY OF DULLES AIRPORT INTERNATIONAL PASSENGERS, YEAR ENDING APRIL 1972
Mar. 1973 15 p
Avail: NTIS HC $3.00

A survey of air passengers flying from Dulles Airport was conducted for a period of one year. A survey questionnaire containing 24 questions was used to obtain the opinions of the air passengers. Details concerning age groups of travelers, annual income, occupations, residence, transportation mode to Dulles Airport, main destination, and main purpose of the trip were reported. Author

N73-21926*# Bell Helicopter Co., Fort Worth, Tex.
V/STOL TILT-ROTOR STUDY, TASK 1. VOLUME 1: CONCEPTUAL DESIGN
[1972] 58 p 4 Vol.
(Contract NAS2-6599)
(NASA-CR-114441; Rept-300-099-005-Vol-1) Avail: NTIS HC $5.00 CSCL 01C

A conceptual design study was conducted to define a representative military and/or commercial tilt-propeller aircraft for short takeoff and landing operation. The level of structural technology selected for the operational aircraft was based on aluminum, steel, titanium, and adhesive bonded structures. The data describe the following: (1) aircraft weight, (2) performance and stability, (3) aerodynamic noise, (4) dynamic characteristics, (5) maintainability and reliability, and (6) operating economics. Author

N73-21927*# Bell Helicopter Co., Fort Worth, Tex.
V/STOL TILT-ROTOR STUDY, TASK 2. VOLUME 2: RESEARCH AIRCRAFT DESIGN
[1972] 254 p refs 4 Vol.
(Contract NAS2-6599)
(NASA-CR-114442; Rept-300-099-006-Vol-2) Avail: NTIS HC $14.75 CSCL 01C
For abstract, see **N73-21926*#**

N73-21928*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EFFECT OF CROSSFLOW VELOCITY ON VTOL LIFT FAN BLADE PASSING FREQUENCY NOISE GENERATION
D. L. Stimpert Feb. 1973 56 p refs
(Contract NAS2-5462)
(NASA-CR-114566) Avail: NTIS HC $5.00 CSCL 01C

Analysis of noise measurements taken during tests of a remote lift fan wing installation, a V/STOL model transport with both lift and lift/cruise fans, and XV5B research aircraft flight tests has indicated a definite increase in pure tone sound pressure level due to crossflow over the face of the life fans. The fan-in-wing and V/STOL model transport tests were conducted in the NASA Ames 40 ft. by 80 ft. wing tunnel and the XV5B flight tests at Moffett Field. Increases up to 10 db were observed for the lift fan installation tested at crossflow to fan tip velocity ratios up to 0.25. Cruise fan noise levels were found to be unaffected by the external flow. The noise level increase was shown to be related to an increase in fan distortion levels. Author

N73-21929*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EFFECT OF CROSSFLOW VELOCITY ON THE GENERATION OF LIFT FAN JET NOISE IN VTOL AIRCRAFT
D. L. Stimpert and R. G. Fogg Feb. 1973 43 p refs
(Contract NAS2-5462)
(NASA-CR-114571) Avail: NTIS HC $4.25 CSCL 01C

Analytical studies based on a turbulent mixing noise prediction technique indicate that jet noise power levels are increased when a jet is situated in a crossflow. V/STOL model transport acoustic test data obtained in the NASA Ames 40 ft. x 80 ft. wind tunnel confirmed this jet noise power level increase due to crossflow. Increases up to 6 db at a Strouhal number of 2.5 and crossflow velocity to jet velocity ratio of 0.58 were observed. The power level increases observed in the experimental data confirm the predicted power level increases. Author

N73-21930*# North American Aviation, Inc., Los Angeles, Calif.
CONCEPTUAL DESIGN STUDY OF A V/STOL LIFT FAN COMMERCIAL SHORT HAUL TRANSPORT
Ronald G. Knight, William V. Powell, Jr., and Jerome A. Prizlow Washington NASA Apr. 1973 136 p refs
(Contract NAS2-6564)
(NASA-CR-2185) Avail: NTIS HC $3.00 CSCL 01C

Conceptual designs of V/STOL lift fan commercial short haul transport aircraft for the 1980-85 time period were studied to determine their technical and economic feasibility. The engine concepts included both integral and remote fans. The scope of the study included definition of the hover control concept for each propulsion system, aircraft design, mass properties, cruise performance, noise and ride qualities evaluation. Economic evaluation was also studied on the basis of direct-operating costs and route structure. Author

N73-21931# Advisory Group for Aerospace Research and Development, Paris (France).
AERODYNAMICS OF ROTARY WINGS
Norman D. Ham (MIT) Mar. 1973 9 p refs Presented at Fluid Dyn. Panel Specialists Meeting, Marseille, 13-15 Sep. 1972
(AGARD-AR-61; AGARD-CP-111) Avail: NTIS HC $3.00

The proceedings of a conference to discuss the aerodynamics of rotary wings are presented. The subjects discussed are: (1) rotor wakes, (2) rotors at hover and at high advance ratio, (3) rotor unsteady airloads, (4) rotor airfoils, (5) rotor configurations, and (6) noise generated by rotary wings. P.N.F.

N73-21932*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY INVESTIGATION OF INLET INGESTION OF A WING TIP VORTEX
Glenn A. Mitchell Apr. 1973 42 p refs
(NASA-TM-X-68225) Avail: NTIS HC $4.25 CSCL 01B

An inlet-coldpipe assembly was placed in a Mach 0.4 stream to ingest the tip vortex of a forward mounted wing. The strongest vortex was produced by a wing angle of attack of 11 degrees. The vortex displayed a tangential velocity of 57 percent of local stream velocity prior to entering the inlet, and a tangential velocity of 25 percent of local velocity at the simulated compressor-face. The total-pressure profiles measured by standard compressor-face rakes were changed by the presence of the vortex only at the highest tested inlet mass-flow ratios. Author

N73-21933# Federal Aviation Administration, Washington, D.C. Engineering and Manufacturing Div.
DETERMINATION OF TURBINE ENGINE PERFORMANCE MARGINS IN TRANSPORT AIRCRAFT
Robert F. Nugent Jul. 1972 14 p
(FS-140-72-2) Avail: NTIS HC $3.00

An investigation of turbine engine performance difficulties in commercial transport aircraft is described. Recommendations are made for an FAA/ industry collaborative program for developing certification criteria to control the factors responsible for stall, slow acceleration, and flameout on aircraft engines in service. Author

N73-21934# Federal Aviation Administration, Washington, D.C. Flight Standards Service.
SERVICE EXPERIENCE WITH LIQUID NITROGEN FUEL TANK INERTING SYSTEM IN FAA DC-9 AIRCRAFT, N119 Final Report
Joseph Haddad, William C. McAdoo, and Oscar C. Ball Jun. 1972 50 p
(FS-140-72-1) Avail: NTIS HC $4.50

Determination is made of the nitrogen consumption, system reliability, maintenance burden, and costs which are associated with the installation and operation of a liquid nitrogen fuel tank inerting system installed in the FAA DC-9 airplane, N119. It is assumed that the data can be extrapolated to a typical airline type of operation of a DC-9 and other jet transport aircraft. Author

N73-21935# Federal Aviation Administration, Washington, D.C.
A LOOK AT FLIGHTS, PART 5
R. B. Bratbak Jun. 1972 28 p
Avail: NTIS HC $3.50

An analysis of trans-Atlantic aircraft movements for the 1970 to 1971 time period was conducted. A base line for all air routes was derived from Oceanic Control Center statistics, United Kingdom, United States, and Canadian Government aviation statistics, IATA statistics, and Air Transport media publications. The data are presented in the form of tables and charts. Author

N73-21936# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: NORTH AMERICAN ROCKWELL, INCORPORATED, TURBO COMMANDER 690, NINR, WELLSBURG, WEST VIRGINIA, 14 AUGUST 1972
14 Aug. 1972 12 p
(NTSB-AAR-73-5) Avail: NTIS HC $3.00

An aircraft accident involving the crash of a Turbo Commander aircraft near Wellsburg, West Virginia on 14 August, 1972 is reported. The aircraft departed the Greater Pittsburgh International Airport, Pittsburgh, Pennsylvania on a training flight and reported reaching an altitude of 12,500 feet. Approximately nine minutes after takeoff, the ground control facilities lost radar and radio contact with the aircraft. The probable cause of the accident was loss of aircraft control in a stall maneuver from which recovery was not accomplished. Author

N73-21937# Federal Aviation Administration, Washington, D.C.
A LOOK AT SOME ARTIFACTS, PART 2
R. B. Bratbak Nov. 1971 23 p
Avail: NTIS HC $3.25

An analysis of air passenger traffic on North Atlantic air routes was conducted. The discussions include: (1) the development of scheduled service, (2) charter flights, and (3) promotional fare plans. Some alternative explanations are offered for these events and conclusions are drawn on the implications of the data. Author

N73-21938# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ABBREVIATED INVESTIGATION OF THE DOUGLAS DC-10 AIRPLANE VORTEX WAKE CHARACTERISTICS IN TERMINAL AREA-TYPE OPERATIONS
Leo J. Garodz, William J. Hanley, and Nelson J. Miller Aug. 1972 30 p refs
(Proj. 214-741-04X)
(Rept-73-00470; FS-2-73) Avail: NTIS HC $3.00

A flight test program was conducted to obtain data on and analyze the time history characteristics of the vortex system of a DC-10 aircraft. The purpose of the tests was to develop air traffic control separation criteria associated with simultaneous operations of various mixes of aircraft with the DC-10 upon its introduction into airline operations. The major parameters considered were aircraft vortex flow tangential velocities, the field of influence, and the persistency of the turbulent vortex. Author

N73-21939# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THREE-DIMENSIONAL POTENTIAL LIFTING FLOW. [ECOULEMENT A POTENTIEL TRIDIMENSIONNEL PORTANT]
G. Heckmann and W. Vitte [1972] 60 p refs In FRENCH
(DGT-7510) Avail: NTIS HC $5.00

The application is discussed of computer graphics to the determination of aerodynamic loads on three-dimensional lifting bodies in a potential flow from a system of nonlinear equations. Nonlinearities are caused by unknown position and forms of wakes, and the Kutta-Joukowski condition. The mathematical scheme chosen is based on a geometrical discretization of the body and a distribution relating to singularities, sinks, sources and vortices. The basic forms of the wing and the fuselage are stored in the computer memory and programs supply the necessary geometric elements. These geometric forms are discretized three-dimensionally and produce the representation of the aircraft by a set of quadrilaterals. These different operations are controlled by a visual display console, which allows the design optimization of the aircraft by an iterative procedure. ESRO

N73-21940# Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECT OF SONIC BOOM ON AVALANCHES. PREPARATION FOR FLIGHT OF A SUPERSONIC JET OVER THE LAVEY VALLEY [EFFET DU BANG SUR LES AVALANCHES. PREPARATION DU SURVOL DE LA VALLEE DE LA LAVEY PAR UN AVION A VITESSE SUPERSONIQUE]
M. Schaffar, B. Carrie, and L. P. Amardei 6 Jun. 1972 48 p refs In FRENCH
(Contract DRME-72/337)
(ISL-13/72) Avail: NTIS HC $4.50

An experiment to determine the effect of sonic booms on the stability of the snow mantle in the Lavey Valley is proposed. It includes provisions for the aircraft trajectory, line of focus, boom zone, as well as the determination of boom intensity levels for the whole valley. ESRO

N73-21941# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFORMATION MATERIALS ADAPTIVE SYSTEMS
26 Dec. 1972 171 p refs Transl. into ENGLISH from Tr. Inform. Materialy (Moscow), 1970 p 1-19, 29-36
(AD-756598; FTD-HC-23-1018-72) Avail: NTIS CSCL 01/3

The report includes the realization of adaptive control algorithms, elements of adaptive control systems, self-adjusting control systems for an aeroelastic aircraft, adaptive control of flight vehicle roll, flight vehicle control during atmospheric reentry, parametrically invariant control systems, statistical estimation in monitoring and control problems, choosing the transfer function of a standard model of a self-adjusting control system, the equations of motion of bodies of variable mass, the synthesis of nonsearching self-adjusting control systems, the development of a criterion for comparing adaptive control systems, the structure of a digital self-adjusting system with a model, the synthesis of a self-adjusting autopilot, and the special features of fixed-adjustment control systems. Author (GRA)

N73-21942# Army Foreign Science and Technology Center, Charlottesville, Va.
AUTOROTATION OF COAXIAL HELICOPTERS
I. Grigorev 24 Aug. 1972 9 p refs Transl. into ENGLISH from Graz. Aviat. (USSR), no. 6, 1970
(AD-756592; FSTC-HT-23-480-72) Avail: NTIS CSCL 01/3

The report describes the flight characteristics of a helicopter with functionable engines but with the transmission disengaged and in a steady autorotation configuration. GRA

N73-21943# Naval Weapons Evaluation Facility, Albuquerque, N.Mex.
SH-3G HELICOPTER EXTERNAL CARGO HOOK SYSTEM SAFETY ANALYSIS
R. L. Clark and G. L. Finley 28 Feb. 1973 42 p refs

(AD-757001; NWEF-1099) Avail: NTIS CSCL 15/6

The report describes the SP-7086-1 external cargo hook used with the SH-3G helicopter, reviews the mechanical and electrical design of the hook system, analyzes possible failure modes and known hook failures, and reviews manufacturer's flight, and vertical replenishment tests that have been conducted on the hook. Author (GRA)

N73-21944# Army Electronics Command, Fort Monmouth, N.J.
STABILITY AND CONTROL OF THE HELICOPTER WHEN USED AS A WEAPONS PLATFORM FOR AERODYNAMICALLY STABILIZED ROCKETS
Robert W. Campagna Feb. 1973 116 p refs
(DA Proj. 1F1-62202-A-A97)
(AD-756436; ECOM-4078) Avail: NTIS CSCL 19/5

The report is concerned with stability and control of the helicopter when used as a weapons platform for aerodynamically stabilized rockets. Analysis and simulation are used to ascertain problem areas that exist when engagement techniques similar to those used for fixed wing aircraft are used for helicopters. It is shown that significant improvements in helicopter controllability and rocket accuracy can be achieved by utilizing an impact prediction calculation which accounts for the relative wind on the rocket launching tubes. Author (GRA)

N73-21945# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), OH-58A ENGINE Interim Technical Report, 1 Jan. 1964 - 1 Jul. 1971
Oct. 1972 23 p
(AD-756406; USAAVSCOM-TR-72-23) Avail: NTIS CSCL 01/3

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N73-21946# Army Electronics Command, Fort Monmouth, N.J.
SIMULATION OF HELICOPTER CONTAINERSHIP LOADING
William Keane and David Usechak Jan. 1973 39 p refs
(DA Proj. 1F1-62202-A-2)
(AD-756865; ECOM-4062) Avail: NTIS CSCL 01/3

The report describes a real-time computer simulation of a Heavy Lift Helicopter containership loading/unloading system. The purpose is to determine helicopter-man/machine system interaction to containership motion. By using several different display/control systems, the positioning capabilities of the helicopter when placing loads in a containership held was determined. The effort was in support of the Heavy Lift Helicopter program sponsored by the US Army Combat Developments Command Aviation Agency, Fort Rucker, Alabama.
Author (GRA)

N73-21947# Coast Guard, San Francisco, Calif.
AIR CUSHION VEHICLE EVALUATION, SAN FRANCISCO, CALIFORNIA, ST. IGNACE, MICHIGAN, MILFORD HAVEN, VIRGINIA, TRANSPO 72 Evaluation Report, 1 Sep. 1971 30 Jun. 1972
Thomas C. Lutton 30 Jun. 1972 149 p
(AD-755409; ACV-EU-3960-2) Avail: NTIS CSCL 01/3

The United States Coast Guard has completed an extensive eighteen month evaluation of air cushion vehicles to determine their potential usefulness in meeting its expanding missions and responsibilities. During the ten month period of this second phase, it has operated the air cushion vehicles over 800 hours in San Francisco, the Northern Great Lakes, and the Chesapeake Bay regions. The operating areas have included the ice of Lake Huron, the narrow passages of the East Coast Intracoastal Waterway, the wide expanses of Chesapeake Bay and the confined spaces of Oakland International Airport. This final evaluation report details the deployments, operations, and special projects conducted by the Evaluation Unit as well as new hovercraft developments.
Author

N73-21948# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF DESIGN IN AIRCRAFT CONSTRUCTION (SELECTED CHAPTERS)
A. L. Gimmelfarb 21 Nov. 1972 233 p refs Transl. into ENGLISH from the book "Osnovy Konstruirovaniya v Samoletostroenii" 1971 p 75-203, 283-308
(AD-755754; FTD-HC-23-1256-72) Avail: NTIS CSCL 01/3

Aircraft construction and design is discussed and riveted connections, calculations and designs, and the advantages are compared to ordinary riveting. Welded joints, bonded joints, and the structural properties of each, are discussed. GRA

N73-21949# Kaman Aerospace Corp., Bloomfield, Conn.
THE CORRELATION AND EVALUATION OF AH-1G, CH-54A, AND OH-6A FLIGHT SPECTRA DATA FROM SOUTHEAST ASIA OPERATIONS Final Report
John D. Porterfield, William A. Smyth, and Paul F. Maloney Oct. 1972 202 p refs
(Contract DAAJ02-71-C-0052)
(AD-755554; R-996; USAAMRDL-TR-72-56) Avail: NTIS CSCL 01/3

The report evaluates the flight spectra data for three vastly different types of helicopters flown under combat conditions in Southeast Asia: the AH-1G, a high-speed gunship; the CH-54A, a heavy-lift helicopter; and the OH-6A, a light, highly maneuverable observation helicopter. The flight spectra data for these three ships were compared to one another, to flight spectra data obtained from other helicopters, and to the spectrum shown in Appendix A of Civil Aeronautics Manual 6. The relationship to empirical fatigue substantiation spectra used to establish component service lives for these three helicopters is also shown. Evaluations and correlations of these spectra are presented; where variations occur, their probable cause and possible effects on fatigue life are discussed. Author (GRA)

N73-21950*# Stanford Univ., Calif. Dept. of Applied Mechanics.
BOUNDS IN NONCONSERVATIVE PROBLEMS OF ELASTIC STABILITY
Shyam N. Prasad (Miss. Univ.) and George Herrmann May 1972 25 p refs
(Grants NGL-05-020-397; AF-AFOSR-1905-70; NSF GK-3092; AF Proj. 9782)
(NASA-CR-131828; AD-746696; SUDAM-72-5; AFOSR-72-0423TR) Avail: NTIS HC $3.25 CSCL 01/3

Synge's method based on the isoperimetric inequality is generalized to study panel flutter and Beck's problem with viscous damping forces. Conditions for stability are derived and also estimates of amplification rates and frequencies of oscillations. Further insight is gained into the destabilizing effect of viscous damping in nonconservative elastic systems. Author (GRA)

N73-21951# Lockheed-Georgia Co., Marietta.
RESPONSE OF AIRCRAFT TO THREE DIMENSIONAL RANDOM TURBULENCE Technical Report, Jul. 1971 - Mar. 1972
Frederick D. Eichenbaum Oct. 1972 105 p refs
(Contract F33615-71-C-1878; AF Proj. 1367)

(AD-756886; AFFDL-TR-72-28) Avail: NTIS CSCL 01/3

Conceptually possible procedures for designing aircraft for the combined effects of vertical, lateral, and longitudinal turbulence by the application of power spectral techniques are developed and outlined. The present state-of-the-art of this technical area is established and evaluated by reviewing and extending current methods used or proposed for predicting the response of aircraft due to combined effects of the three components of atmospheric turbulence. Requirements for solving the problem are identified and recommendations are made with respect to major problem areas such as: description of the turbulence environment, determination of the frequency response function of the structure, and methods of combining the effects of vertical, lateral and longitudinal turbulence components to theoretically predict aircraft response. Author (GRA)

N73-21952# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPROXIMATE METHOD OF CALCULATING THE AERODYNAMIC LOAD DISTRIBUTION ON A LOW-FLYING WING WITH A FUSELAGE

L. G. Tsvetkov 26 Jan. 1973 20 p refs Transl. into ENGLISH from Tr. Korablestroitelnyi Inst. (Leningrad), no. 69, 1970 p 111-121

(AF Proj. 1369)

(AD-756075; FTD-MT-24-1646-72) Avail: NTIS CSCL 01/3

A technique is proposed for the numerical calculation of the aerodynamic load distribution under uniform motion of a wing with an angle of sweepback and an angle of heel, and with a fuselage in the form of an infinite circular cylinder and a zero angle of attack over a solid screen. The wing is modeled by a system of discrete oblique horseshoe shaped vortices. A scheme with 18 vortices was selected. The calculations showed how the fuselage has a considerable effect on the distribution of aerodynamic load along the wing, the effect being especially great in the motion of the system close to a solid screen.

Author (GRA)

N73-21953# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRACTICAL AERODYNAMICS ON THE AN-12 AIRCRAFT

I. M. Varukha, V. D. Bychkov, and E. L. Smolenskii 17 Nov. 1972 286 p refs Transl. into ENGLISH from the monograph "Prakticheskaya Aerodinamika Samoleta An-12" Moscow, 1971 p 1-180

(AD-756948; FTD-MT-24-1346-72) Avail: NTIS CSCL 01/3

The design and aerodynamic features of the An-12 turboprop aircraft, questions of its handling technique and flight safety are discussed in this book. There is shown the effect of the turboprop power plant on stability, aircraft handling and primary aerodynamic characteristics. The substantiations of a number of design solutions are given. The book is intended for the flying and technical personnel of civil flying and technical personnel of civil aviation. It can be used by flying school cadets and by students of training detachment. Author (GRA)

N73-21954# Flight Dynamics Research Corp., Burbank, Calif.

A COANDA INLET/JET FLAP DIFFUSER EJECTOR Final Technical Report, Jun. 1970 - Aug. 1972

Morton Alperin Aug. 1972 75 p refs

(Contract F33615-70-C-1656; AF Proj. 1366)

(AD-756895; AFFDL-TR-72-106; TR-72-02-01-106) Avail: NTIS CSCL 01/3

The combination of a Coanda inlet and jet flap diffusion, for the achievement of high performance, low volume, thrust augmentation, has been investigated in a two-dimensional experiment. The use of jet flap diffusion provides a mechanism for the achievement of large control forces, through the use of variable jet flap angles, or through the application of incremental power to the jet flap. Vectoring of the total thrust force is achievable through the use of the fluidic effect, which can be utilized to detach the flow from one side of the jet flap, by decreasing the plenum pressure of that side relative to the plenum pressure of the other side. Author (GRA)

N73-21975# Army Aviation Systems Command, St. Louis, Mo.

MAJOR ITEM SPECIAL STUDY (MISS), CH-47A AUXILIARY POWER UNIT Interim Report, 1 Jan. 1964 - 1 Jul. 1971

Feb. 1972 23 p refs

(AD-756407; USAAVSCOM-TR-72-21) Avail: NTIS CSCL 10/2

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain conditions change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N73-22086# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

MLS SYSTEM: DME POWER AMPLIFIER [SYSTEME M.L.S.: D.M.E. CHAINE DE PUISSANCE]

Y. Amblard, J. J. Bonnier, and R. Ermoglio 28 Aug. 1972 17 p In FRENCH

Avail: NTIS HC $3.00

An airborne C-band pulse transmitter was developed for use with an ILS system. Transmitter characteristics include a transmitting frequency of 5067 to 5124 MHz, frequency number of 20 spaced 3 MHz, 1 second switching time, 0.00002 stability, and a 2 kW maximum power, 205 mW average power, 0.66 microsec pulse width, 40 Hz repetition frequency, and a 2 spaced between 10 and 30 microsec pulse number.

Author (ESRO)

N73-22097# Pacific Missile Range, Point Mugu, Calif.

ALTITUDE-AIDED RADAR TRACKING

L. L. Goertzen 20 Oct. 1972 33 p refs

(AD-756655; PMR-TP-72-10) Avail: NTIS CSCL 17/9

The report describes an algorithm that is used to determine the maximum likelihood position of an aircraft from the measurement of one radar's range, azimuth, and elevation and from an altitude measurement of the aircraft. The variances of these measurements must also be known. The report also shows how much the altitude-aided algorithm improves the accuracy as compared to a one-radar determination. It was concluded that: The position error in the low radar elevation angle ACMTS (Air Combat Maneuvering Test System) geometry at the Pacific Missile Range, obtained by using a telemetered altitude measurement and the R, A, and E from one radar in the algorithm described in the report, could be reduced from 1/2 to 1/5 that of the position error obtained when only the R, A, E measurement from one radar is used. The altitude measurement greatly reduces the error in determination of the position point when the aircraft being tracked is a large distance from the radar. Author (GRA)

N73-22100# Hughes Aircraft Co., Culver City, Calif.

FAULT-TOLERANT DIGITAL AIRBORNE DATA SYSTEM Final Report, Jan. 1971 - Mar. 1972

John D. Anderson, Dale G. Birmingham, and Ronald W. Landgraff Wright-Patterson AFB, Ohio AFFDL Aug. 1972 91 p

(Contract F33615-71-C-1142; AF Proj. 8222)

(AD-756485; HAC-P72-71; AFFDL-TR-72-69) Avail: NTIS CSCL 17/2

An exploratory development project is described that has resulted in the successful design and demonstration of a fault tolerant data transmission and multiplexing system called the Fault Tolerant Digital Airborne Data System (F-DADS). The F-DADS is a modification of the previously demonstrated Digital Airborne Data System (DADS) incorporating redundancy, fault detection, and reconfiguration to achieve fail-operate

performance. A replacement system design approach was selected in which one or more spare terminals are activated to replace faulty units to achieve the level of fault tolerance desired. Data handling and fault tolerant performance of the F-DADS was demonstrated by the design, fabrication and test of a three-terminal brassboard demonstration system. Author (GRA)

N73-22105# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A MAXIMUM-LIKELIHOOD MULTIPLE-HYPOTHESIS TESTING ALGORITHM, WITH AN APPLICATION TO MONOPULSE DATA EDITING
E. J. Kelly 9 Feb. 1973 30 p refs
(Contracts F19628-73-C-0002; DOT-FA72WAI-261; FAA Proj. 034-241-012)
(AD-756844; TN-1973-7; ESD-TR-73-66) Avail: NTIS CSCL 09/4

A simple algorithm for multiple-hypothesis testing, based on a generalization of likelihood ratio testing between pairs of hypotheses, is developed and applied to a specific problem: The problem arises in connection with an amplitude comparison monopulse system in an air traffic control application. In particular, it is desired to measure target azimuth in a beacon system in the presence of interference and multipath. The multiple hypotheses relate to the presence or absence of a desired signal, with or without either of two kinds of interfering signal. The analysis leads to a new technique of data editing, or processing, to detect the presence of interference. Author (GRA)

N73-22107# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
APPLICATIONS OF ELECTROMAGNETIC TECHNOLOGY IN TELECOMMUNICATIONS
C. J. Sletten 12 Jan. 1973 22 p ref Presented at NSF Workshop, Williamsburg, Va., 10 Dec. 1972
(AF Proj. 5635)
(AD-756482; AFCRL-TR-73-0043) Avail: NTIS CSCL 17/2

Based on a presentation at the Workshop on Electromagnetic Theory of Continuous Media sponsored by the National Science Foundation, the paper identifies many science-addressable problems in the areas of radar, air traffic control and communication technologies. Approaches and solutions to these problems are outlined advocating a search for new ideas and concepts strongly focussed on the world of applications. Some discussion of management of research to attain objectives is included. Author (GRA)

N73-22111# Army Electronics Command, Fort Monmouth, N.J.
CROSS AND SQUARE COMMAND SYMBOL AND VIDEO INSET GENERATOR FOR TELEVISION DISPLAY
C. J. Capriglione and E. A. Karcher Dec. 1972 27 p
(DA Proj. 1F1-62202-A-A97)
(AD-755160; ECOM-4055) Avail: NTIS CSCL 17/2

The report describes the design of a cross and square command symbol generator for display on a television screen. These command symbols are used in aircraft displays to present flight command data to the pilot. The design of a video inset generator is also described which enables a portion of two different video sources to be seen simultaneously on one television screen. The hardware is for use in both the Tactical Avionics System Simulator (TASS) and in the experimental RAVE (Research Aircraft Visual Environment) helicopter. Author (GRA)

N73-22125# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
WIDEBAND COMMAND AND CONTROL MODEM WAVEFORM AND MODEM CONCEPTUAL DESIGN STUDY Final Technical Report, 16 Jun. - 16 Dec. 1972
James A. Kivett, Gene F. Bowers, Tonis Tilk, and Willard E. White Dec. 1972 221 p
(Contract F30602-72-C-0500; ARPA Order 2154)
(AD-756933; FR-73-14-158; RADC-TR-73-12) Avail: NTIS CSCL 17/7

The report describes in precise terms the results of the study phase of the Wideband Command and Control Modem (WCCM) program. The study phase was devoted to the performance analysis and conceptual design of a waveform and modem which will provide a jamming-resistant command and control data link for unmanned, remote, multiple, and airborne vehicle control and position location. Direct sequence, 60 Mpps keying rate, spread-spectrum signalling using binary continuous phase shift modulation is recommended for both forward and return link communication between the ground control station (GCS) and the remotely controlled vehicles (RCVs). The forward link employs a single channel, time division multiplexed, continuous transmission for communication of command messages to the RCVs. A multichannel hybrid FDMA/TDMA return link waveform design is recommended for minimum complexity of the RCV modem and maximum flexibility in configuring the ground station for a wide range of operational requirements. (GRA)

N73-22144# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
MEDIUM SPEED MASS RANDOM ACCESS MEMORY MODULE Final Report
Robert A. White and Glenn M. Krueger Griffiss AFB, N. Y. RADC Jan. 1973 34 p
(Contract F30602-69-C-0325)
(AD-755937; PX-5407-50; RADC-TR-72-331) Avail: NTIS CSCL 09/2

The objective of the program is to develop a preproduction model of a solid-state, plated-wire memory module to operate in an airborne or tactical field environment with a command and control system computer. This module was designed within the basic constraints that the completed 10 million bit module is both random access in its retrieval mode and reliable in a tactical field application while the cost per bit of the module in production remained sufficiently low ($0.01 to $0.015 per bit), to be acceptable to the users. The module was designed, fabricated, and tested to the requirements of MIL-E-5400 over an operating range of 0C to 55C. Basically, the final environmental test results bore out the design criteria in that the module was successfully tested for shock, vibration, humidity, etc., without any evidence of significant design problems. The module is presently at Rome Air Development Center where it is scheduled for use in various Air Force applications. Author (GRA)

N73-22159# Application et de Societe Technique d Recherche Electronique, Massy (France).
MULTIPLE BEAM ANTENNA FOR AN AIR TRAFFIC CONTROL SATELLITE. OPTIMIZATION OF PRINCIPAL PARAMETERS AND DEVELOPMENT OF A TEST MODEL [ANTENNE A FAISCEAUX MULTIPLES POUR SATELLITE DE CONTROLE DE TRAFIC AERIEN. OPTIMISATION DES PRINCIPAUX PARAMETERS ET REALISATION D'UN MODELE PROBATOIRE]
13 Nov. 1972 89 p refs In FRENCH
(Contract ESTEC-1514/71-CG)
(ESRO-CR(P)-199; Rept-945) Avail: NTIS HC $6.50

The design and optimization of a multiple beam antenna for an air traffic control satellite is presented. The antenna works in the L band and is built up out of a set of sources which illuminate a reflector, every source associated with a transmitter and a receiver. The principal source and its integration with the other sources is studied. The choice of the primary source and the focal distance of the mirror diameter is discussed. An antenna model was constructed and tested. ESRO

N73-22173# Hamilton Standard, Windsor Locks, Conn.
HIGH-PRESSURE VIBRATING PRESSURE TRANSDUCER Final Report
Elbert M. Moffatt Nov. 1972 50 p
(Contract DAAJ02-71-C-0067; DA Proj. 1F1-62203-A-434)
(AD-755533; USAAMRDL-TR-72-42) Avail: NTIS CSCL 09/1

The report describes the modifications and testing done to develop a high-pressure version of the vibrating cylinder pressure transducer previously developed at Hamilton Standard Division.

The previous designs of this device were rated at 20 and 50 psia maximum pressure and -65F to 250F operating temperature. The modification is rated at 250 psia and -65F to 200F. In addition, the results of a company project to develop a modification for higher temperatures (up to 400F) are reported. The vibrating cylinder pressure is an extremely accurate device which is currently being used in the air inlet control of the F-15 aircraft. It is small and light and has no moving parts aside from the vibrating member, so its life is indefinitely long.
Author (GRA)

N73-22196# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
GRUMMAN JET NOISE FACILITY
A. Maciulaitis, J. T. Yen, A. L. Lind, and A. L. Loeffler, Jr. May 1973 58 p refs
(RE-450) Avail: NTIS HC $5.00

A jet noise test facility is described. Hot film anemometers have been used with a specially designed traversing mechanism to measure mean and turbulent velocites in the jet flow. The basic acoustic instrumentation consists of microphones mounted at the ends of three 23-foot booms which swing through the nozzle's axis of symmetry. These microphones provide information on the directionality and strength of the far field noise emanating from the jet. Flow and acoustic measurements made to date are in good agreement with data of other investigators. One of the major unsolved problems of jet noise research is the determination of the distribution of noise sources within the jet flow.
Author

N73-22198# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEST BENCH FOR HIGH-ALTITUDE BY-PASS ENGINE
K. K. Bokov 25 Feb. 1972 7 p Transl. into ENGLISH from the Russian Patent no. 249002 (Appl. no. 1226842/24-6, 20 Mar. 1968), 1969 p 1-2
(AD-742376; FTD-HT-23-1375-71) Avail: NTIS HC $3.00 CSCL 14/2

This invention pertains to the area of bench testing of ducted fan engines under conditions close to those of flight. Test benches for high altitude turbojet engines, including by-pass engines, consist of exhaust diffuser and pressure chamber with engine being tested, a turbo-cooling unit for suppling air to the engine under pressure and temperature corresponding to conditions of flight, and an exhaust unit with a cooler, connected to the pressure chamber exhaust diffuser with a line for removing and cooling exhaust gases. In testing by-pass engines with high by-pass ratio it is necessary to supply the engine with a large volume of air than when testing a single pass engine or by-pass engine with decreased by-pass level. Great technical difficulties are encountered in cooling and drying large volumes of air supplied to the bench and during the removal of the exhaust gases while ensuring the rarefaction corresponding to the simulated altitude of flight.
Author

N73-22199# Howard, Needles, Tammen and Bergendoff, Alexandria, Va.
AIRPORTS AND URBAN DEVELOPMENT: SOME PLANNING ISSUES
F. Roy Madgwick [1973] 17 p refs Presented at 55th Ann. Conf. of Am. Inst. of Planners, Boston, 10 Oct. 1972
Avail: NTIS HC $3.00

The effects of airport operations on urban development were studied. The subjects discussed were: (1) the economic impact of airports, (2) distribution of airport related activities, (3) commercial activities produced by major airport operations, (4) residential development, and (5) prediction of future effects on ecomomy and ecology.
Author

N73-22200# British European Airways, London (England). Corporate Planning Dept.
THE COST OF AIRPORT CONGESTION
J. Richard Graham 1972 31 p refs Presented at the ITA Symp., 29 Nov. 1972
(Rept-73-00315) Avail: NTIS HC $3.75

An account is made of conditions which foster civil airport congestion and flight delays which result in lost resources, wasted time, and inconvenience to paying air passengers. An air industry economic analysis is used to demonstrate the unfeasibility of new airports to cope with the conditions owing to adverse social and environmental factors. It rather is interpreted to conclude that the most viable method of dealing with congestion and delay must involve investment, on the part of the airlines, in larger aircraft to provide improved efficiency using already existing facilities.
J.M.M.

N73-22201*# National Aeronautical Establishment, Ottawa (Ontario).
SURVEY OF NEEDS AND CAPABILITIES FOR WIND TUNNEL TESTING OF DYNAMIC STABILITY OF AIRCRAFT AT HIGH ANGLES OF ATTACK
K. J. Orlik-Rueckemann 1973 128 p refs
(Contract NAS2-7279)
(NASA-CR-114583) Avail: NTIS HC $8.50 CSCL 14B

A survey was conducted relative to future requirements for dynamic stability information for such aerospace vehicles as the space shuttle and advanced high performance military aircraft. High-angle-of-attack and high-Reynolds number conditions were emphasized. A review was made of the wind-tunnel capabilities in North America for measuring dynamic stability derivatives, revealing an almost total lack of capabilities that could satisfy these requirements. Recommendations are made regarding equipment that should be constructed to remedy this situation. A description is given of some of the more advanced existing capabilities, which can be used to at least partly satisfy immediate demands.
Author

N73-22202# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TWO DIMENSIONAL AEROFOIL TEST FACILITY IN THE S3 BLOW-DOWN WIND TUNNEL OF MODANE-AVRIEUX
Maurice Bazin 1972 17 p refs In FRENCH; ENGLISH summary
(ONERA-NT-203) Avail: NTIS HC $3.00

A device for two-dimensional airfoil testing in the transonic test section of the intermittent blow-down wind tunnel S3 of Modane was designed and built. Aerofoils up to 0.3m chord length can be studied by pressure surveys up to Mach 0.95, with stagnation pressure ranging from 1.2 to 4.0 bars. The Reynolds number can thus be varied in a broad range, reaching 15.10 to the 6th power at Mach 0.95. The main features of the device are outlined and its various components are described. They include test section with horizontal perforated walls, 0.78 m X 0.56 m rotating supports for angle of attack changes from -35 to +215 degrees, mobile rake for wake pressure survey, models with wall pressure taps. The method and means for data acquisition are given, along with the aerodynamic features of the test device and the visualization methods used.
Author

N73-22205# Federal Aviation Administration, Washington, D.C.
DEVELOPMENTS IN AIRPORT PAVING CRITERIA
Philip L. Melville [1972] 38 p refs
Avail: NTIS HC $4.00

The Federal Aviation Administration (F.A.A.) has had to meet an unpracedented challenge to provide new and updated airport pavement criteria. FAA's immediate action was to initiate R&D to respond to the most urgent needs with follow-up programs to fill in gaps in a proposed comprehensive plan. Efforts to date have been concerned with the three key areas of design, construction, and evaluation primarily under an interagency agreement with the U.S. Army Engineers Waterways Experiment Station, but involving other agencies and organizations. Research reports have already been prepared on criteria for multiple-wheel heavy-gear load aircraft (e.g., B-747), on keyways in airfield rigid pavements, and on airfield fibrous concrete. Additional reports

on the other projects will be available as the R&D effort progresses. Results from these efforts will be actively considered for FAA's continuous updating of its airport pavement standards covering structural designs, materials, and construction. Author

N73-22207# Federal Aviation Administration, Washington, D.C. Aviation Forecast Div.
PROFILES OF SCHEDULED AIR CARRIER AIRPORT OPERATIONS. TOP 100 US AIRPORTS, FRIDAY 3 NOVEMBER 1972
Jan. 1973 308 p
(Rept-73-00328) Avail: NTIS HC $17.50

Data are provided for total scheduled air carrier aircraft operations by hour of the day for Friday, 3 November 1972, for the top 100 airports within the 50 states of the United States, the District of Columbia, and Puerto Rico. The selection of the top 100 airports was based on a ranking by number of air carrier passenger enplanements in domestic and international service. For each airport, two graphs are provided which depict total arrivals and departures by hour, and detail by hour for domestic trunk, local service, and international (U.S. and foreign flag) passenger operations, plus air taxi and all-cargo operations. Tabular listings of these data are also included. Author

N73-22208# Association of Bay Area Governments, Berkeley, Calif.
REGIONAL AIRPORT SYSTEMS STUDY, FINAL PLAN
Walter E. Gillfillan Jun. 1972 265 p refs Sponsored in part by HUD
(Rept-73-00316) Avail: NTIS HC $15.25

Recommendations for airport planning in the San Francisco Bay Area are presented in terms of projected annual passenger capacities through 1990. Workable plans for a comprehensive regional airport cooperative system include elements of citizen input, organizational influences, goals, decision criteria, and alternatives involved in air traffic policy making as set forth by the Association of Bay Area Governments. Cost estimates, implementation procedures, and long term forcasts of community impact constitute the thrust of the report. J.M.M.

N73-22209# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DERIVATION OF URBAN TACV NOISE LEVELS AND ENVIRONMENTAL EFFECTS Quarterly Progress Report, 17 Oct. 1971 - 31 Jan. 1972
15 Feb. 1972 46 p refs
(Contract DOT-TSC-329)
Avail: NTIS HC $4.50

An evaluation was made of noise control treatment planned for urban TACVs. Analytical and experimental investigations were made of cushion noise and turbulent boundary layer noise. E.H.W.

N73-22211# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
EXPERIMENTAL SET-UP FOR WIND TUNNEL SIMULATION OF JETS [MONTAGE EXPERIMENTAL DE SIMULATION DE JET EN SOUFFLERIE]
C. Couedor 1972 21 p refs In FRENCH Presented at the 9th AAAF Colloq. on Aerodyn. Appl., Paris, Nov. 1972
(DGT-8352) Avail: NTIS HC $3.25

The test techniques are described which are used in simulating jet exhausts in low speed wind tunnels, in connection with the development of the V/STOL aircraft, Alpha-Jet. The several stages of development are described which have led to the present mounting of the aircraft model, without contact with the simulation circuit, and weighed with an internal balance. ESRO

N73-22213# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
PROJECT GUK (LARGE SUBSONIC WIND TUNNEL) [PROJEKT GUK. GROSSER UNTERSCHALL-KANAL]
R. Goethert (DFVLD, Brunswick) and B. Ewald Feb. 1973 16 p In GERMAN
(Rept-Ea-317-a) Avail: NTIS HC $3.00

The requirements for the design of a large subsonic wind tunnel are discussed. The dimensions and driving power are given, and the equipment is briefly described. Applications such as normal measurements at high Reynolds number, V/STOL, flutter and rotor measurements, are reviewed. ESRO

N73-22215# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
THE DEPENDENCE OF COMPRESSOR FACE DISTORTION ON TEST CELL INLET CONFIGURATION M.S. Thesis
Philip William Tower Dec. 1972 251 p refs
(AD-756540) Avail: NTIS CSCL 21/5

The aircraft turbine engine has evolved to the point that current static test facility designs require modification to provide adequate service and growth potential. Current design procedures are inadequate in that they do not provide methods for the prediction of flow uniformity at the increased thrust and air flow rates now being required. Through the testing of a multiplicity of inlet models the effect of test cell inlet configuration on engine distortion level is evaluated. A method is developed for the correlation of inlet design characteristics with experimentally observed distortion levels. Together with the evaluation of augmentor performance in an associated thesis by Lt. David L. Bailey, this tentative correlation provides a basis for the development of a practical system for the prediction of the performance of proposed test cell designs. Author (GRA)

N73-22217 Iowa Univ., Iowa City.
ON OSCILLATIONS OF VISCOUS SHOCK WAVE AND SONIC BOOM RISE TIME Ph.D. Thesis
Rajbir Singh Samra 1972 145 p
Avail: Univ. Microfilms Order No. 72-26730

The effect of the small amplitude periodic disturbances on the shock wave structure and the modifications in the sonic boom rise time due to the vibrations of the shock wave system of a supersonic transport are investigated. Mathematical analysis considers the model of the unsteady, plane viscous shock wave. Under small disturbance assumptions any flow variable, may be written as the sum of zero-order quantities, and the first-order perturbation quantities, etc. The Mach number considered varies from 1.1 to 3.0. The results indicate that a small amplitude disturbance at the lower edge of the shock wave decays exponentially in the shock wave structure. Frequency of oscillation does not effect significantly the amplitude of the disturbance in the shock wave. The shock thickness varies with the amplitude of the disturbance, but is almost independent of the frequency range considered. The small disturbance analysis presented predicts the change of shock wave thickness and is not expected to predict the change in the position of the shock wave. Dissert. Abstr.

N73-22223 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL INVESTIGATION OF A JET ISSUING FROM A WING IN CROSSFLOW Ph.D. Thesis
William Theodore Mikolowsky 1972 249 p
Avail: Univ. Microfilms Order No. 72-26312

The aerodynamic interference resulting from a jet issuing normal to the chordal plane of a two-dimensional wing in a crossflow has been experimentally investigated. The primary purpose of this work was to provide a link between previous investigations of a jet issuing into a crossflow from an infinite flat plate and the numerous experiments in which the aerodynamic characteristics of V/STOL aircraft configurations in transitional flight were determined. Dissert. Abstr.

N73-22387*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSTRUMENTATION FOR MEASUREMENT OF AIRCRAFT NOISE AND SONIC BOOM Patent Application

Allan J. Zuckerwar, inventor (to NASA) Filed 25 Apr. 1973 15 p
(NASA-Case-LAR-11173-1; US-Patent-Appl-SN-354408) Avail: NTIS HC $3.00 CSCL 14B

Instrumentation suitable for measuring both aircraft noise and sonic boom is described. It is comprised of a converter that produces an electric current proportional to the sound pressure level at a condenser microphone. The electric current is transmitted over a cable, amplified by a zero drive current amplifier, and recorded on a magnetic tape recorder. The converter consists of a local oscillator, a dual-gate field-effect transistor (FET) mixer, and a voltage regulator/impedance translator. The local oscillator generates a carrier voltage that is applied to one of the gates of the FET mixer. The mixer mixes the microphone signal with the carrier to produce an electrical current at the frequency of vibration of the microphone diaphragm. The voltage regulator/impedance translator regulates the voltage of the local oscillator and mixer stages, eliminates the carrier at the output, and provides a low output impedance at the cable terminals. Diagrams are included. NASA

N73-22390# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
INFRARED FOURIER SPECTROSCOPY APPLIED TO THE MEASUREMENT OF AIRCRAFT SPECTRA
M. W. Slack Apr. 1973 26 p refs
(RM-572) Avail: NTIS HC $3.50

Fourier spectroscopy has been used to obtain infrared spectra from a number of aircraft, including an OV-1D Mohawk, and F-14, and a UH1. This memorandum presents performance specifications of the instrumentation together with a description of data reduction techniques and examples of measured IR spectra. Author

N73-22400# Royal Aircraft Establishment, Farnborough (England).
A SEISMIC ANGULAR VIBRATION TRANSDUCER EMPLOYING AS GAS ROTOR
W. R. MacDonald and P. W. Cole Apr. 1972 31 p refs
(RAE-TM-IR-128; BR-29484) Avail: NTIS HC $3.75

A angular vibration transducer in which a helical column of gas constitutes the seismic rotary mass is described. The design of a transducer of range plus or minus 10 deg covering the frequency band from 2 to 20 Hz discussed, and results of performance tests on the instrument are given. In contrast to other instruments of its type, this has an inbuilt perfection of balance which makes it immune to linear acceleration, and its dynamic response is stable over a wide range of temperature due to the stable characteristics of gas dampings. ESRO

N73-22430*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-ACTING AND HYDRODYNAMIC SHAFT SEALS
Lawrence P. Ludwig 1973 40 p refs Presented at Seal Educ. Course of the Ann. Meeting of the Am. Soc. of Lubrication Engr., Chicago, 30 Apr. - 3 May 1973
(NASA-TM-X-68214; E-7406) Avail: NTIS HC $4.00 CSCL 11A

Self-acting and hydrodynamic seals are described. The analytical procedures are outlined for obtaining a seal force balance and the operating film thickness. Particular attention is given to primary ring response (seal vibration) to rotating seat face runout. This response analysis revealed three different vibration modes. Proposed applications of self-acting seals in gas turbine engines and in rocket vehicle turbopumps are described. Also experimental data on self-acting face seals operating under simulated gas turbine conditions are given; these data show the feasibility of operating the seal at conditions of 345 newtons per square centimeter (500 psi) and 152 meters per second (500 ft/sec) sliding speed. Author

N73-22436# Battelle Columbus Labs., Long Beach, Calif. Ocean-Engineering Facility.
HELICOPTER-LOAD TENSION-MEMBER STUDY Final Report, 26 Jun. 1970 - 12 Apr. 1972
John C. Minor, Philip T. Gibson, and Hobart A. Cress Nov. 1972 170 p refs
(Contract DAAJ02-70-C-0064; DA Proj. 1F1-62203-A-254)
(AD-755532; USAAMRDL-TR-72-20) Avail: NTIS CSCL 13/9

The objectives of this program were to analyze technology applicable to tension members as it relates to the functional requirements of heavy outsized loads externally suspended from helicopters, and to develop a comprehensive design theory and conceptual designs for tension members which will provide a basis for future detail design, fabrication, and test programs. The tension-member concepts selected for study included wire rope, wire-rope belt, synthetic rope, synthetic tape, steel tape, roller chain, and jointed links. A weighted-parameter technique was used to begin evaluation of these candidate concepts, followed by an analysis of practical considerations with reference specifically to the 1972, 1975, and 1980 time frames. Author (GRA)

N73-22441# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING GAS FLOW IN A BYPASS COMPRESSOR
V. S. Salnilov 23 Jan. 1973 18 p Transl. into ENGLISH from Lopatochnye Mashiny i Struynye Apparaty (USSR), no. 5, 1971 p 45-54
(AD-756092; FTD-HT-23-1789-72) Avail: NTIS CSCL 13/7

The report discusses a calculation scheme for finding a number of solutions when designing a by-pass engine, where it is necessary to calculate also the flow in the compressor whose running section is divided into two annular channels by a longitudinal semibarrier extending downstream from a certain intermediate stage. Author (GRA)

N73-22442# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
A COMPUTER PROGRAM FOR THE SPECIFICATION OF AXIAL COMPRESSOR AIR FOILS Final Report
George R. Frost, Richard M. Hearsey, and Arthur J. Wennerstrom Dec. 1972 171 p refs
(AF Proj. 7065)
(AD-756879; ARL-72-0171) Avail: NTIS CSCL 21/5

The report describes the analysis in, and the use of, a computer program which has been developed for use in the design of axial compressor airfoils suitable for operation at high subsonic and supersonic Mach numbers. Four rather versatile camber line shapes and two thickness distributions are mathematically derived. These camber lines provide the capability of defining a wide variety of blades, from those of continuously positive camber to the so-called S-blades, including many of the intermediate possibilities. A method is presented whereby the airfoils are specified on arbitrary axisymmetric streamsurfaces and then accurately redetermined in Cartesian coordinates on planes normal to the stacking axis. Author (GRA)

N73-22448*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE APPLICATION OF LASER DOPPLER VELOCIMETRY TO TRAILING VORTEX DEFINITION AND ALLEVIATION
Kenneth L. Orloff and George R. Grant Feb. 1973 35 p refs
(NASA-TM-X-62243) Avail: NTIS HC $3.75 CSCL 20E

A laser Doppler velocimeter whose focal volume can be rapidly traversed through a flowfield has been used to overcome the problem introduced by excursions of the central vortex filament within a wind tunnel test section. The basic concepts of operation of the instrument are reviewed and data are presented which accurately define the trailing vortex from a square-tipped rectangular wing. Measured axial and tangential velocity distributions are given, both with and without a vortex dissipator

panel installed at the wing tip. From the experimental data, circulation and vorticity distributions are obtained and the effect of turbulence injection into the vortex structure is discussed.
Author

N73-22474*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED COATINGS FOR REFRACTORY METALS Patent Application
Salvatore J. Girsaffe and Stanley R. Levine, inventors (to NASA) Filed 4 May 1973 10 p
(NASA-Case-LEW-11179-1; US-Patent-Appl-SN-357312) Avail: NTIS HC $3.00 CSCL 11D

Improvement in the protective ability of a coating having a higher thermal expansion coefficient than the metal it covers is described. The invention is particularly directed to protecting space shuttle reentry thermal protection systems, aircraft gas turbine engine components, and other applications where coatings must provide environmental protection for refractory metals. Silicide coatings on refractory metals were modified to improve their resistance to cracking while further modifying other physical properties that affect their high temperature performance. Discrete particles or fibers are incorporated in the coating as inclusions by imbedding the particles in the substrate surface. The result is that the improved coatings have greater resistance to cracking.
NASA

N73-22491# Aeronautical Research Labs., Melbourne (Australia).
FRACTURE MECHANICS STUDIES OF FATIGUE CRACK PROPAGATION IN 2024 ALUMINUM ALLOY PANELS CONTAINING TRANSVERSE SLITS
R. Ellis Aug. 1972 35 p refs
(ARL/SM-379) Avail: NTIS HC $3.75

An experimental investigation was undertaken in order to produce suitable fatigue cracks in 2024-T3 aluminum alloy panels containing manufactured slits, the panels themselves being required for a future residual strength test program. A relatively large amount of crack propagation data was generated, and this was analyzed using a fracture mechanics approach. Most of the data correlated reasonably well with Paris's nth power crack propagation law, and this would appear to be a useful design tool when there is a requirement to produce controlled cracking from panels containing slits.
Author

N73-22525# Vought Aeronautics, Dallas, Tex.
INVESTIGATION OF SOLID CADMIUM EMBRITTLEMENT IN A-7 AIRCRAFT FAILED SHAFTS AND HORN FRACTURE SURFACES Final Report, 1 Apr. 1972 - 15 May 1973
O. H. Cook, R. E. Duval, C. G. Ford, and R. W. White Jan. 1973 90 p refs
(Contract F33615-72-C-1609; AF Proj. 7381)
(AD-756906; VAC-2-50110/3R-3062; AFML-TR-72-249) Avail: NTIS CSCL 01/3

Solid cadmium embrittlement, which was first discovered as the cause of failures in titanium fasteners, can also cause cracking in high strength steels. The conditions which must be present for initiation of this phenomenon are: there must be intimate contact between the cadmium and steel; the steel must be heat treated to ultimate strength levels of 200 Ksi or over; a tensile stress must act parallel to the surfaces exposed to the cadmium. The A-7 Aircraft horizontal tail actuator shaft and horn assembly meet these conditions; therefore, an investigation was made to determine the possible presence of cadmium as a contributor to failure on six shaft and one horn fracture surfaces.
Author (GRA)

N73-22537# Construction Engineering Research Lab. (Army), Champaign, Ill.
FIBROUS CONCRETE FOR PAVEMENT APPLICATIONS
B. H. Gray and J. L. Rice Apr. 1972 12 p
(AD-741357; M-13) Avail: NTIS HC $3.00 CSCL 13/3

A new paving material was introduced which provides outstanding performance from thin pavement sections. The material is called fibrous concrete and is composed of conventional portland cement concrete materials with steel fibers randomly dispersed throughout the concrete mass. The material exhibits highly desirable behavioural properties for pavement applications. High first crack strength, ability to carry load after cracking, ability to arrest cracks and high spall resistance and ductility are some of the advantages offered by fibrous concrete over conventional concrete. Two controlled traffic test sections were conducted and the preliminary results are remarkable. Traffic simulating operations of the C-5A cargo aircraft were applied to a 6-in. thick fibrous concrete slab on grade and a 4-in. thick fibrous concrete overlay of a 10-in. thick plain concrete slab. The fibrous concrete thickness represents approximately one half the design thickness of plain concrete necessary to sustain about 4000 simulated repetitions of the C-5A before significant structural damage to the slab occurs. About 8700 repetitions were applied to the 6-in. thick slab on grade and 6900 repetitions were applied to the 4-in. thick overlay pavement. After this volume of traffic, testing was suspended and the only distress evident was a number of hairline width cracks. These cracks would not interfere with normal aircraft operations on an in-use pavement.
Author

N73-22553 Ohio State Univ., Columbus.
BI-NORMAL COORDINATES IN DISCRETE SYSTEMS WITH APPLICATION TO AN AIRCRAFT SHIMMY PROBLEM Ph.D. Thesis
Lynn Carroll Rogers 1972 257 p
Avail: Univ. Microfilms Order No. 72-27093

The use of bi-normal coordinate theory in the analysis of practical discrete systems is presented as providing the substantial benefits of conceptual value/physical insight, computational utility, and enhanced redesign capability. These benefits are explained and demonstrated with attention to practical considerations. In particular, the nature of response in a single homogeneous phasor mode is described in detail; also, an expression for the derivative of an eigenvalue is developed and explained. Analysis is made of an aircraft nosegear shimmy problem using bi-normal coordinate methods. Stability boundaries, mode shapes, and sensitivities to parameter changes are presented, in addition to derivatives of eigenvalues to illustrate automated minimum weight design for a shimmy-free nosegear. Recommendations for further research are made.
Dissert. Abstr.

N73-22584*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF HIGH ALTITUDE AIR QUALITY USING AIRCRAFT
Richard A. Rudey and Porter J. Perkins 13 Jun. 1973 15 p refs Proposed for presentation at Intern. Conf. on the Environ. Impact of Aerospace Operations in the High Atmosphere, Denver, 11-13 Jun. 1973; sponsored by Am. Inst. of Aeron. and Astronaut. and the Am. Nucl. Soc.
(NASA-TM-X-68221; E-7422) Avail: NTIS HC $3.00 CSCL 04B

The minor atmospheric constituents associated with and affected by aircraft exhaust emissions at altitudes from 6 to 20 km will be monitored in flight programs presently being implemented. Preliminary in situ data are available from flight tests of dedicated instruments to be used in these programs. A Global Atmospheric Sampling Program using Boeing 747 airliners was determined to be feasible in studies conducted by airlines and airframe companies. Worldwide monitoring in the troposphere and the lower stratosphere is planned. Stratospheric air sampling on a more local basis will be done with a U2 aircraft. Measuring system evaluations and improvements have been required to detect the low background levels.
Author

N73-22586# Environmental Protection Agency, Washington, D.C.
AIRCRAFT EMISSIONS: IMPACT ON AIR QUALITY AND FEASIBILITY OF CONTROL

[1972] 106 p refs
(Rept-72-02452) Avail: NTIS HC $7.50

The present and predicted nature, extent, and control of air pollution related to aircraft operations in the U.S. were studied. The methodology for impact assessment, and the results of impact evaluation are discussed along with the technological feasibility of controlling aircraft emissions, and emission control. It is concluded that: (1) Aircraft emissions are significant contributors to pollution. (2) Airports exert localized impact on air quality. (3) Aircraft emissions and nonaircraft sources must be controlled at airports to comply with the National Ambient Air Quality Standards. Techniques for controlling aircraft emissions are listed. F.O.S.

N73-22601# Environmental Technical Applications Center (Air Force), Washington, D.C.
AN OPERATIONAL DECISION MODEL EMPLOYING OPERATIONAL AND ENVIRONMENTAL FACTORS
Dana P. Hall Nov. 1972 24 p refs
(AD-755403; USAFETAC-TN-72-8) Avail: NTIS CSCL 04/2

The model discussed in the paper combines conditional climatological probabilities, climatological probabilities, and operational loss values for specified actions in a manner to make the best operational decision. A sample scenario is given and demonstrated using a hypothetical problem of airlift supply.
Author (GRA)

N73-22605# Weather Wing (3rd), Offutt AFB, Nebr.
SYNOPTIC FEATURES ASSOCIATED WITH MODERATE AND HEAVY SNOW FOR LORING AFB, MAINE
Limon E. Fortner, Jr. and Paul Mulder Feb. 1973 16 p refs
(AD-756881; Rept-3WW-TN-73-1) Avail: NTIS CSCL 04/2

The table for event frequency for moderate and heavy snow and the charts presented in the note were prepared from data extracted from the Loring AFB, ME, hourly surface observations tape and the historical map tapes. Average Map Displays (AVMAPS) were prepared for 1000 mb, 850 mb, 700 mb and 500 mb for moderate to heavy snow cases associated with an initial surface wind from the northeast quadrant or the southeast quadrant. Author (GRA)

N73-22607*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF LANDING VISIBILITY AT AIRPORTS
V. A. Gavrilov and V. I. Goryshin Washington NASA Apr. 1973 13 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 153, 1964 p 18-23
(Contract NASw-2482)
(NASA-TT-F-14887) Avail: NTIS HC $3.00 CSCL 17G

The problem of changing from meteorological visibility range, measured by the M-37 atmospheric transmittance indicator, to the real visibility range of a landing strip, measured by the pilot when landing is discussed. The characteristics of the atmospheric transmittance indicator are described. An example of a typical installation is presented. Author

N73-22609# Joint Publications Research Service, Arlington, Va.
INERTIAL NAVIGATION
A. N. Balyasnikova 12 Apr. 1973 26 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 1, Jan. 1973
(JPRS-58722) Avail: NTIS HC $3.50

Articles are presented on computing the rotor potential of an electrostatic gyroscope, stability of the stationary motions of a gyroscope with spring limiters on a rotating platform in a Newtonian central field of forces, on the error of a pendulum with a vibrating suspension, and on an algorithm for determining the position of a moving object.

N73-22614*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES-AIDED INERTIAL NAVIGATION WORK - THE FIRST TWO YEARS OF PROGRESS
Gerald L. Smith Apr. 1973 21 p refs
(NASA-TM-X-62199) Avail: NTIS HC $3.25 CSCL 15G

A description of work whose broad objective is to attain improved aircraft navigation performance through exploitation of the concept of combining navigation data from several sources in an optimum manner is presented. The system developed as a result of the work, called RAINPAL (Recursive Aided Inertial Navigation for Precision Approach and Landing) is designed to combine precision radio range measurements with data from on-board inertial sensors to achieve precision navigation for approach and landing. The paper describes RAINPAL and the rationale of its design, and also serves as a sort of planning document, including a progress report, a summary of objectives past and present, and an exposition of reasons for doing the work. Author

N73-22615*# Texas Instruments, Inc., Dallas.
ATS-1/ATS-3 DUAL SATELLITE NAVIGATION STUDY Final Report, Apr. - Oct. 1970
W. M. Hoover Jan. 1971 220 p refs
(Contract NAS5-21163)
(NASA-CR-130213; TI-U-03-835300-F) Avail: NTIS HC $13.00 CSCL 17G

A study which illustrated the feasibility of implementing an on-board aircraft navigation system based on using the ATS-1 and ATS-3 satellites, the modified Omega Position Location Equipment (OPLE) Control Center, and a suitable aircraft terminal was conducted. The report provides: (1) a consideration of the problems of satellite navigation and an objective definition of the optimum system under the constraints of its specified components, (2) a description of the necessary modifications to the OPLE Control Center, the design of an aircraft terminal, and the design of ground reference terminals, and (3) an outline of an experiment plan and an estimate of the cost to be expected in conducting the program. Author

N73-22620# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.
AN INVESTIGATION OF ADVANCED PILOTS VERTICAL DISPLAY TECHNIQUES Final Report, Jun. 1971 - Jul. 1972
John L. McDade 29 Jan. 1973 450 p refs
(Contract N62269-71-C-0574)
(AD-755739; NORT-71-295-2) Avail: NTIS CSCL 17/7

The report summarizes the results of a one-year investigation of advanced vertical display techniques. The purpose of the study was to appraise the relative merits of nonconventional display techniques for their potential application aboard a 1985 era naval all-weather day/night attack aircraft. The vertical display system (VDS) must present situation, command, and multisensor (radar, FLIR and TV) information to the pilot and systems requirements were defined including informative, functional and human factors, and VDS performance and design criteria were established. Two mission plans and scenarios were prepared to cover a wide range of aircraft flight conditions and weapon delivery modes to exercise the various avionics sensor systems and establish the worst case or most demanding VDS information and design requirements. A weighting factor tradeoff analysis was conducted to determine the optimum scanning standards and the system design specifications for a complete VDS DIGISPLAY system. A preliminary design for the recommended VDS was prepared and a series of simulation tests were conducted to verify the performance and flyability of the recommended design. Author (GRA)

N73-22621# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
AIR TRAFFIC CONTROL SYSTEM INTERFERENCE CONSIDERATIONS Final Report
F. Tabor and J. Shields Mar. 1972 55 p refs
(Contract DOT-FA70WAI-175)
(AD-755646; FAA-RD-72-20) Avail: NTIS CSCL 17/7

The FAA Air Traffic Control Navigation/Communications

system is examined to identify areas within the system that are particularly susceptible to radio frequency interference effects. The identified areas are investigated in the light of known past and present analyses, and recommendations for further studies are made. The report concludes that the cosite aspects of the FAAVHF communications system require further study in order to derive a practical means for achieving electromagnetic compatibility in the future. Author (GRA)

N73-22711*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY APPRAISAL OF HYDROGEN AND METHANE FUEL IN A MACH 2.7 SUPERSONIC TRANSPORT
John B. Whitlow, Jr., Richard J. Weber, and Kestutis C. Civinskas [1972] 51 p refs Prepared in cooperation with Army Air Mobility R and D Lab. Cleveland
(NASA-TM-X-68222; E-7425) Avail: NTIS HC $4.75 CSCL 21D

The higher heating value of hydrogen relative to JP fuel is estimated to reduce fuel weight by three fold and gross weight by 40 percent for comparable designed airplanes of equal payload and range. Engine design parameters were varied to determine the influence of lower noise goals on gross weight and direct operating cost. At current fuel prices, the DOC of a hydrogen airplane would be much higher than that of a JP airplane. A methane airplane could offer an 8.5-percent lower KOC than JP. But future shortages may escalate the prices of both JP and methane, whereas the price of hydrogen manufactured hydrolytically could be reduced from present levels. If in the future all three fuels are postulated to have equal costs per unit of energy, the DOC for hydrogen could be as much as 20 percent below that for JP on the reference 4000-nautical-mile mission. Longer ranges or lower noise requirements would improve the advantage of hydrogen. Author

N73-22723# Carleton Univ., Ottawa (Ontario).
AXIAL FLOW COMPRESSOR ANALYSIS USING A MATRIX METHOD
W. R. Davis and D. A. J. Millar Feb. 1973 92 p refs Revised (ME/A-73-1) Avail: NTIS HC $6.75

A matrix technique, which calculates the inviscid, rotational, compressible axisymmetric flow field through an axial flow compressor, is described. Both enthalpy and entropy gradients are permitted; and an empirical cascade model of total pressure loss and deviation angle which is a function of blade geometry and inlet conditions is integrated into the calculation procedure. A FORTRAN computer program, which will analyse multistage transonic axial flow compressors of a specified geometry using the above technique is described and documentation given. Author

N73-22727*# AiResearch Mfg. Co., Los Angeles, Calif.
HIGH-TIP-SPEED, LOW-LOADING TRANSONIC FAN STAGE. PART 1: AERODYNAMIC AND MECHANICAL DESIGN
L. C. Wright, N. G. Vitale, T. C. Ware, and J. R. Erwin Apr. 1973 180 p refs
(Contract NAS3-13498)
(NASA-CR-121095; AiResearch-72-8421-Pt-1) Avail: NTIS HC $11.00 CSCL 21E

A high-tip-speed, low-loading transonic fan stage was designed to deliver an overall pressure ratio of 1.5 with an adiabatic efficiency of 86 percent. The design flow per unit annulus area is 42.0 pounds per square foot. The fan features a hub/tip ratio of 0.46, a tip diameter of 28.74 in. and operates at a design tip speed of 1600 fps. For these design conditions, the rotor blade tip region operates with supersonic inlet and supersonic discharge relative velocities. A sophisticated quasi-three-dimensional characteristic section design procedure was used for the all-supersonic sections and the inlet of the midspan transonic sections. For regions where the relative outlet velocities are supersonic, the blade operates with weak oblique shocks only. Author

N73-22729*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SIMPLIFIED FUEL CONTROL APPROACH FOR LOW COST AIRCRAFT GAS TURBINES
Harold Gold 26 Apr. 1973 32 p refs Presented at Natl. Air Transportation Meeting, Miami, Fla., 24-26 Apr. 1973; sponsored by the Soc. of Automotive Engr.
(NASA-TM-X-68229; E-7254) Avail: NTIS HC $3.75 CSCL 21E

Reduction in the complexity of gas turbine fuel controls without loss of control accuracy, reliability, or effectiveness as a method for reducing engine costs is discussed. A description and analysis of hydromechanical approach are presented. A computer simulation of the control mechanism is given and performance of a physical model in engine test is reported. Author

N73-22730# Federal Aviation Administration, Washington, D.C.
AIRCRAFT ENGINE TYPE CERTIFICATION HANDBOOK
5 Jun. 1972 40 p
(FAA-AC-33-2A) Avail: NTIS HC $4.00

Information and guidance for the type certification of aircraft engines as required by the Federal Aviation Administration of the Department of Transportation are presented. The subjects discussed are: (1) general type certification procedures, (2) type certificate data sheet, (3) engine specifications, (4) installation considerations, (5) engine changes which affect installations, (6) official engine tests, (7) processing changes in type design; and (8) selection of engine power and thrust ratings. Author

N73-22731# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DISTORTION DATA ANALYSIS Final Report, Feb. - Nov. 1972
Michael T. Moore Feb. 1973 144 p refs
(Contract F33615-72-C-1763; AF Proj. 3066)
(AD-756481; AFAPL-TR-72-111) Avail: NTIS CSCL 21/5

A detailed study of the characteristics of inlet distortion has been conducted. Data was selected from inlet and engine/inlet tests with various duct diameters and various levels of steady-state distortion. A similarity parameter was developed which showed consistent trends in dynamic distortion relative to steady-state distortion over different scale sizes. These trends were consistent when the GE Method D Phase O Distortion Parameter, ID, was used and not when gross overall distortion parameters were used. Author (GRA)

N73-22883# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE BUCKLING OF SHELLS UNDER COMBINED LOADING AND THERMAL STRESSES Final Report
Josef Singer and Menahem Baruch Oct. 1972 22 p
(Contract F44620-71-C-0116; AF Proj. 9782)
(AD-756494; AFOSR-73-0302TR) Avail: NTIS CSCL 20/11

The studies described are part of a continuing investigation of the stability of stiffened and unstiffened shells under different loads and load combinations as well as heating. The purpose of the investigation is not only a better understanding of the phenomenon of buckling but also better methods of analysis and improved structural efficiency of aerospace vehicles. Author (GRA)

N73-22891*# SKF Industries, Inc., King of Prussia, Pa.
AIRCRAFT ENGINE SUMP FIRE MITIGATION
J. W. Rosenlieb 31 Jan. 1973 74 p refs
(Contract NAS3-14310)
(NASA-CR-121158; AL73T007) Avail: NTIS HC $5.75 CSCL 13L

An investigation was performed of the conditions in which fires can result and be controlled within the bearing sump simulating that of a gas turbine engine; Esso 4040 Turbo Oil, Mobil Jet 2, and Monsanto MCS-2931 lubricants were used. Control variables include the oil inlet temperature, bearing

temperature, oil inlet and scavenge rates, hot air inlet temperature and flow rate, and internal sump baffling. In addition to attempting spontaneous combustion, an electric spark and a rub (friction) mechanism were employed to ignite fires. Spontaneous combustion was not obtained; however, fires were readily ignited with the electric spark while using each of the three test lubricants. Fires were also ignited using the rub mechanism with the only test lubricant evaluated, Esso 4040. Major parameters controlling ignitions were sump configuration, bearing and oil temperatures, hot air temperature and flow, and bearing speed. Rubbing between stationary parts and rotating parts (eg. labyrinth seal and mating rub strip) is a very potent fire source suggesting that observed accidental fires in gas turbine sumps may well arise from this cause. Author

N73-22910 Ohio State Univ., Columbus.
SPATIAL ANALYSIS OF DOMESTIC UNITED STATES AIR PASSENGER TRAFFIC: A NETWORK ANALYSIS APPROACH Ph.D. Thesis
Budd Hansel Hebert 1972 431 p
Avail: Univ. Microfilms Order No. 72-27422

An algorithm, the Out-of-Kilter Algorithm, is used to evaluate the efficiency of passenger capacity provided by selected air transport carriers in the United States. Based upon data collected from the Official Airline Guide, including the number and type of aircraft, air passenger generating cities in the United States. Data were then taken from the Civil Aeronautics Board publication, Domestic Origin Destination Survey of Airline Passenger Traffic, to provide the numbers of air passengers flown between these twenty cities. Finally, the direct operating cost of transporting passengers over each arc connecting the twenty cities was computed. Dissert. Abstr.

N73-22926# Urban Systems Research and Engineering, Inc., Cambridge, Mass.
LAND USE CONTROL STRATEGIES FOR AIRPORT IMPACTED AREAS Final Report May 1971 - Oct. 1972
Oct. 1972 185 p refs
(Contract DOT-FA71WA-2579)
(FAA-EQ-72-1) Avail: NTIS HC $11.25

Conversion of land near airports from residential and other airport-incompatible uses to commercial, industrial, or other airport-compatible uses is treated as providing a potential solution to the airport noise problem. This study developed a methodology for analyzing the feasibility of redevelopment and applied it in four case study airport areas: Los Angeles International, Miami International, Long Island-MacArthur (Islip, N. Y.), and Dallas-Fort Worth. The study examined existing land use patterns, the impact of current land use controls, prices for incompatible land, the market for compatible reuses of impacted land, community participation in redevelopment, and institutional and political barriers to successful redevelopment. The study found incompatible land uses prevalent and increasing in all areas. Redevelopment was found to be an effective and permanent but generally very expensive solution, because of high land acquisition costs and low demand for reuses. Redevelopment can be justified only in selected, small, heavily impacted areas. Author

N73-22932*# California Univ., Berkeley. Inst. of Transportation and Traffic Engineering.
FORECASTING THE DEMAND POTENTIAL FOR STOL AIR TRANSPORTATION
Shing-Leung Fan, Robert Horonjeff, Adib Kanafani, and Abdollah Mogharabi Feb. 1973 127 p refs
(Contract NAS2-6717)
(NASA-CR-114572) Avail: NTIS HC $8.50 CSCL 05C

A process for predicting the potential demand for STOL aircraft was investigated to provide a conceptual framework, and an analytical methodology for estimating the STOL air transportation market. It was found that: (1) schedule frequency has the strongest effect on the traveler's choice among available routes, (2) work related business constitutes approximately 50% of total travel volume, and (3) air travel demand follows economic trends. F.O.S.

N73-22934# Committee on Armed Services (U. S. Senate).
WEAPON SYSTEMS ACQUISITION PROCESS
Washington GPO 1972 46 p Hearing before Comm. on Armed Serv., 92d Congr., 2d Sess., 12 May 1972
Avail: Comm. on Armed Serv.

The Committee on Armed Services for the United States Congress considers the development of a prototype lightweight fighter aircraft. Weapon systems acquisition aspects of funding, planning, and management are discussed. G.G.

N73-22945# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
ROLL COUPLING MOMENT OF DEFLECTED WING BODY COMBINATION
Shigeki Tsukamoto Dec. 1972 41 p refs
(ISAS-488(Vol-37/No-14)) Avail: NTIS HC $4.25

A method of analysis based on the slender-body theory has been developed to investigate the characteristics of the roll coupling moment due to the flow induced by deflected wings and cross flow. The method makes use of conformal mapping of the well-known hydrodynamics and numerical integration. Flow patterns on the wing have been obtained in the form of elliptic integrals and are shown for various values of span to body radius ratio. Calculations have been performed for uniformly canted and elastically deflected wings in planar and cruciform wing-body combinations. It is shown that there exists a considerably wide region (from the root to 50-57 percent of the wing span) where unduced velocity has negative sign for the elastically deffected wings. Roll coupling moment coefficients are also presented for various wing-body combinations. Author

N73-22946# Institut Aerotechnique de Saint-Cyr, Saint-Cyr-l'Ecole (France).
SIGMA 4 AFTERBODY [LES ARRIERES-CORPS A SIGMA 4]
Y. Sagnard Paris Soc. Natl. Ind. Aerospatiale 1972 25 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.25

A description is given of the wind tunnel installation used to simulate and test sigma 4 afterbody performance in the Mirage 3 aircraft. Injector nozzle internal reactions, skin friction, flow instability, and primary and secondary flow are measured. Afterbody performance, precision, and fidelity are discussed.
Transl. by E.H.W.

N73-22948# Advisory Group for Aerospace Research and Development, Paris (France). Fluid Dynamics Panel.
HELICOPTER AERODYNAMICS AND DYNAMICS
Mar. 1973 378 p refs Lectures presented at Rhode-St.-Genese, Belgium, 2-6 Apr. 1973; sponsored in part by von Karman Inst.
(AGARD-LS-63) Avail: NTIS HC $21.00

The role of aerodynamics and dynamics in helicopter development from the fundamental methods and principles through conceptual design to flight test and proof-of-concept is discussed. The subjects presented include the following: (1) applications of aerodynamics and dynamics to rotary wing aircraft; (2) basic aerodynamics and performance of the helicopter; (3) basic dynamics of rotary wings; (4) aeroelasticity of rotary wing aircraft; (5) helicopter noise analysis; (6) rotary wing model testing in wind tunnels; (6) selection of configuration and prototype design; and (7) flight testing for performance and flying qualities.

N73-22949 Army Air Mobility Research and Development Lab., Moffett Field, Calif.
THE ROLE OF AERODYNAMICS AND DYNAMICS IN MILITARY AND CIVILIAN APPLICATIONS OF ROTARY WING AIRCRAFT
Paul F. Yaggy *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 14 p

The various aerodynamic and dynamic factors which influence the design of helicopters are discussed. The subjects presented are: (1) performance requirements; (2) dynamics, stability, and control: (3) airloads, aeroelasticity, and mechanical instabilities; and (4) proof of technology. Performance charts for typical helicopter configurations are included. Author

N73-22950 Boeing Co., Philadelphia, Pa. Vertol Div.
BASIC AERODYNAMICS AND PERFORMANCE OF THE HELICOPTER
W. Z. Stepniewski *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 62 p refs

The fundamentals of rotary wing aerodynamics and their application to performance considerations of helicopters are discussed. The subjects presented are: (1) momentum theory; (2) blade element theory: (3) fundamentals of vortex theory: (4) applications of theory to design of rotary wing aircraft and performance optimization; and (5) example of helicopter performance prediction based on current industrial practice. Author

N73-22951 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
BASIC DYNAMICS OF ROTORS; CONTROL AND STABILITY OF ROTARY WING AIRCRAFT; AERODYNAMICS AND DYNAMICS OF ADVANCED ROTARY-WING CONFIGURATIONS
G. Reichert *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 50 p refs

Rotary wing configurations such as teetering, articulated, elastomeric-bearing, rotor hub, and hingeless systems are discussed. The basic dynamics of rotary wings are presented to show the elementary forces on a blade element, motion of rotary wing blades, and the influence of inplane stiffness, elastic coupling effects. The mechanics of helicopter flight are analyzed to demonstrate the principles of helicopter control, static and dynamic stability, and maneuver capability. The aerodynamics and dynamics of advanced rotary wing configurations are examined. Author

N73-22952 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROELASTICITY OF ROTARY WING AIRCRAFT
Rolland Dat *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 33 p refs

The effects of aeroelasticity on the performance of rotary wing aircraft are discussed. Flutter instability is illustrated by the case of an airfoil and the theoretical tools used to investigate the flutter of a flexible wing are presented. Procedures for predicting the aerodynamic forces on the blades of rotary wings are developed. A formulation of the problem of forced vibration in forward flight is given. Mathematical models are included to support the theoretical considerations. Author

N73-22953 Loughborough Univ. of Technology (England).
HELICOPTER NOISE: ANALYSIS - PREDICTION AND METHODS OF REDUCTION
Martin V. Lowson *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 37 p refs

The fundamentals of helicopter noise radiation phenomena are presented, to include a review of the features of subjective response. Emphasis is placed on the basic mechanisms of rotor noise generation, both for discrete frequency and broad band noise components. The implications for helicopter noise control are discussed. A review of possible propagation effects and the potential costs of helicopter noise reduction are included. Author

N73-22954 Societe Nationale Industrielle Aerospatiale, Marseille (France). Div. Helicopteres.
DRAG PROBLEMS ON ROTARY WING AIRCRAFT
Paul Fabre *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 12 p ref In ENGLISH and FRENCH

The effects of aerodynamic drag on rotary wing performance are analyzed. The influence of stall and compressibility on rotor drag is examined. An example of parasite drag reduction by fairing the rotor head is presented. The nature of helicopter in-flight limitations and methods for improving performance through autogyro configuration and reduction of rotor rotational speed are submitted. Author

N73-22955 Boeing Co., Philadelphia, Pa. Vertol Div.
AERODYNAMIC AND DYNAMIC ROTARY WING MODEL TESTING IN WIND TUNNELS AND OTHER FACILITIES
Franklin D. Harris *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 62 p refs

Procedures for testing models of rotary wing aircraft in wind tunnels are discussed. The test objectives involved in rotary wing tunnel tests are described. The characteristics of various testing facilities are analyzed and compared. Methods for obtaining and reducing wind tunnel data are presented. Cost considerations for models and test facilities are analyzed to provide basis for decision on construction and modification. Examples of typical wind tunnel tests conducted with rotary wing models are included. Author

N73-22956 Boeing Co., Philadelphia, Pa. Vertol Div.
FACTORS IN THE DESIGN AND FABRICATION OF POWERED DYNAMICALLY SIMILAR V/STOL WIND TUNNEL MODELS (APPENDIX 1)
Carl O. Albrecht *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 24 p refs

The factors involved in the design of a wind tunnel for testing V/STOL aircraft models are discussed. Mach-scaled rotor systems are analyzed to show development and construction. A review of Mach-scaling and Froude-scaling is included to show the relative advantages of each method. Techniques for constructing the models are illustrated. The construction of the test stands and specialized test equipment is explained. Author

N73-22957 Boeing Co., Philadelphia, Pa. Vertol Div.
THE EFFECTS OF REYNOLDS NUMBER ON ROTOR STALL (APPENDIX 2)
William G. S. Hardy *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 8 p refs

A theoretical analysis of the effects of Reynolds number on the aerodynamic stalling of rotary wings is presented. A comparison of full scale Reynolds number and model scale Reynolds number for specific airfoil configurations is made. The effects of aeroelasticity on rotary wing performance are analyzed. The relationship of Reynolds number to the aerodynamic coefficients of rotary wings is established. Author

N73-22958 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
PARAMETRIC TRENDS AND OPTIMIZATION; PRELIMINARY SELECTION OF CONFIGURATION; PROTOTYPE DESIGN AND MANUFACTURE
H. Huber *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 55 p refs

The contribution of aerodynamic and dynamic inputs to the design synthesis of rotary wings is discussed. Aerodynamic rotor design is concentrated on disc loading, tip speed, and solidity selection. Rotor airfoil design is examined under the aspects of compressibility and stall problems. Fundamental flapping and inplane frequencies are shown to be the two basic parameters in dynamic rotor design. Methods of developing various trend curves and their interpretation is supplemented by formal and iterative optimization techniques. Author

N73-22959 Westland Helicopters, Ltd., Yeouil (England).
FLIGHT TESTING FOR PERFORMANCE AND FLYING QUALITIES
Kieran T. McKenzie *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 15 p

A review is presented of the required approach to flight testing of rotary wing aircraft in the major areas of performance and flying qualities. Program philosophies, problem areas, techniques of measurement, recording, and analysis are examined and discussed. Some sample measurements and procedures are examined to illustrate approaches. Author

N73-22963 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF DATA ITEMS ON ROLLING MOMENT DERIVATIONS OF AN AEROPLANE
Oct. 1972 2 p
(ESDU-06.01.00-Amend-A-C) Copyright. Avail: Issuing Activity

The rolling moment derivatives of an aircraft due to rolling, yawing, and sideslip are discussed. The rolling moments are further defined with respect to the effects of wing planform, fin and rudder configurations, and dihedral and wing-body arrangement. It is stated that good approximation of the aerodynamic characteristics may be obtained by determining the effects of various parts of the aircraft separately and then combining the part derivatives to obtain the overall derivative. Author

N73-22964*# Boeing Co., Philadelphia, Pa. Vertol Div.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 1: CONCEPTUAL DESIGN OF USEFUL MILITARY AND/OR COMMERCIAL AIRCRAFT
Mar. 1972 145 p refs Sponsored in part by Army 4 Vol.
(Contract NAS2-6598)
(NASA-CR-114437; D222-10016-1) Avail: NTIS HC $9.25 CSCL 01C

The conceptual designs of four useful tilt-rotor aircraft for the 1975 to 1980 time period are presented. Parametric studies leading to design point selection are described, and the characteristics and capabilities of each configuration are presented. An assessment is made of current technology status, and additional tilt-rotor research programs are recommended to minimize the time, cost, and risk of development of these vehicles. Author

N73-22965*# Boeing Co., Philadelphia, Pa. Vertol Div.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 2: PRELIMINARY DESIGN OF RESEARCH AIRCRAFT
Mar. 1972 343 p refs Sponsored in part by Army 4 Vol.
(Contract NAS2-6598)
(NASA-CR-114438; D222-10016-2-Vol-2) Avail: NTIS HC $19.25 CSCL 01C

A preliminary design study was conducted to establish a minimum sized, low cost V/STOL tilt-rotor research aircraft with the capability of performing proof-of-concept flight research investigations applicable to a wide range of useful military and commercial configurations. The analysis and design approach was based on state-of-the-art methods and maximum use of off-the-shelf hardware and systems to reduce development risk, procurement cost and schedules impact. The rotors to be used are of 26 foot diameter and are the same as currently under construction and test as part of NASA Tilt-Rotor Contract NAS2-6505. The aircraft has a design gross weight of 12,000 lbs. The proposed engines to be used are Lycoming T53-L-13B rated at 1550 shaft horsepower which are fully qualified. A flight test investigation is recommended which will determine the capabilities and limitations of the research aircraft. Author

N73-22966# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A PILOT SURVEY OF SOME EFFECTS OF AIRCRAFT NOISE IN RESIDENTIAL COMMUNITIES NEAR LONDON (HEATHROW) AIRPORT
J. B. Ollerhead Jan. 1973 69 p refs
(TT-7302) Avail: NTIS HC $5.50

A pilot survey (601 interviews) has been undertaken to evaluate methods for measuring disturbance and annoyance caused by aircraft noise together with monetary valuation of noise nuisance. Disturbance is defined as the direct effects of noise which includes intrusion, interference or distraction and annoyance is defined as an indirect effect which may be considered as a subjective response to disturbance. Measurements of perceived disturbance give perhaps a less complete indication of the overall effects of aircraft noise than those of annoyance but they can be expressed in more objective dimensions and they should correlate more highly with physical measures of noise exposure. A preliminary analysis of the results is presented. A non-dimensional noise other coefficient is developed which directly relates noise annoyance to other sources of community dissatisfaction. Author

N73-22967# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
THEORETICAL INVESTIGATIONS OF SUPERSONIC ROTOR NOISE
D. L. Hawkings and M. V. Lowson Dec. 1972 98 p refs
(TT-7213) Avail: NTIS HC $7.00

A theoretical analysis of supersonic rotor noise is presented. The initial noise generation processes are investigated in detail using the Lighthill aerodynamic sound theory, and its subsequent non-linear propagation is accounted for using the Whitham weak shock theory. The combined analysis explains many of the observed features of supersonic rotor noise. Author

N73-22968# Societe Nationale Industrielle Aerospatiale, Paris (France).
CALCULATION OF FEATHERING CHARACTERISTICS IN THE WHIRLWIND FIELD OF AN AIRFOIL WHIRLWIND FIELD OF AN AIRFOIL [CALCUL DES CARACTERISTIQUES D'EMPENNAGES DANS LE CHAMP TOURBILLONNAIRE D'UNE VOILURE]
M. Yermia 17 Oct. 1972 36 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn, Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
(DEP/PRA/NT/88/72) Avail: NTIS HC $4.00

A theoretical determination was made of the effects of a perfect incompressible fluid flow on feathering characteristics in airfoil whirlwinds. Airfoil configuration, whirlwind-wake interaction effects, equilibrium flow, and velocity fields are analyzed.
Transl. by E.H.W.

N73-22969# Aeronautical Research Inst. of Sweden, Stockholm.
DISK APPROXIMATION FOR A HELICOPTER ROTOR IN FORWARD FLIGHT
C. A. Johansson 1972 66 p refs
(FFA-123) Avail: NTIS HC $5.50

A theory is developed for calculation of the induced velocity field of a helicopter rotor in forward flight. The rotor is approximated by a disk of continuous thrust and in-plane force distributions, which are assumed to be known. Its wake is represented by a semi-infinite cylinder of distributed vorticity. It is also suggested how this theory can be used for solving the full rotor problem, when the inflow data are given but the force distribution of the rotor is unknown. A numerical example is calculated. Author

N73-22970# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).
THREE DIMENSIONAL SUPERSONIC FLOW SEPARATION ON A DELTA WING [DECOLLEMENT TRIDIMENSIONNEL SUR UNE AILE DELTA EN ECOULEMENT SUPERSONIQUE]
P. Srinivasan, R. Leblanc, and T. AlziaryDeRoquefort Paris Soc. Natl. Ind. Aerospatiale 1972 32 p refs In FRENCH Presented

at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
(Contract DRME-70/145)
Avail: NTIS HC $3.75

An integral method is used to study the effects of interaction and flow separation in three-dimensional boundary layers, and for establishing a point of theoretical approach to the problem. A visualization procedure was used to study the effects of wall flow and wall pressure at Mach numbers 3.4, and 8. Pressure fields, longitudinal flow, and transverse movement were calculated using a bidimensional method. Numerical integration is used to determine wall flow lines in the interaction region and compare visualization results. A delta wing was used for the study.
Transl. by E.H.W.

N73-22971# Societe Nationale Industrielle Aerospatiale, Paris (France).
CRITICAL STUDY OF REPRESENTATIONS OF THE EFFECTS OF WIND GUST ON AIRCRAFT [ETUDE CRITIQUE DE LA REPRESENTATION DES EFFETS DE RAFALES SUR L'AVION]
R. Hirsch, J. J. Perrin, and H. Lethuy 1972 28 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.50

A detailed analysis is presented of the response of STOL type aircraft to wind gusts. The study utilizes fundamental factors of physical mechanisms including transition deflection on the tail assembly, separation of return flow by bending, structural deformation, and lift instability. Equipment specifications necessary for eventual automatic control of lift are discussed.
Transl. by E.H.W.

N73-22972# Societe Nationale Industrielle Aerospatiale, Paris (France).
APPLICATION OF SEVERAL AERODYNAMIC PROBLEMS TO LIGHT AIRCRAFT [QUELQUES PROBLEMES D'AERODYNAMIQUE APPLIQUEE A L'AVION LEGER]
Yves Gardan 1972 8 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.00

Aerodynamic problems of light aircraft in relation to flight qualities and minimum performance and construction of its engine are discussed. Data cover aircraft stability, longitudinal and transverse control, and response to wing configuration and other design changes.
Transl. by E.H.W.

N73-22973# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDY OF WING DEFLECTION DURING LOW SPEED FLIGHT AND IN A LARGE INCIDENCE DOMAIN [ETUDE THEORIQUE ET EXPERIMETALE D'UNE AILE EN FLECHE A FAIBLE VITESSE ET DANS UN LARGE DOMAINE D'INCIDENCES]
M. Ledoux and B. Monnerie 1972 25 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.25

A straight wing model is used to experimentally study three-dimensional flow. The effects of low speed on the wing model was tested in a wind tunnel and results compared to those obtained by calculation. The effects of pressure are also studied.
Transl. by E.H.W.

N73-22974# Mitre Corp., McLean, Va.
EXECUTIVE SUMMARY OF THE SHORT HAUL AIR TRANSPORTATION SYMPOSIUM
Apr. 1973 95 p Symp. held in McLean, Va., 10-12 Apr. 1973
(M73-54) Avail: NTIS HC $6.75

The proceedings of a conference on short haul air transport are presented. The subjects discussed are: (1) demand growth and prospects; (2) international trade and economic prospects; (3) urban and environmental impacts, (4) aviation technology prospects; (5) capitalization, finance, and profit; (6) regulation needs and prospects; (7) operations needs and prospects; and (8) airport requirements.
Author

N73-22975*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE SUPPRESSOR Patent Application
William E. Zorumski, inventor (to NASA) Filed 14 May 1973 13 p
(NASA-Case-LAR-11141-1; US-Patent-Appl-SN-359957) Avail: NTIS HC $3.00 CSCL 20A

The characteristics of a noise suppression system for installation in the inlet and exhaust ducts of a turbofan engine to reduce the level of noise emitted from the engine are presented. The device consists of a number of annular acoustically porous elements installed in the ducts. The elements are designed and located so that a sound wave travelling through one element will be incompatible with a wave travelling through another element. The wave reflection which occurs at the element interfaces cause a reflection and absorption of the sound with reduction in intensity.
NASA

N73-22976*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
PRELIMINARY WEIGHT AND COST ESTIMATES FOR TRANSPORT AIRCRAFT COMPOSITE STRUCTURAL DESIGN CONCEPTS
30 Mar. 1973 117 p refs
(Contract NAS1-10702)
(NASA-CR-112255) Avail: NTIS HC $8.00 CSCL 01C

Preliminary weight and cost estimates have been prepared for design concepts utilized for a transonic long range transport airframe with extensive applications of advanced composite materials. The design concepts, manufacturing approach, and anticipated details of manufacturing cost reflected in the composite airframe are substantially different from those found in conventional metal structure and offer further evidence of the advantages of advanced composite materials.
Author

N73-22977*# Bell Helicopter Co., Fort Worth, Tex.
AN ANALYTICAL STUDY FOR THE DESIGN OF ADVANCED ROTOR AIRFOILS
Larry D. Kemp 29 Mar. 1973 233 p refs
(Contract NASw-2334)
(NASA-CR-112297; Rept-299-099-635) Avail: NTIS HC $13.75 CSCL 01A

A theoretical study has been conducted to design and evaluate two airfoils for helicopter rotors. The best basic shape, designed with a transonic hodograph design method, was modified to meet subsonic criteria. One airfoil had an additional constraint for low pitching-moment at the transonic design point. Airfoil characteristics were predicted. Results of a comparative analysis of helicopter performance indicate that the new airfoils will produce reduced rotor power requirements compared to the NACA 0012. The hodograph design method, written in CDC Algol, is listed and described.
Author

N73-22979*# Lockheed-Georgia Co., Marietta.
PROGRAM FOR ESTABLISHING LONG TIME FLIGHT SERVICE PERFORMANCE OF COMPOSITE MATERIALS IN THE CENTRAL WING STRUCTURE OF C-130 AIRCRAFT. PHASE 2: DETAILED DESIGN
W. E. Harvill, J. J. Duhig, and B. R. Spencer Apr. 1973 171 p refs
(Contract NAS1-11100)
(NASA-CR-112272) Avail: NTIS HC $10.75 CSCL 01C

The design, fabrication, and evaluation of boron-epoxy

reinforced C-130 center wing boxes are discussed. Design drawings, static strength, fatigue endurance, flutter, and weight analyses required for the wing box fabrication are presented. Additional component testing to verify the design for panel buckling and to evaluate specific local design areas are reported. Author

N73-22980# National Transportation Safety Board, Washington, D.C.
A PRELIMINARY ANALYSIS OF AIRCRAFT ACCIDENT DATA, US CIVIL AVIATION, 1972 Special Study, 1972
11 Apr. 1973 54 p
(NTSB-APA-73-1) Avail: NTIS HC $4.75

The record of aircraft accidents which occurred in U.S. Civil Aviation Operations during calendar year 1972 is presented. It includes a statistical recapitulation of all accidents and a brief of each air carrier accident containing the essential items of information. Author

N73-22981*# Kanner (Leo) Associates, Redwood City, Calif.
STOL AIRCRAFT WITH MECHANICAL HIGH-LIFT SYSTEMS COMPARED WITH STOL AIRCRAFT WITH WINGS EQUIPPED WITH BLOWN FLAPS
E.-A. Bielefeldt Washington NASA May 1973 37 p refs Transl. into ENGLISH from Messerschmitt-Boelkow-Blohm bmBh report UH-12-72(o) (West Germany), 20 Sep. 1972 35 p Presented at the 5th Ann. Meeting of the DGLR, 4-6 Oct. 1972 (Contract NASw-2481)
(NASA-TT-F-14895; UH-12-72(o); Paper-72-057) Avail: NTIS HC $4.00 CSCL 01C

Net lifts of modern mechanical auxiliary high-lift systems and blown flaps are compared, as used on STOL aircraft with high surface loads. The possibilities for achieving aerodynamic efficiencies with these high-lift systems are discussed. Aerodynamic system problems and the effects of system weights of different auxiliary high-lift devices on net lift are considered. The net lifts of complex mechanical and blown-flap systems are determined as applied to a STOL aircraft configuration based on a surface loads of 370 kilograms per square meter for which a maximum lift coefficient of about 3.6 is required in the trimmed state. It is found that mechanical high-lift systems are superior to blown flaps in this comparison. Author

N73-22983# National Transportation Safety Board, Washington, D.C.
SPECIAL STUDY: IN FLIGHT SAFETY OF PASSENGERS AND FLIGHT ATTENDANTS ABOARD AIR CARRIER AIRCRAFT
14 Mar. 1973 43 p refs
(NTSB-AAS-73-1) Avail: NTIS HC $4.25

Nonfatal in-flight injuries of passengers and flight attendants in air carrier operations during the years, 1968 through 1971 are discussed. Injuries caused by turbulence, evasive maneuvers to avoid a collision, and self-initiated injuries are summarized. Conditions, circumstances, and pre-existing factors instrumental in creating a hazardous environment for persons aboard aircraft are examined, as well as types of injuries sustained and the treatment of such injuries. Also examined is the relationship of injuries to passenger seatbelt discipline, structure and design of cabin furnishings, flight attendants' duties, consumption of alcoholic beverages, and the location in the airplane of passengers and flight attendants. Six safety recommendations are presented. Author

N73-22984# Calspan Corp., Buffalo, N.Y.
IN FLIGHT SIMULATION OF MINIMUM LONGITUDINAL STABILITY FOR LARGE DELTA WING TRANSPORTS IN LANDING APPROACH AND TOUCHDOWN. VOLUME 1: TECHNICAL RESULTS Final Report
Richard Wasserman and John F. Mitchell Feb. 1973 129 p refs
(Contracts DOT-FA72WAI-143; F33615-72-C-1386)
(TR-5084-F-1-Vol-1; FAA-RD-73-43-Vol-1; AFFDL-TR-72-143-Vol-1) Avail: NTIS HC $8.50

An in-flight simulation to investigate minimum longitudinal stability for large delta-wing transports in landing approach and touchdown (including ground effect) was conducted using the USAF/Calspan Total In-Flight Simulator (TIFS)airplane. Aerodynamic, inertial and control data for this class of airplane were obtained from a prototype Concorde package supplied by the FAA. The simulation program involved the examination of 20 configurations by four evaluation pilots. The configurations evaluated were based upon a systematic variation of the longitudinal stability characteristics for this class of airplane. These variations were designed to examine the influence of pitch stiffness, backsideness, pitch damping and nonlinear pitching moment effects on pilot acceptability of minimum longitudinal stability for the landing approach task. A total of 61 evaluations was performed. Author

N73-22985# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: SPECTRUM AIR INCORPORATED SABRE MARK 5, N275X, SACRAMENTO EXECUTIVE AIRPORT, SACRAMENTO, CALIFORNIA, 24 SEPTEMBER 1972
24 Sep. 1972 35 p
(NTSB-AAR-73-6) Avail: NTIS HC $3.75

A Sabre Mark 5 aircraft crashed during a rejected takeoff at Sacramento, California Executive Airport on September 24, 1972. The aircraft became airborne twice during the attempted takeoff, but returned to the runway each time. The pilot reported that the aircraft acceleration and control response were normal until a vibration was felt shortly after initial liftoff. The aircraft crashed into a commercial establishment killing 22 persons and injuring 28, including the pilot. The probable cause of the accident was overrotation of the aircraft and subsequent loss of performance. Author

N73-22986 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
A STANDARDIZED LOAD SEQUENCE FOR FLIGHT SIMULATION TESTS ON TRANSPORT AIRCRAFT WING STRUCTURES
J. B. DeJonge, D. Schuetz, H. Lowak, and J. Schijve Mar. 1973 51 p refs Prepared in cooperation with Natl. Lucht en ruimtevaartlab., Amsterdam
(LBF-Bericht-FB-106; NLR-TR-73029-U) Avail: NTIS HC $4.75

A description is given of the development of a standardized load sequence which may be considered to be representative for the load history of the wing root of transport aircraft. Adoption of this standardized sequence is proposed for various aeronautical fatigue testing purposes. Author

N73-22987# Technische Hochschule, Aachen (West Germany). Inst. Fuer Luft- und Raumfahrt.
ACOUSTIC FEEDBACK OF A SUBSONIC AND SUPERSONIC FREE JET IMPINGING ON AN OBSTACLE [AKUSTISCHE RUECKKOPPLUNGSERSCHEINUNGEN AM UNTER- UND UEBERSCHALLFREISTRAHL, DER AUF EINEN STOERKOERPER TRIFFT]
Guenther Neuwerth 31 Oct. 1972 37 p refs In GERMAN; ENGLISH summary Presented at the 5th DGLR Annual Meeting, Berlin, 4-6 Oct. 1972
(DLR-FB-72-72) Avail: NTIS HC $4.00; DFVLR, Porz. 13,40 DM

Stationary wave pattern in the jet core, ring vortices in the jet boundary, and high intensity discrete frequencies in the noise and turbulence spectrum are observed during circular subsonic free jet impinging on an obstacle. The sound pressure level is enlarged by about 10 db. All these phenomena are explained by the feedback between the flow and the pressure field generated. The Strouhal numbers were determined as a function

of Mach number, jet temperature, nozzle diameter, and distance between the obstacle and the nozzle. A pressure wave in the jet core responsible for feedback was investigated. ESRO

N73-22988# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECTS OF REDUNDANCY ON SURVIVAL OF CRITICAL AVIONICS EQUIPMENT
Keats A. Pullen Jan. 1973 36 p refs
(DA Proj. 1T6-62708-A-068)
(AD-757152; BRL-MR-2266) Avail: NTIS CSCL 09/5

The design of simple circuits capable of keeping communications equipment in operation under conditions of failure of vital sections or sub-units of a system are described. Analyses are included which indicate possible routes for improvement of equipment survivability in a battlefield-type environment. Author (GRA)

N73-22989# Rochester Applied Science Associates, Inc., N.Y.
DETERMINATION OF THE AERODYNAMIC CHARACTERISTICS OF VORTEX SHEDDING FROM LIFTING AIRFOILS FOR APPLICATION TO THE ANALYSIS OF HELICOPTER NOISE Final Report, 18 Jun. 1969 - 31 Jan. 1973
S. Gene Sadler, H. Kevin Johnson, and Timothy D. Evans Feb. 1973 76 p refs
(Contract DAHC04-69-C-0090; DA Proj. 200-61102-B-33G)
(AD-757167; RASA-73-02; AROD-8695-2-E) Avail: NTIS CSCL 01/3

A study of vortex shedding from a lifting airfoil has been carried out. The objective of the study was to determine the important parameters affecting vortex shedding from airfoils for application to the study of vortex noise in helicopters. The study was conducted in the UARL acoustic research wind tunnel. Measurements of far-field noise and surface pressure fluctuations were obtained and analyzed for a NACA 0012 airfoil. (Author Modified Abstract) GRA

N73-22990# Naval Postgraduate School, Monterey, Calif.
THE NUMERICAL SOLUTION AND ANALYSIS OF AIRPLANE SPIN EQUATIONS MODELED IN A FIXED COORDINATE SYSTEM M.S. Thesis
Robert Louis Champoux Dec. 1972 140 p refs
(AD-757257) Avail: NTIS CSCL 01/3

Three forms of the airplane spin equations of motion, derived by Buehler form the basis for the development of a computer program designed to seek dynamically stable equilibrium solutions of a spinning aircraft. The program incorporates two solution techniques: one based upon Euler integration, the other, a version of minimization by gradient search. Secondary programs are developed to generate power off glide parameters for use in the validation of the equations of motion, and evaluate equation residuals obtained from a grid of initial conditions over the potential solution space. F-111 and F-4 aerodynamic force and moment models were utilized to evaluate the solution methods and equations of motion. The numerical results indicate that the F-111 and F-4 data are not representative of the actual aircraft and, therefore, it is highly unlikely that dynamically stable equilibrium solutions can be achieved from these models. (Author Modified Abstract) GRA

N73-22991# Cranfield Inst. of Technology (England).
ANALYSIS OF TAXIING INDUCED VIBRATIONS IN AIRCRAFT BY THE POWER SPECTRAL DENSITY METHOD Final Report, May - Dec. 1971
C. L. Kirk Wright-Patterson AFB, Ohio AFFDL Jan. 1973 44 p refs
(Contract F44620-71-C-0084; AF Proj. 1370)
(AD-757283; AFFDL-TR-72-74) Avail: NTIS CSCL 01/3

Taxiing induced vibrations in large aircraft due to runway and taxiway unevenness have been recognized as a significant factor in causing airframe metal fatigue damage and dynamic stressing, as well as discomfort for the crew and passengers. Vibration of the landing gear also causes seal wear with subsequent leakage of air and hydraulic fluid. The report presents an analytical method of determining the random vibration response of a flexible aircraft caused by runway unevenness transmitted through the main landing gear struts. The aircraft used in the computation of vibration response is the Boeing KC-135A (Stratotanker) in the fully loaded configuration (324,000 lb) (146,963 kg). GRA

N73-22992# Army Electronics Command, Fort Monmouth, N.J.
AIRFRAME EXCITATION OF THE LOH-6A HELICOPTER AT HF (2-30 MHz)
Charles M. DeSantis Feb. 1973 55 p refs
(DA Proj. 1T0-61102-B-31A)
(AD-757143; ECOM-4077) Avail: NTIS CSCL 01/3

The report describes the results of a four-month investigation of the controlled airframe excitation of helicopters in the 2 - 30 MHz frequency range. Two methods of excitation are considered: magnetic and electric. Magnetic excitation is achieved by using a pair of coils placed symmetrically on the tail section of the aircraft to induce longitudinal currents in the aircraft skin. Electric excitation is achieved by covering the rear section of the aircraft with a metallic sleeve to create a high impedance gap which can be driven with a voltage source. Measurements of the impedance, radiation patterns, bandwidth, and efficiency were made on a 5:1 scale model of the LOH-6A helicopter in the frequency range 10 - 150 MHz. Author (GRA)

N73-22993# Boeing Co., Seattle, Wash.
STOL TRANSPORT THRUST REVERSER/VECTORING PROGRAM, VOLUME 1 Final Report, Jul. 1971 - Nov. 1972
John E. Petit and Michael B. Scholey Feb. 1973 304 p refs
(Contract F33615-71-C-1850; AF Proj. 643A)
(AD-756860; AFAPL-TR-72-109-Vol-1) Avail: NTIS CSCL 01/3

Existing data were reviewed for application to computer programs to predict TR/TV performance and evaluating TR/TV influence on the total airplane system. Three programs were developed: (1) Jet Trajectory and Spreading Program - to predict the shape and trajectory of the TR/TV exhaust plume; (2) Reingestion Prediction Program - to predict the onset of reingestion; and (3) TR and TV System Performance and effect TR/TV operation on engine stability margin. Static tests were conducted to determine multibearing thrust vectoring nozzle performance and blocker door geometry effects on annular cascade thrust reverser performance. Results were incorporated in the TR and TV System Performance Program. The programs provide relatively simple design tools to evaluate TR/TV performance and to determine potential exhaust flow interference and reingestion data to STOL transport configurations is limited. Low speed wind tunnel testing is recommended to obtain this type of data. Author (GRA)

N73-22994# Boeing Co., Seattle, Wash.
STOL TRANSPORT THRUST REVERSER/VECTORING PROGRAM, VOLUME 2 Final Report, Jul. 1971 - Nov. 1972
John E. Petit and Michael B. Scholey Feb. 1973 207 p refs
(Contract F33615-71-C-1850; AF Proj. 643A)
(AD-756861; AFAPL-TR-72-109-Vol-2) Avail: NTIS CSCL 01/3

Design studies were conducted of thrust reverser and thrust vectoring systems for STOL tactical transports to evolve systems properly integrated with the aircraft. The studies included configuration design, performance, and weight analyses of feasible thrust reverser and thrust vectoring concepts. Test plans were developed for static tests of the most promising concepts. Following Air Force approval of the test plans, test model hardware were fabricated. Model tests were conducted of a fan thrust reverser that exhausts all of the fan flow through cascades installed in the upper 180 degrees sector of the nacelle, and an external deflector/target TR/TV system that combines the functions of thrust vectoring and reversing into a single mechanism. Scaling relationships were used to correct the data to full-scale

performance, and data correlations were developed for the external/target model as a function of geometric parameters and nozzle pressure ratio. Author (GRA)

N73-22995# *General Dynamics/Fort Worth, Tex. Convair Aerospace Div.*
COMPOSITE WING FOR TRANSONIC IMPROVEMENT. VOLUME 3: STRUCTURAL RELIABILITY STUDIES Final Technical Report
Sherrell D. Manning, Glenn H. Lemon, and Max E. Waddours Nov. 1972 244 p refs
(Contract F33615-70-C-1242)
(AD-756893; AFFDL-TR-71-24-Vol-3) Avail: NTIS CSCL 01/3

Studies were conducted to establish the reliability characteristics of large scale bonded joints applicable to an advanced composite wing. A combined experimental/analytical approach was used to examine the residual strength/lifetime characteristics of a boron-epoxy-to-titanium scarf joint. The implications of joint reproducibility and fatigue characteristics on structural reliability and design criteria have been studied. The results correlate strength/lifetime characteristics, define the joint fatigue failure process, and establish the required technology for proceeding with reliability-based design for bonded joints. (Author Modified Abstract) GRA

N73-22996 Bendix Corp., South Bend, Ind. Energy Controls Div.
FILAMENT COMPOSITE MATERIAL LANDING GEAR PROGRAM, VOLUME 1 Final Report, 1 Apr. 1969 - 1 Feb. 1972
Aug. 1972 235 p refs
(Contract F33615-69-C-1558; AF Proj. 1368; AF Proj. 1369)
(AD-756922; AFFDL-TR-72-78-Vol-1) Avail: NTIS CSCL 01/3

The objective of this program was to explore the utility of boron composite materials in aircraft landing gear construction. The contract work statement required the design, fabrication and test of a boron composite material landing gear assembly interchangeable in both geometry and performance with the main landing gear of the A-37B aircraft. The use of BIRSIC (Registered)-aluminum and boron epoxy materials was explored. Hardware designs were evolved for both materials. One full size landing gear assembly was tested. This assembly was composed of a boron epoxy outer cylinder, inner cylinder and side brace. All attachment fittings were metallic. The assembly was tested for hydraulic pressure containment and static structural strength in the Bendix laboratories. (Author Modified Abstract) GRA

N73-22997# Bendix Corp., South Bend, Ind. Energy Controls Div.
FILAMENT COMPOSITE MATERIAL LANDING GEAR PROGRAM, VOLUME 2 Final Report, 1 Apr. 1969 - 1 Feb. 1972
Aug. 1972 279 p refs
(Contract F33615-69-C-1158; AF Proj. 1368; AF Proj. 1369)
(AD-756923; AFFDL-TR-72-78-Vol-2) Avail: NTIS CSCL 01/3

For abstract, see N73-22996. GRA

N73-22998# United Aircraft Corp., East Hartford, Conn.
LIFTING SURFACE THEORY FOR STATICALLY OPERATING PROPELLERS Final Report, May 1971 - Sep. 1972
James C. Murray and Franklin O. Carta Dec. 1972 124 p refs
(Contract F33615-71-C-1430; AF Proj. 3066)
(AD-757264; AFAPL-TR-72-100) Avail: NTIS CSCL 01/3

A method was derived and a computer program formulated which utilizes a vortex-lattice lifting surface representation to model a statically operating propeller and to compute its performance. The computer program has been written to yield propeller performance characteristics for a prescribed blade geometry (the direct problem) or to yield blade camber distribution (the indirect problem). All of the results described were obtained for the direct problem. Performance characteristics, including propeller thrust and torque coefficients, were computed for three propeller configurations and were compared with test data and with results computed using lifting line theory. (Author Modified Abstract) GRA

N73-22999# Boeing Commercial Airplane Co., Seattle, Wash.
EXPLORATORY DEVELOPMENT ON APPLICATION OF RELIABILITY ANALYSIS TO AIRCRAFT STRUCTURES CONSIDERING INTERACTION OF CUMULATIVE FATIGUE DAMAGE AND ULTIMATE STRENGTH Final Report, 16 Nov. 1970 - 15 Mar. 1972
I. C. Whittaker and S. C. Saunders Jan. 1973 52 p refs
(Contract F33615-71-C-1134; AF Proj. 7351)
(AD-757529; D6-60165; AFML-TR-72-283) Avail: NTIS CSCL 01/3

An analysis method for determining the reliability of airplane structures, subjected to the cumulative and maximum operational loads and the resultant interaction of fatigue damage and strength, has been investigated. The design variables include the central tendency values of the fatigue performance, that is, the average lives to initiation and the growth of a major crack, and the effect of the crack on structural strength. Other variables include the standard operational procedure of periodic inspection of the structure and its repair when found to be damaged. Functions, based on the length of the fatigue crack, are used to describe both the residual strength of the structure and the probability of the crack being detected and the cracked structure being repaired. The times to initiation of a crack and the later time when the crack becomes critical, i.e., unstable, are taken as random variables. The derived reliability model considers that at any time the structure is either failed or unfailed. (Author Modified Abstract) GRA

N73-23000# United Aircraft Corp., East Hartford, Conn. Research Labs.
NONDESTRUCTIVE HOLOGRAPHIC TECHNIQUES FOR STRUCTURES INSPECTION Annual Technical Report, 1 Jul. 1971 - 30 Apr. 1972
R. K. Erf, J. P. Waters, R. M. Gagosz, F. Michael, and G. Whitney Oct. 1972 140 p refs
(Contract F33615-71-C-1874)
(AD-757510; L991208-12; AFML-TR-72-204) Avail: NTIS CSCL 01/3

The program is investigating the feasibility of using holographic interferometry for the inspection of large aircraft structures in a manufacturing or maintenance environment. The work comprised the following: (1) An investigation of various problems to be encountered in technically difficult physical environments as a result of ambient lighting, vibration and suspended aerosols. (2) An evaluation of the effects that various surface finishes have on the holographic construction process. (3) The development of the theory required to relate holographic records to the strain patterns and areas of maximum strain present on large structures. (4) Successful application of both continuous-wave (cw) and pulsed laser systems to time-averaged interferometric holography of composite compressor blades subjected to ultrasonic stressing. (Author Modified Abstract) GRA

N73-23001# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
HIGH VOLTAGE DC AIRCRAFT SYSTEM DEVELOPMENT Progress Report
R. Howard Ireland 23 Feb. 1973 21 p refs
(AD-757646; NADC-73035-30) Avail: NTIS CSCL 01/3

The report presents the advantages of a high voltage dc aircraft electrical system over conventional ac systems, discusses several conceptual distribution system designs, and summarizes the current status of the high voltage dc development program. Author (GRA)

N73-23002# Lear Siegler, Inc., Santa Monica, Calif. Astronic Div.

FEASIBILITY STUDY FOR AN ADVANCED DIGITAL FLIGHT CONTROL SYSTEM (DIGIFLIC). VOLUME 1: SUMMARY, ANALYSIS, AND SYSTEM STUDIES. VOLUME 2: SOFTWARE, SPECIFICATION, SIMULATION STUDIES, AND APPENDICES Final Report, Sep. 1971 - Aug. 1972

M. L. Sutton, W. J. Hasson, and G. M. Soderlund Oct. 1972 490 p refs

(Contract N62269-72-C-0142)

(AD-757271; ADR-773-Vol-1-2) Avail: NTIS CSCL 01/3

The digital flight control system (DIGIFLIC) program is an advanced development program of which the principle objective was to study the feasibility of advanced flight control using a digital processor as the main computational element. The studies and analyses conducted during this program resulted in the determination of a set of basic system requirements which could be implemented using present day technology. Investigation of future technology showed that significant advances can be expected which will reduce the size, weight and power required for such a flight control system. The results of these studies are contained in two volumes. Volume 1 contains a detailed summary of the objectives and results, analytical studies and system studies. Volume 2 contains the software studies, system specification, simulation studies and appendices. (Author Modified Abstract)

GRA

N73-23003# National Aeronautical Establishment, Ottawa (Ontario).

A DETERMINISTIC MODEL OF SONIC BOOM PROPAGATION THROUGH A TURBULENT ATMOSPHERE

B. H. K. Lee and H. S. Ribner (Toronto Univ.) Nov. 1972 24 p refs

(AD-756790; NAE-LR-566; NRC-12981) Avail: NTIS CSCL 20/1

The propagation of a weak normal shock wave through a turbulent atmosphere is studied in terms of an idealized model. The turbulent field is assumed to be weak and represented by the superposition of two inclined shear waves of opposite inclination to the mean flow. The resulting flow is of a cellular nature. The cells are rectangular in shape and the sense of rotation of the flow alternates from cell to cell. If the angles made by the normal of the incident shear waves with the direction of the mean flow are greater than some critical value an exponentially decaying pressure wave is generated behind the shock. Spiked or rounded waveforms are obtained by adding or subtracting this pressure wave from the steady state pressure field. An illustrative example for a mean flow Mach number of 1.0005 is considered.

Author (GRA)

N73-23004# Naval Ship Research and Development Center, Bethesda, Md.

COLLISION PROTECTION FOR THE ARCTIC SURFACE-EFFECT VEHICLE

William E. Gilbert Feb. 1973 82 p refs

(ARPA Order 1676)

(AD-758359; NSRDC-3885) Avail: NTIS CSCL 13/6

Collision protection is studied for the Advanced Research Projects Agency, concerning the proposed Arctic surface-effect vehicle (ASEV). The approach to collision protection is presented, and various energy absorbing concepts are investigated and evaluated for their possible use in protecting the ASEV in ice-obstacle impacts. Schemes being investigated are the air bag, foam-core sandwich panels, energy-absorbing steering columns, inverting and torsional tubes, fluid dispersal shock absorbers, and tubes which buckle intextensionally in axial compression.

Author (GRA)

N73-23005# School of Aerospace Medicine, Brooks AFB, Tex.

AEROMEDICAL FACTORS IN MIDAIR COLLISIONS Aeromedical Review

Royce Moser, Jr. Mar. 1973 21 p refs

(AD-758189; SAM-Review-2-73; SAM-TR-73-7) Avail: NTIS CSCL 01/12

Midair collisions continue to be a serious hazard in Air Force flight operations. Various aeromedical factors affect one's ability to detect another aircraft in time to avoid a collision. The review discusses these factors and illustrates the role of these factors in an accident. It also considers the actions the crewmember should take to obtain the maximum benefit from the capabilities he does possess and thus reduce the risk of a midair collision.

Author (GRA)

N73-23006# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: CESSNA 182, N70586, DULUTH INTERNATIONAL AIRPORT, DULUTH, MINNESOTA, 8 NOVEMBER, 1972

26 Apr. 1973 12 p

(NTSB-AAR-73-10) Avail: NTIS HC $3.00

The crash of a Cessna 182 aircraft near Duluth, International Airport, Duluth, Minnesota on 8 November, 1972 is reported. The crash occurred while attempting a precision radar approach to the airport during instrument flying conditions. The probable cause of the accident was considered to be the formation of ice on the aircraft which was not equipped with deicing or antiicing equipment.

Author

N73-23007# Bell Helicopter Co., Fort Worth, Tex.

TRADEOFF STUDY FOR EXTENDED LIFE HELICOPTER TRANSMISSION Technical Report, 1 Jul. 1970 - 16 Apr. 1971

Charles W. Bowen and Richard D. Walker Ft. Eustis, Va. Army Air Mobility R and D Lab. Nov. 1972 242 p refs

(Contract DAAJ02-70-C-0053)

(AD-758465; BHC-299-099-492; USAAMRDL-TR-72-40) Avail: NTIS CSCL 13/9

The report presents the results of a design tradeoff study conducted to determine the operational cost impact of extending and overhaul life of the drive train components from 1200 hours to 3000 and 6000 hours on future Army helicopters. Pertinent Army and BHC publications were reviewed to determine time between overhaul (TBO) limiting factors. An analytical review was also made of a mission profile study conducted on monitored AH-1G, UH-1H, and UH-1C helicopters in Viet Nam to determine an appropriate usage rate, power spectrum, and flight length spectrum for this study. (Author Modified Abstract)

GRA

N73-23008# Boeing Co., Renton, Wash. Commercial Airplane Group.

DEVELOPMENT OF TITANIUM AND STEEL FATIGUE VARIABILITY MODEL FOR APPLICATION OF RELIABILITY ANALYSIS APPROACH TO AIRCRAFT STRUCTURES Final Report, 16 Nov. 1970 - 15 Mar. 1972

I. C. Whittaker Wright-Patterson AFB, Ohio AFML Oct. 1972 114 p refs

(Contract F33615-71-C-1134; AF Proj. 7351)

(AD-758219; D6-60164; AFML-TR-72-236) Avail: NTIS CSCL 01/3

An investigation of the fatigue performance test scatter in titanium alloys and steels was made with the intent of identifying their variability in terms of a distribution and its shape parameter. The two-parameter Weibull distribution was selected for matching the fatigue variability of these two materials. About 1200 groups of titanium alloy and 800 groups of steels were collected and analyzed to determine the feasibility of establishing a typical distributional Weibull shape parameter for these materials. A Weibull distribution shape parameter of 3.0 is suggested for titanium alloys and those steels with a 240-ksi strength level or less. Steels having greater than a 240-ksi strength level seem better represented by a shape parameter of 2.2. In a further study, the choice of a distribution most aptly matching fatigue variability was explored with the use of previously collected extensive aluminum alloy and the titanium alloy data. (Author Modified Abstract)

GRA

N73-23009# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
G PROTECTIVE AIRCRAFT SEATS, WITH SPECIAL CONSIDERATION GIVEN TO PELVIS AND LEGS ELEVATING (PALE) SEATS
Harald J. VonBeckh 1 Oct. 1972 52 p refs
(MF51524005)
(AD-756630; NADC-72262-CS) Avail: NTIS CSCL 01/3

The author is developing a crew seat which achieves the supine position, not by reclining the seat-back, but by elevating the pelvis and the legs forwards-upwards, while the head and the shoulders barely move. In order to differentiate this type of supinating seat from reclining seats, it is named PALE (Pelvis and Legs Elevating) seat. Author (GRA)

N73-23010# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
VIBRATION ANALYSIS OF CURVED SKIN-STRINGER STRUCTURES HAVING TUNED ELASTOMERIC DAMPERS Ph.D. Thesis - Ohio State Univ. Technical Report, Mar. 1968 - Mar. 1972
John P. Henderson Oct. 1972 146 p refs
(AF Proj. 7351)
(AD-758220; AFML-TR-72-240) Avail: NTIS CSCL 01/3

The steady state vibration response of curved skin-stringer structure is analyzed through the application of transfer matrix techniques. Previous transfer matrix analyses of similar structures are improved through the development of a technique for generating the transfer matrix for a curved panel directly from the matrix differential equation, representing eight first order linear differential equations, for an appropriate shell theory. In addition, the effects of stringer stretching and finite stringer width are analyzed. Specifically, the analysis is demonstrated on a structure consisting of a row of five cylindrically curved panels with constant radius of curvature, stiffened by stringers parallel to the generators and simply supported by frames normal to the stringers at the edges. (Author Modified Abstract) GRA

N73-23017# Gulton Industries, Inc., Hawthorne, Calif. Engineering Magnetics Div.
MAINTENANCE FREE BATTERY SYSTEM, MODEL NO. EMBC114C. BATTERY SYSTEM, SEALED CELL, NICKEL CADMIUM, INTEGRAL CHARGE CONTROL, AIRCRAFT Final Report
Thomas W. Grasmehr, William Newman, and Thomas Pierce Dec. 1972 288 p refs
(Contract F33615-70-C-1737; AF Proj. 3145)
(AD-757535; AFAPL-TR-72-85) Avail: NTIS CSCL 10/3

The program covers work performed on the EMBC114C Maintenance Free, Nickel-Cadmium Battery System. The EMBC114C consists of a hermetically sealed nickel-cadmium battery and an associated control logic and charger circuit. The Battery System is compatible with existing aircraft electrical systems and may be operated at altitudes up to 100,000 feet. The system is a two-terminal device connected in parallel with the aircraft 28 vdc power. This system was modified to reduce EMI and minimize bus power interruptions when switching from charge to discharge. Tests were performed to verify these modifications. A study was conducted to determine the best charge rate, whether sealed or vented cells were most suitable, and the advisability of using three terminal systems where possible. The EMBC114C is the modified system in accordance with the stated objectives and was qualification tested. GRA

N73-23093*# Little (Arthur D.), Inc., Cambridge, Mass.
ODOR INTENSITY AND CHARACTERIZATION OF JET EXHAUST AND CHEMICAL ANALYTICAL MEASUREMENTS Technical Report, Mar. 1972 - Mar. 1973
David A. Kendall and Philip L. Levins Mar. 1973 69 p refs
(Contract NAS3-15701)
(NASA-CR-121159; ADL-74443) Avail: NTIS HC $5.50 CSCL 07D

Odor and chemical analyses were carried out on the exhaust samples from a J-57 combustor can operated over a range of inlet conditions, and with several fuel types and nozzle modifications. The odor characteristics and total intensity of odor for each exhaust were determined over a range of dilutions to allow for a least squares determination of the intensity at 1,000 to 1 dilutions. Analytical measures included the concentration of total hydrocarbons and the concentrations of aromatic organic species and oxygenated organic species from collected samples which were taken concurrently. A correlation was found between the concentration of the odorous oxygenated fraction and the total intensity of aroma. Inlet operating conditions and nozzle modifications which increase the efficiency of combustion as measured by exhaust gas analyses reduce the odor intensity and the quantity of oxygenates in the exhaust. The type of fuel burned altered the intensity of odor in relation to the quantity of oxygenates produced and, in some instances, changed the odor character. Author

N73-23105# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
JET EXHAUST REACTIONS: A THEORETICAL STUDY Final Report, 1 Jul. - 31 Dec. 1972
Edward Y. H. Keng and Clyde Orr, Jr. 31 Jan. 1973 23 p refs
(Contract F19628-72-C-0353; GIT Proj. A-1437; AF Proj. 7605)
(AD-758200; AFCRL-TR-73-0110) Avail: NTIS CSCL 07/4

The objective of the project was to find an appropriate means for temporarily reducing the temperature of engine exhaust gases while holding to a minimum the infrared spectral emission in the reaction products at the exhaust temperature. The most promising approach appears to involve the injection of materials that undergo endothermic decomposition. Only limited data on endothermic decomposition were found in the literature. However, heat of decomposition values can be calculated from heat of formation data which is much more readily available. Some promising substances were tested by injecting their powders into a hot gas stream and measuring the temperature reduction thereby induced. Preliminary calculations based on these measurements indicate, typically, that engine exhaust temperature reductions of about 100F can be achieved for each 1 lb/sec of powder injected. The emission spectra of materials and their reaction products are also discussed. Author (GRA)

N73-23111# Canadian Air Transportation Administration, Ottawa. Telecommunications and Electronics Branch.
[RESEARCH PROGRESS ON TELECOMMUNICATIONS AND ELECTRONIC SYSTEMS] Quarterly Progress Report, period ending 30 Jun. 1972
30 Jun. 1972 25 p
(Rept-73-00567) Avail: NTIS HC $3.25

Engineering progress is reported in the following areas: radar and automation systems, enroute aids, approach and landing aids, flight calibration, communications, ship electronics, and reliability and quality assurance. D.L.G.

N73-23209 Magnavox Co., Silver Spring, Md.
A COMPARISON OF VOICE CODING TECHNIQUES FOR A SATELLITE-BASED AIR TRAFFIC CONTROL SYSTEM
J. N. Birch *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 352-355 refs

The results are summarized of a survey of voice coding and intelligibility tests for a satellite-based air traffic control system. There were two primary constraints imposed on the study. First, the RF bandwidth allocation for each transmission is 20 kHz or less, and second, voice coding techniques capable of providing usable communications at low values of carrier-to-noise density were emphasized. The words 'voice coding' apply to both analog and digital techniques. Candidate voice coding techniques were selected at the beginning of the study for their ability to provide adequate air traffic control communications over the range of carrier/noise density values from 40 db-Hz to 48 db-Hz while requiring an RF bandwidth of 20 kHz or less. Other considerations included size, weight, power requirements, reliability, availability, and multiplexing capabilities. Both domestic as well as foreign technologies were used in the survey study. Author

N73-23235# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
POSSIBILITIES OF AN AIRCRAFT TELEVISION SYSTEM [MOEGLICHKEITEN EINES FLUGZEUG-FERNSEH-SYSTEMS]
Armin Quast 1973 30 p refs In GERMAN: ENGLISH summary (DLR-MITT-73-09) Avail: NTIS HC $3.50; DFVLR, Porz, West Ger. 8,50 DM

The advantages of an aircraft television system over satellite transmission are discussed. A network of two aircraft circulating at a 20 km altitude and covering the Federal Republic of Germany territory is investigated. Its possible future applications, including geophysical and meteorological reconnaissance, use as a platform for astronomical observations and satellite experiments, are envisaged. ESRO

N73-23246# Army Electronics Command, Fort Monmouth, N.J.
CIRCULAR SYMBOL AND VIDEO INSET GENERATOR FOR TELEVISION DISPLAYS
C. J. Capriglione and E. A. Karcher Mar. 1973 18 p refs
(DA Proj. 1F2-62202-A-A97)
(AD-757621; ECOM-4095) Avail: NTIS CSCL 17/2

The report describes the design of a circular symbol generator for use with television displays. These symbols can be used for presenting circles, ellipses or rings in the television raster. It can also be used for video insetting which enables a portion of two different video sources to be seen simultaneously one television screen. In this case, the inset would be circular or elliptical. The hardware is used in the Tactical Avionics System Simulator (TASS) in support of the Night Low Level Program. (Author Modified Abstract) GRA

N73-23247# Army Electronics Command, Fort Monmouth, N.J.
ATTITUDE LINE GENERATOR FOR TELEVISION DISPLAYS
C. J. Capriglione and E. A. Karcher Mar. 1973 26 p refs
(DA Proj. 1F2-62202-A-A97)
(AD-757620; ECOM-4094) Avail: NTIS CSCL 17/2

The report describes the design of an attitude line generator for use with aircraft-type television displays. The attitude line appears as a continuous line that can be pitched and rolled through 360 degrees. The attitude line is in effect a special symbol generated for a television display. The hardware is used in the Tactical Avionics System Simulator (TASS) in support of the Night Low Level Program. (Author Modified Abstract) GRA

N73-23304* Boeing Co., Seattle, Wash. Commercial Airplane Group.
TRANSITION SPLICES AND COST COMPARISON
M. Dalmado Remedios *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 35 p

CSCL 09A

The development and testing of two designs of transition splices are reported. The design goal was to produce splice terminations that are electrically insulated to withstand the environmental conditions of commercial aircraft and are capable of being repaired and reworked on installed cables with the use of hand tools. In addition, a cost study comparison of FCC vs. RCC is reported. The comparison was made on a basis of 10 aircraft with each vehicle using approximately 100,000 feet of wiring and 2,000 connectors. The results are tabulated for seven different wiring configurations. D.L.G.

N73-23310* AMP, Inc., Harrisburg, Pa.
CJ CONCEPT FOR ADVANCED AIRCRAFT WIRING
Jack Redslob *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 7 p

CSCL 09A

The techniques and hardware are described which were developed for facilitating the use of flexible flat conductor cable (FFCC) in commercial air transports. The system was designed as an evolutionary transition from the current round wire harnessing to the use of FFCC harnesses. The equipment discussed includes the pressure crimp barrel designed for terminating FFCC, reel-fed applicator, cable connectors and adaptors, and equipment racks. F.O.S.

N73-23311* Boeing Co., Seattle, Wash.
ADVANCED WIRING TECHNIQUE AND HARDWARE APPLICATION: AIRPLANE AND SPACE VEHICLE
H. L. Ernst and C. D. Eichman *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 21 p
CSCL 09A

An advanced wiring system is described which achieves the safety/reliability required for present and future airplane and space vehicle applications. Also, present wiring installation techniques and hardware are analyzed to establish existing problem areas. An advanced wiring system employing matrix interconnecting unit, plug to plug trunk bundles (FCC or ribbon cable) is outlined, and an installation study presented. A planned program to develop, lab test and flight test key features of these techniques and hardware as a part of the SST technology follow-on activities is discussed. Author

N73-23338# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SIMULATION OF A WIND GUST BLOWER [SIMULATION D'UNE RAFALE EN SOUFFLERIE]
J. P. LeHetet, J. Commelin, and P. Lafon Soc. Natl. Ind. Aerospatiale 1972 15 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.00

An attempt is made to develop a means of studying the behavior of aircraft in low speed wind gusts and turbulent atmosphere near the ground. Flow profiles are presented and an analysis is made of results obtained by a wind simulation apparatus. Transl. by E.H.W.

N73-23339*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION AND CALIBRATION OF THE LANGLEY 6-BY 19-INCH TRANSONIC TUNNEL
Charles L. Ladson Washington May 1973 64 p refs
(NASA-TN-D-7182; L-8680) Avail: NTIS HC $3.00 CSCL 14B

A description and calibration is presented of the Langley 6-by 19-inch transonic tunnel which is a two-dimensional facility with top and bottom slotted walls used for testing two-dimensional airfoil sections. Basic tunnel-empty Mach number distributions and schlieren flow photographs as well as integrated normal-force coefficients, pitching-moment coefficients, surface-pressure distributions, and schlieren flow photographs of an NACA 0012 airfoil calibration model are presented. The Mach number capability of the facility is from 0.5 to about 1.1 with a corresponding Reynolds number range of 1.5 million to 3 million based on a 4.0-in. model chord. Comparisons of experimental results from the tests with previous data are also presented. Author

N73-23341# Georgia Inst. of Tech., Atlanta.
ELECTRONIC FACILITY BONDING, GROUNDING AND SHIELDING REVIEW Final Report
H. W. Denny, J. C. Toler, F. P. Holder, J. A. Woody, S. L. Robinette, and R. W. Larson Washington FAA Nov. 1972 121 p refs
(Contract DOT-FA72WA-2850)
(FAA-RD-73-51) Avail: NTIS HC $8.25

The results of a review of grounding, bonding, and shielding practices are presented. The practices are evaluated in terms of their applicability to the enhancement of the operational reliability of the Federal Aviation Administration's air traffic control electronic facilities. Existing standards and specifications related to these

practices are critically reviewed as to their appropriateness for FAA facilities. Facility earth grounding requirements are examined in terms of the needs for lightning protection, power fault protection, and signal referencing. Author

N73-23342# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIRCRAFT WAKE VORTEX AVOIDANCE SYSTEM
Mar. 1972 51 p refs
(FAA-ED-21-1) Avail: NTIS HC $4.75

Efforts to develop a Wake Vortex Avoidance System (WVAS) are discussed. The basic objective of the program is the design of a system to increase runway capacity by removing the capacity-restrictive large spacings now required between aircraft to avoid wake vortex hazards. These large spacings will be replaced by separations tailored to aircraft type and prevailing meteorological conditions. In addition, through the use of vortex sensors, safety will be increased in the terminal area by warning of the existence of vortices in the aircraft approach and departure paths. The program consists of three major task areas: Sensor development, vortex behavior, and hazard definition. These tasks will be integrated into an overall system design. Although the program will require up to five years to complete, interim capabilities specifically directed toward safety will be available in useable form in advance of the completion date. Author

N73-23345# Mitre Corp., McLean, Va.
MODELS FOR RUNWAY CAPACITY ANALYSIS Final Report
Richard M. Harris Dec. 1972 141 p refs
(Contract DOT-FA70WA-2448)
(MTR-4102-Rev-2; FAA-EM-73-5) Avail: NTIS HC $9.25

Mathematical and simulation models for the calculation of single runway IFR capacity are described. With the basic statistical model one can calculate basic saturation capacity under arrival only and mixed arrival/departure operations. In addition extensions have been made into the analysis of less-than-saturation demand by a simple queueing model, and of speed-class sequencing as a Markov process. A statistical model used to predict capacities for alternative runway configurations, levels of approach control system precision, and changes in aircraft separation standards. This analysis was performed to compare alternative ways of increasing the IFR capacity of both single and parallel runways. Author

N73-23349# Oceanics, Inc., Plainview, N.Y.
WALL INTERFERENCE ON AIRFOILS IN TRANSONIC TUNNELS AT MACH ONE Final Report
Theodore R. Goodman May 1973 50 p refs
(Contract F44620-72-C-0079; AF Proj. 9781)
(AD-757534; AFOSR-73-0492TR; Rept-73-95) Avail: NTIS CSCL 14/2

A new approximate technique for determining the transonic flow about nonlifting airfoils at Mach 1 is introduced. The technique is based on combining the method of local linearization with an integral method. This combined technique is flexible enough to permit analysis of an airfoil in a transonic wind tunnel in order to determine wind tunnel wall interference effects at Mach 1. The results of carrying out such an analysis indicate that the interference will be negligible whenever a particular condition is satisfied-involving the blockage, the ratio of specific heats, the semiheight of the tunnel, and the chord of the airfoil. (Author Modified Abstract) GRA

N73-23350# Naval Postgraduate School, Monterey, Calif.
A NEW FLUID MECHANICS LABORATORY IN THE DEPARTMENT OF AERONAUTICS
Gustave J. Hokenson Jan. 1973 29 p
(AD-756512; NPS-57HW73012A) Avail: NTIS CSCL 14/2

A brief description of four new experimental fluid mechanics facilities in the Naval Postgraduate School, Department of Aeronautics is presented. Each of the facilities was developed with the capability of studying one classical flow situation thoroughly and extended to include a variety of complex secondary effects which are of current interest. Author (GRA)

N73-23351# Wyle Labs., Inc., Huntsville, Ala. Eastern Operations.
ENVIRONMENTAL IMPACT OF NOISE FROM THE PROPOSED ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC) HIGH REYNOLDS NUMBER TUNNEL Final Report, 13 Mar. - 30 Jun. 1972
K. J. Plotkin, J. E. Robertson, and J. A. Cockburn Arnold AF Station, Tenn. AEDC Mar. 1973 183 p refs
(Contract F40600-72-C-0007)
(AD-757552; WR-72-7-Rev; AEDC-TR-72-151-Rev) Avail: NTIS CSCL 14/2

A study to evaluate the environmental impact of the noise produced by a proposed high Reynolds number tunnel (HIRT) under consideration at the Arnold Engineering Development Center (AEDC) has been conducted. The studies include theoretical analyses of the noise generation mechanisms associated with the operation of the facility, and scale-model experiments to provide base-line data for extrapolation to full-scale conditions. This assessment contains all pertinent data of relevance to the noise impact which may be anticipated during HIRT operation and includes a specification of acceptable noise limits for people, animals and buildings which will be exposed to HIRT noise, and special considerations for noise protection and control. (Author Modified Abstract) GRA

N73-23352# ARO, Inc., Arnold Air Force Station, Tenn.
MODEL INDUCTION TEST FACILITY CAPABILITY FOR TESTING TURBOFAN ENGINES Final Report, 6 Jul. 1971 - 30 Jun. 1972
James W. Hale AEDC Mar. 1973 33 p ref Sponsored by AEDC
(AF Proj. 2256; ARO Proj. BE2256)
(AD-757197; ARO-ETF-TR-72-189; AEDC-TR-73-10) Avail: NTIS CSCL 14/2

The objective of this model study was to determine the potential for testing very large thrust, high-bypass-ratio, turbofan engines at conditions simulating flight Mach numbers of 0.4 to 0.6, sea level, by use of a jet pumped air supply system. The simulation of low altitude, subsonic operation of a large, high-bypass-ratio, turbofan engine in ground test facilities requires extremely large airflows. This airflow, even at relatively low pressure, cannot be provided by existing test facilities for engines having thrust levels of 60,000 to 100,000 lbf. The jet pumped air supply is therefore a very attractive potential facility. (Author Modified Abstract) GRA

N73-23353# Army Construction Engineering Research Lab., Champaign, Ill.
AN ANALYSIS OF PICKETT'S SOLUTION TO WESTERGAARD'S EQUATION FOR RIGID PAVEMENTS
A. C. Eberhardt Jan. 1973 12 p refs
(DA Proj. 4A6-64717-D-895)
(AD-755526; CERL-TR-S-14) Avail: NTIS CSCL 01/5

Influence coefficients used by the Corps of Engineers for the development of design curves for rigid airfield pavements have been recomputed and extended to permit an expanded and more accurate analysis of large military aircraft such as the C-5A. Calculations were performed using a digital computer in conjunction with a more refined numerical integration technique. Results are compared with the original influence coefficients, and the impact of the more accurate extended table of influence coefficients is evaluated by employing the new and old influence coefficients to calculate edge stress resulting from several representative aircraft gear loads. It is also demonstrated that further accuracy can be obtained by using a non-linear interpolation scheme derived from a bivarient quadratic regression analysis in place of a linear interpolation procedure to extract intermediate values from the table of influence coefficients. Finally, other areas of research which may possibly lead to improvements in the Corps design procedure for rigid airfield pavements are suggested. Author (GRA)

N73-23355# Army Construction Engineering Research Lab., Champaign, Ill.

INSPECTION OF PAVEMENT GROOVING Technical Report, Dec. 1971 - Jan. 1972

Robert C. Gunkel Kirtland AFB, N. Mex. AFWL Feb. 1973 51 p

(AF Proj. 6111A)

(AD-757208; AFWL-TR-72-149) Avail: NTIS CSCL 01/5

A reinspection of grooved pavements at four commercial and one military airfield was conducted by the Construction Engineering Research Laboratory (CERL) in December 1971 and January 1972. The inspection included grooving in both portland cement concrete (PCC) asphaltic concrete (AC) pavements which had been grooved approximately 4 1/2 years prior to this inspection. Grooves in all PCC pavements were considered to be in excellent condition with no evidence of deterioration on the pavement surface. At one airfield, Kansas City Municipal, numerous surface voids were noted which were due mainly to weathering out of poor quality materials. Many of these surface defects apparently were present at the time of grooving; however, it was apparent that some of the surface defects had developed recently. (Author Modified Abstract) GRA

N73-23356# Army Construction Engineering Research Lab., Champaign, Ill.

A STOCHASTIC NETWORK TO MODEL AIR CARGO TERMINALS

Howard A. Porte, W. W. Happ, C. T. Lee, and L. P. McNamee Feb. 1973 21 p Presented at the Army Sci. Conf., West Point, N. Y., 20-23 Jun. 1972

(AD-757629; CERL-TM-A-7) Avail: NTIS CSCL 01/5

Bottlenecks of the material handling operation of an air cargo terminal are investigated by the stochastic network method of GERT IIIQ. The relationship of the GERTS IIIQ network model to construction specification is discussed. Operations bottlenecks are identified and corrected through modification of facility constraints. (Author Modified Abstract) GRA

N73-23357# Army Construction Engineering Research Lab., Champaign, Ill.

ACTIVITY NETWORKS TO MODEL TRANSPORTATION SYSTEMS SUBJECT TO FACILITY CONSTRAINTS

Howard A. Porte and W. W. Happ Feb. 1973 15 p refs Presented at the 9th Ann Allerton Conf. on Circuit and system Theory, Monticello, Ill., 6-8 Oct. 1971

(DA Proj. 4A6-64717-D-895)

(AD-757628; CERL-TM-A-6) Avail: NTIS CSCL 01/5

Cargo flow through an air cargo terminal is modeled as an activity network by utilizing: deterministic and probabilistic decision-making elements as nodes, activities or branches which relate the nodes and whose characteristics determine the magnitude and delay of commodity flow, and a set of statistical monitors to count events and to perform statistical evaluations at strategic points of the network. Author (GRA)

N73-23359# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

EMPLACEMENT AND MAINTENANCE OF DUST-CONTROL MATERIALS

Moody M. Culpepper Sep. 1972 40 p

(DA Proj. 1G6-64717-D-H01)

(AD-756179; AEWES-Instruction-S-72-3) Avail: NTIS CSCL 01/5

The purpose of the report is to provide guidance for those engineer construction troops or troops of the field Army who will emplace and maintain dust-control materials in conjunction with the construction and maintenance of aircraft and helicopter landing facilities. Author (GRA)

N73-23366# Institut Aerotechnique de Saint-Cyr, Saint-Cyr-l'Ecole (France).

AN EXAMPLE OF THE UTILIZATION OF A FIXED BLOWER TO PERFORATE A WALL WITH VARIABLE GEOMETRY [ON EXEMPLE D'UTILISATION DE SOVFFLERIE MUNIE DE PAROIS PERFOREES A GEOMETRIE VARIABLE]

M. Menard and Jean-Ch. Vayssaire Paris Soc. Natl. Ind. Aerospatiale 1972 45 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972

Avail: NTIS HC $4.25

The effects of corrections to porous walls, with different ventilated configurations, on transport aircraft model performance are analyzed. The application of theoretical calculations to annular corrections for straight wings and horizontal feathering is discussed. Transl. by E.H.W.

N73-23373# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CALCULATIONS OF WALL CORRECTIONS IN TRANSONIC WIND TUNNEL [CALCUL DES CORRECTIONS DE PAROIS EN SOUFFLERIE TRANSSONIQUE]

J. P. Chevallier Soc. Natl. Ind. Aerospatiale 1972 22 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972

Avail: NTIS HC $3.25

Developments and changes in the hypothesis of the classical correction method used to calculate wall effects are briefly recalled, particularly in the case of flow over slotted or perforated walls. Attempts were made to validate results by applying the method to small transonic perturbations. Transl. by E.H.W.

N73-23384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONDITIONS FOR THE EXISTENCE OF A NORMAL SHOCK WAVE IN THE ELEMENTS OF AXIAL SUPERSONIC COMPRESSOR

Yu. N. Vasilev and G. A. Freyman 5 Feb. 1973 28 p Transl. into ENGLISH from Lopatochnye Mash. Struinye App. (Moscow), no. 5, 1971 p 28-44

(AD-756102; FTD-HT-23-1790-72) Avail: NTIS CSCL 13/7

Due to the rise of velocities in the running section of a compressor, of ever increasing interest is the problem dealing with stagnation of supersonic swirling flows in shock waves. In this work, conditions are found for the existence of a normal shock wave in the interblade channels of a rotor and the stator of the axial supersonic stage with a finite number of blades, and equations which permit one to calculate flows satisfying these conditions are given. Author (GRA)

N73-23390# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

APPLICATION OF THE METHOD OF INTEGRAL RELATIONS (MIR) TO TRANSONIC AIRFOIL PROBLEMS. PART 2: INVISCID SUPERCRITICAL FLOW ABOUT LIFTING AIRFOILS WITH EMBEDDED SHOCK WAVE

Tsze C. Tai Jul. 1972 76 p refs

(WR0230201)

(AD-755762; AERO-1176-Pt-2; NSRDC-3424-Pt-2) Avail: NTIS CSCL 20/4

Numerical procedures developed in a previous part of the report for applying the method of integral relations to transonic airfoil problems are extended to lifting cases. A modification enables any desired number of strips and size of integration domain to be used. Full inviscid flow equations are approximated by second-order polynomials in transverse direction in a physical plane. Numerical procedures including iterative processes are formulated for the case of high subsonic free-stream Mach numbers. Cartesian coordinates are employed except near the leading edge region where the use of a body coordinate system is convenient. Results are presented for supercritical flows past various airfoils, including two conventional, one advanced, and two shockless airfoils. Author (GRA)

N73-23397# ARO, Inc., Arnold Air Force Station, Tenn.
UPWASH INTERFERENCE ON A SYMMETRICAL WING IN A RECTANGULAR VENTILATED WALL WIND TUNNEL. PART 1: DEVELOPMENT OF THEORY Final Report, Oct. 1971 - May 1972
E. M. Kraft AEDC Mar. 1973 73 p refs
(AF Proj. 1366; ARO Proj. PW5271)
(AD-757196; ARO-PWT-TR-72-162; AEDC-TR-72-187) Avail: NTIS CSCL 14/2

The wind tunnel boundary upwash interference on a symmetrical finite wing of arbitrary lift distribution is calculated in a rectangular test section with solid vertical walls and ventilated (porous-slotted) horizontal walls. The interference is found by applying linearized theory for a compressible medium at subsonic speed to the boundary value problem. The theory uses an image method in addition to Fourier transforms with an equivalent homogeneous boundary condition on the ventilated wall. A treatment of the far downstream end condition consistent with the Fourier transform method is presented. (Author Modified Abstract) GRA

N73-23403# North American Rockwell Corp., Columbus, Ohio. Aircraft Div.
ANALYSIS OF A PULSING WALL JET Final Report, Mar. - Oct. 1972
John R. Williams, Jack P. Ambrosiani, and William E. Palmer 15 Oct. 1972 108 p refs
(Contract N00014-71-C-0259; NR Proj. 215-182)
(AD-758390; NR72H-325) Avail: NTIS CSCL 20/4

An analysis is presented of the mixing characteristics of steady and intermittent blowing when applied for boundary layer control. The analysis considers blowing tangent to the surface of a flap at deflection angles of 0 deg and 40 deg. It is shown that, relative to the steady jet, mixing with the external stream is increased considerably for the intermittent jet. Author (GRA)

N73-23484# Societe d'Etudes Techniques et d'Entreprises Generales, Leplessis-Robinson (France).
EARTH RESOURCES AIRCRAFT FACILITY. VOLUME 1: PROJECT SUMMARY Final Report [EARTH RESOURCES AIRCRAFT FACILITY. VOLUME 1: SOMMAIRE DE L'ETUDE RAPPORT FINAL]
[1972] 87 p refs In FRENCH 8 Vol.
(Contract ESTEC-1517/EL)
(ESRO-CR(P)-117) Avail: NTIS HC $6.50

Results of a study on the mission planning for a European earth resources survey aircraft are summarized. They include choice of mission, analysis of payload, choice of aircraft, technical feasibility, initial operational program, and juridical aspects of the Earth Resources Aircraft Facility project. ESRO

N73-23540# Technology, Inc., Dayton, Ohio.
EVALUATION OF THE NASA ELECTRONIC STRAIN LEVEL COUNTER AS A FATIGUE DAMAGE MONITOR Final Report, Apr. - Dec. 1972
Larry E. Clev and Sandra K. Buehler Wright-Patterson AFB, Ohio AFFDL Jan. 1973 51 p refs
(Contract F33615-72-C-1249; AF Proj. 1467)
(AD-757210; AFFDL-TR-72-135) Avail: NTIS CSCL 14/2

The NASA Electronic Strain-Level Counter was evaluated by analyzing the data recorded during 26 flights on an A-37B aircraft. The strain-level counter output was compared with data from a collocated strain gage recorded by a digital magnetic tape recorder. Fatigue damages were computed for several hypothetical strain-level counters to determine their suitability as fleet damage monitoring devices. (Author Modified Abstract) GRA

N73-23541# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
ANALYSIS OF DOPPLER VELOCITY SENSOR PERFORMANCE IN PRECIPITATION
David J. Krile Jan. 1973 81 p refs
(AD-757509; ASD-TR-72-78) Avail: NTIS CSCL 01/4

Airborne Doppler velocity sensors obtain measurements of aircraft groundspeed by observing Doppler frequency shifts in beams of microwave energy reflected from the earth. When hydrometeors exist between the aircraft and the earth, some of the received energy is a result of reflections from the hydrometeors. Computer simulations were performed to determine the amount of energy reflected from raindrops with pulsed, CW, and FM/CW Dopplers. Descriptions of the simulations and their results are presented herein. They indicate that significant amounts of energy are received from rain reflections even with moderate rain rates. (Author Modified Abstract) GRA

N73-23542# Oxford Univ. (England). Dept. of Engineering Science.
A DOUBLE-PULSE TORSIONAL HOPKINSON-BAR TECHNIQUE FOR INVESTIGATING STRAIN-RATE EFFECTS Interim Report, Mar. - Oct. 1972
John D. Campbell Wright-Patterson AFB, Ohio AFML Nov. 1972 25 p refs
(Grant AF-AFOSR-2056-71; AF Proj. 7353; AF Proj. 7351)
(AD-757527; OUEL-1036/72; AFML-TR-72-207) Avail: NTIS CSCL 14/2

A brief description is given of an apparatus by means of which a torsional wave can be generated which exhibits a double-step structure. Each step has a rise time of order 40 microseconds, and the time between them is about 150 microseconds; three different bar systems have been built, giving respectively 4.6, 6.5 and 10.0 as the nominal ratio of the amplitude of the second step to that of the first. By means of this apparatus, a short thin-walled tubular specimen can be subjected to a sudden change in strain rate at rates in the range 10 to 500 s to the minus 1 power. The test method is described, and some preliminary results are presented and discussed in order to illustrate the potential and limitations of the technique. Author (GRA)

N73-23546# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
INERTIA MEASURING EQUIPMENT DESIGN STUDY
C. H. Hutchinson 1973 166 p
(Contract AF 33(600)-31919; AF Proj. 8219)
(AD-758398; CAL-IM-1060-F-2) Avail: NTIS CSCL 14/2

A practical method of measuring all moments and products of inertia of aircraft weighing up to 300,000 pounds was devised. Designs and specifications for the required equipment and instrumentation are presented. The measurement technique employs forced oscillation of a large platform upon which the aircraft is rigidly mounted. Forces and moments acting on the aircraft are resolved and summed in an orthogonal coordinate system during oscillation about each of three fixed axes. These data and the time-history of the motion are used to compute the moments and products of inertia. (Author Modified Abstract) GRA

N73-23547# Panametrics, Inc., Waltham, Mass.
ULTRASONIC MASS FLOWMETER FOR ARMY AIRCRAFT ENGINE DIAGNOSTICS Final Technical Report, Jun. 1971 - Aug. 1972
Lawrence C. Lynnworth, Norman E. Pedersen, and Edmund H. Carnevale Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Jan. 1973 116 p refs
(Contract DAAJ02-71-C-0061; DA Proj. 1F1-62203-A-434)
(AD-758462; USAAMRDL-TR-72-66) Avail: NTIS CSCL 14/2

Development is reported on a new type of ultrasonic mass flowmeter for fuel flow in gas turbine engines, consisting of a flow velocimeter, a densitometer, a time intervalometer, and a

metering section containing nonintrusive transducers. The complete system was tested on various liquids at rates up to 5000 lb/hr. It was operated during and recalibrated after 104 hours exposure to a contaminated fluid flowing at approx. 1900 lb/hr. Response time was determined. The flowmeter can operate in laminar, transitional, and turbulent flow, using a special method of weighing the profile. (Author Modified Abstract) GRA

N73-23561# Lord Mfg. Co., Erie, Pa.
ENVIRONMENTAL ENDURANCE TESTING OF AN ELASTOMERIC PITCH CHANGE BEARING Final Report
David L. Myers Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Feb. 1973 115 p ref
(Contract DAAJ02-71-C-0044; DA Proj. 1F1-63204-DB-38)
(AD-758463; PE-158; USAAMRDL-TR-72-73) Avail: NTIS CSCL 13/9

Presented in the report are the results of pre-endurance and environmental endurance testing of the LM-726-1 elastomeric pitch change bearing designed for the all-elastomeric rotor in the AH-1G helicopter. Testing was conducted to form a basis for determining the airworthiness of the bearing in terms of expected reliability and inspection and replacement criteria. (Author Modified Abstract) GRA

N73-23562# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
DEVELOPMENT OF A SILICONE BASE NONFLAMMABLE HYDRAULIC FLUID FOR USE IN CURRENT AND FUTURE MILITARY AIRCRAFT Progress Report
Alfeo A. Conte, Jr. 7 Mar. 1973 47 p refs
(AD-758361; NADC-73055-30) Avail: NTIS CSCL 11/8

A nonflammable hydraulic fluid has been developed based on a chlorinated phenyl methyl silicone fluid. Laboratory results as well as limited hydraulic pump-loop circuit evaluations have demonstrated the unique antiwear properties of this silicone based fluid. In addition, compatibility of the fluid with Buna N elastomer seals has also been established. These results indicate the potential for use of this fluid as a replacement for MIL-H-5606 in current and future military aircraft. Author (GRA)

N73-23599 National Gas Turbine Establishment, Pyestock (England).
THE ENVIRONMENT ENCOUNTERED BY HIGH TEMPERATURE COMPONENTS OF THE AIRCRAFT GAS TURBINE

J. E. Restall *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 11-30 refs

A brief examination is made of the factors governing the behavior of hot components: combustion chamber, nozzle guide vanes, and turbine rotor blades, in aero engines in the absence of a hot-salt corrosion environment. The effects on components in engine trails of controlled additions of salt made to the intake air and fuel are discussed. Author

N73-23600 Societe Nationale d'Etudes et de Construction de Moteurs Aeronautiques, Corbeil (France).
MATERIALS CURRENTLY EMPLOYED IN HIGH TEMPERATURE COMPONENTS OF THE AIRCRAFT GAS TURBINE

M. Brunetaud *In* AGARD High Temp. Corrosion of Aerospace Ailoys Mar. 1973 p 31-42 In FRENCH; ENGLISH summary

General aspects of the high temperature components of the gas turbine are briefly reviewed, along with mechanical and chemical properties required of materials. Commercial nickel and cobalt base superalloys are reviewed in terms of their 1000-hour rupture strengths, together with some experimental alloys currently being developed. This last group includes powder metallurgy alloys, directionally solidified alloys, and alloys based on the refractory metals. Hot corrosion resistant superalloys contain high chromium contents, at the expense of high temperature strength. Designers are currently attempting to develop an intermediate group of high strength alloys with acceptable corrosion resistance complemented by aluminium-based diffusion coatings. Author

N73-23614 Nancy Univ. (France).
WHAT ARE THE PROSPECTS FOR THE SUCCESSFUL APPLICATION OF COATED REFRACTORY METALS IN UNCOOLED TURBINES? [QUEL EST L'AVENIR DES ALLIAGES REFRACTAIRES PROTEGES DANS LA CONSTRUCTION DES TURBOMACHINES?]
B. Roques *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 269-282 refs In FRENCH; ENGLISH summary

Various protective coatings are investigated to determine the most effective application for refractory metal alloys used in the structural makeup of turbine engines. The results indicated that coatings based on SiO2 and Al2O3 constitute foundations from which improved protective oxides may be developed. J.M.M.

N73-23620# Solar, San Diego, Calif.
TUNGSTEN FIBER REINFORCED OXIDATION RESISTANT COLUMBIUM ALLOYS Final Report, 9 Dec. 1971 - 9 Feb. 1973
Mark J. Klein and Arthur G. Metcalfe Feb. 1973 63 p refs
(Contract N00019-72-C-0230)
(AD-757380; RDR-1727-4) Avail: NTIS CSCL 11/4

High-strength, oxidation-resistant composites were developed for use in turbine engines at 2000F. A composite system with columbium alloy matrices and tungsten filaments was selected and evaluated for oxidation resistance and mechanical properties. These composites were intended for use in the coated condition with the oxidation-resistant matrix providing fail-safe protection. The coated composite with 27 volume percent reinforcement had excellent stress-rupture strength (100-hour rupture strength of 25 ksi at 2200F), elevated-temperature strength (33 ksi at 2600F), and isothermal-oxidation life (>1100 hours at 2000F). However, both the fail-safe life(e.g., 50 one-hour cycles at 2000F) varied with the composition of the matrix. With continued work, it should be possible to tailor the properties of this composite system so that desired properties can be optimized for specific high-temperature applications. Author (GRA)

N73-23634# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
CONSTRUCTION OF FIBROUS REINFORCED CONCRETE OVERLAY TEST SLABS, TAMPA INTERNATIONAL AIRPORT, FLORIDA Interim Report
Frazier Parker, Jr. Oct. 1972 74 p refs
(Contract DOT-FA71WAI-218)
(FAA-RD-72-119) Avail: NTIS HC $5.75

The planning and construction of two fibrous reinforced concrete overlay test sections at TIA are described. The test sections included 4- and 6-in.-thick overlays located on a currently used parallel taxiway to one of the primary N - S runways. The test sections were inspected after about one month's traffic, and the condition of the overlays is described. Conclusions based on the construction of the test section indicate that fibrous reinforced concrete can be produced in a central mix plant and placed with a slip-form paver. Procedures and equipment for bulk handling of the fibers will have to be developed. Author

N73-23636# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugzeugbau.
STRENGTH INCREASE OF HEAT-RESISTANT METAL-TO-METAL BONDED JOINTS BY COMBINING TWO ADHESIVES (ADHESIVE COMBINATION JOINT). [FESTIGKEITSSTEIGERUNG VON WAERMEBESTAENDIGEN METAL-

LKLEBUNGEN MIT HILFE VON KLEBSCHICHTEN AUS ZWEI KLEBSTOFFEN (KOMBINATIONSKLEBUNG)]
Walter Althof 1973 70 p refs
(DLR-FB-73-22) Avail: NTIS HC $6.00; DFVLR, Porz, West Ger. 16 DM

The lap shear strength of a high temperature adhesive bonded joint is increased by an additional adhesive, which is more ductile than the high temperature adhesive. The magnitude of the strength increase and the corresponding parameters are investigated experimentally at room and elevated temperatures by static and fatigue tests. The joints consisted of aluminum and titanium adherents with various aircraft structural adhesives. The measurement of the shear stress distribution in lap joints showed the reason for the strength increase. Author (ESRO)

N73-23643# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
TEST AND EVALUATION OF DOUBLE BRAIDED NYLON ROPE EXTRACTION LINES Final Technical Report, Dec. 1967 - Jan. 1972
Lawrence E. Fielding Dec. 1972 71 p refs
(AF Proj. 411A; AF Proj. 410A)
(AD-757209; ASD-TR-72-80) Avail: NTIS CSCL 11/5

The current technique of using multiple layers of flat nylon webbing for construction of extraction lines has proven to require considerable detail to fabricate, is unwieldy in large sizes, and does not have a long service life. Multiple layered extraction lines when bent over connecting hardware pins fail to achieve uniform loading throughout the plies. Therefore, additional plies are needed to compensate for the strength loss. These deficiencies have promoted an investigation into using commercially available nylon double braided rope as extraction lines. This report describes the various tests performed on the nylon rope which project some operational advantages and indicate suitability of the nylon double braided rope extraction line. (Author Modified Abstract) GRA

N73-23677# Eastern Air Lines, Inc., Miami, Fla. Engineering Dept.
AN INVESTIGATION OF A VERTICALLY SCANNING INFRARED RADIOMETER AS A CLEAR AIR TURBULENCE WARNING SYSTEM Final Report, 1 Oct. 1971 - 31 Oct. 1972
Dale N. Jones Dec. 1972 105 p refs
(Contract F19628-72-C-0086; AF Proj. 6670)
(AD-757501; AFCRL-72-0729) Avail: NTIS CSCL 04/2

Over 350 flight hours were flown on a specially instrumented DC8-61 in regular passenger-carrying service. The aircraft was instrumented with an Infrared Clear Air Turbulence stabilized remote-temperature sensor and a digital recording system. All flights were accomplished with specially trained research observers occupying a cockpit jump-seat making detailed records of atmospheric conditions and significant events. Approximately 200 hours of cruise-level recordings were obtained and analyzed. It was found that all clear air turbulence encountered during cruise-level flight was associated with measurable horizontal temperature gradients. On the other hand, only half of the observed temperature changes were associated with vertical accelerations of -0.1 g or greater. The flight records contain meager evidence that clear air turbulence severity may be associated with the magnitude of horizontal temperature change. (Author Modified Abstract) GRA

N73-23679# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ON THE OPERATION VALUE OF TERMINAL WEATHER FORECASTS
C. N. Touart 12 Dec. 1972 13 p
(AF Proj. 8628)
(AD-757489; AFCRL-AFSIG-252; AFCRL-72-0719) Avail: NTIS CSCL 04/2

Real forecast verifications are used to test a Wx-85 conclusion based on synthetic data: namely, that where the climatic frequency of closed terminal weather is as low as found typically in the CONUS, then the present level of forecasting skill for periods of 3 hours or more is of negative value to aircraft operations. The new results confirm the previous conclusion for longer periods but suggest that it is unduly pessimistic with respect to the 3-hour forecast. Author (GRA)

N73-23686*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE 4-D GUIDANCE OF STOL AIRCRAFT IN THE TERMINAL AREA
Thomas Pecsvaradi and Heinz Erzberger Oct. 1972 41 p refs
(NASA-TM-X-62234) Avail: NTIS HC $4.25 CSCL 17G

Advanced STOL aircraft for the improvement of the nation's air transportation system by the elimination of delays and congestions associated with today's air travel are discussed. A new guidance technique, referred to as 4-D guidance, is being developed for STOL aircraft. The 4-D guidance technique synthesizes complex three-dimensional flight paths from a minimum set of input and files the aircraft along the paths according to a prespecified time schedule. The two major elements of a 4-D guidance system are the trajectory synthesizer and the control law. Inputs to the trajectory synthesizer are the three-dimensional coordinates of way points, the turning radii, the speed ranges, the acceleration limits, and the arrival times at time control way points. First, the three-dimensional trajectory is computed by using circular arcs and straight lines. Then the airspeed profile, compensated for wind, is calculated to achieve the desired arrival times. The synthesized trajectory is stored as a time sequence of reference states which the aircraft is forced to track by using a linear feedback law. Author

N73-23687# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AN INVESTIGATION OF ATC PROCEDURES FOR IFR APPROACHES TO TRIPLE PARALLEL RUNWAYS Final Report, Dec. 1972 - Jan. 1973
William Crimbring and G. Errol Porter May 1973 20 p
(FAA Proj. 142-177-030)
(FAA-NA-73-23; FAA-RD-73-37) Avail: NTIS HC $3.00

Air traffic control (ATC) procedures applicable to the conduct of simultaneous instrument flight rules (IFR) approaches to a set of three parallel runways were investigated. A dynamic simulation was conducted to examine the various aspects of such an operation, including ATC procedures, monitoring requirements, general controller workload limits, and a comparison of the effect of greater and lesser percentages of Mode C-equipped aircraft on monitoring procedures. Results show that the concept of conducting simultaneous instrument approaches to a set of triple parallel runways is feasible using standard ATC procedures and separation standards (except on the final approach course). Author

N73-23688# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: NAVIGATION
4 Jun. 1973 55 p
(FAA-ED-04-1) Avail: NTIS HC $4.75

The development of CONUS and Oceanic Navigation Systems necessary for projected traffic loads into the 1980's is discussed. Program goals, approach, development activities, and expected results are presented. The program is based on the continuing role of VORTAC as the primary means of navigation in the airways system into the 1980's. Concurrently programs have been established to determine the feasibility for adoption of VLF systems, such as Omega, for aviation users in both oceanic and continental applications. Author

N73-23689# Advisory Group for Aerospace Research and Development, Paris (France).
AIR TRAFFIC CONTROL SYSTEMS
Apr. 1973 371 p refs In ENGLISH and FRENCH Presented

at the 14th Meeting of the Guidance and Control Panel of AGARD, Edinburgh, 26-29 Jun. 1972
(AGARD-CP-105) Avail: NTIS HC $20.75

The proceedings of a conference on air traffic control developments and procedures are presented. The subjects discussed involve the following: (1) control concepts; (2) automation; (3) area and enroute navigation; (4) terminal navigation and control; (5) landing guidance; (6) surveillance; (7)communications; (8) collision avoidance; and (9) integrated communication, navigation, and identification system.

N73-23690 Electronic Systems Div., Bedford, Mass.
STATUS AND TRENDS IN MILITARY AIR TRAFFIC CONTROL SYSTEMS
Albert R. Shiely, Jr. *In* AGARD Air Traffic Control Systems Apr. 1973 3 p

The status and trends in military air traffic control systems are discussed. The air navigation facilities operated by U.S. Military Forces are described. The mission of the Air Defense Control System is explained. The development of automated air control systems, airborne search radar, and integrated communication, navigation, and identification systems is reported. Author

N73-23691 Eurocontrol Agency, Brussels (Belgium).
AIR TRAFFIC CONTROL IN THE EUROCONTROL AREA
G. H. Trow *In* AGARD Air Traffic Control Systems Apr. 1973 18 p

The organization and operation of the Eurocontrol area air traffic control system are discussed. The member nations comprising the organization are identified. The accomplishments of the organization are presented. The problems peculiar to European flights because of national sovereignty are analyzed. The development of an improved system of air traffic control is reported. Maps of the Eurocontrol area of operation are included. Author

N73-23692 Wilcox Electric Co., Inc., Kansas City, Mo.
DECISIONS FOR THE 70'S
Robert J. Shank *In* AGARD Air Traffic Control Systems Apr. 1973 15 p

The nature of the air traffic control system and procedures during the 1970's are almost completely determined by decisions made during the past twenty years. A brief review of this already-determined baseline system and its operation is included, and a set of objectives for the future and guiding principles will provide a background for the major decisions now confronting the world air traffic control community. The important proposed changes or improvements in the areas of surveillance, navigation, communications, collision avoidance, and instrument landing are examined, and the major issues for decision are proposed. Author

N73-23693 National Aerospace Lab., Amsterdam (Netherlands).
ATC AUTOMATION, PRESENT AND FUTURE
C. G. H. Scholten *In* AGARD Air Traffic Control Systems Apr. 1973 5 p refs

A number of design principles in which future air traffic control systems should differ from present systems in order to cope with increased air traffic demands are discussed. The principles are that available air space and airports should be used in as flexible a manner as possible by using computers and that improved data links between ground and air will be required for pilot-computer communication. The need for a back up system in the event of complete computer failure to allow controllers to clear existing traffic safely is proposed. Author

N73-23694 IBM Italia, Rome.
AUTOMATION OF AIR TRAFFIC CONTROL IN ITALY, ROME CONTROL AREA
Camillo Martucci and Bruno Tincani *In* AGARD Air Traffic Control Systems Apr. 1973 10 p

The physical structure and operative unit organization of the Rome, Italy air traffic control system are discussed. The automation of the system is described to include the functions and capabilities. The phases in which the automated system is being implemented are reported. Diagrams of the system components and network to show the operation of the system are provided. Author

N73-23695 Centre d'Experimentation de la Navigation Aerienne, Orly (France).
THE SAVVAN: MEANS FOR INSPECTION BY VOR AND DME [LE SAVVAN, MOYEN D'INSPECTION DES VOR ET DES DME]
Gilbert Montel *In* AGARD Air Traffic Control Systems Apr. 1973 11 p In FRENCH

An evaluation is presented of the effectiveness of the SAVVAN (automatic system for vertification of navigation aids in flight) in locating and controlling high altitude aircraft. The system responds to signals from VOR and DME onboard the aircraft. Signals are registered on a magnetic band where they are processed according to a pre-established computer program. Along with the magnetic band, the system has logic elements and 12 receivers. Transl. by E.H.W.

N73-23696 Federal Aviation Administration, Washington, D.C.
STATUS AND TRENDS IN CIVIL AIR TRAFFIC CONTROL SYSTEMS
Gustav E. Lundquist *In* AGARD Air Traffic Control Systems Apr. 1973 5 p

The status and trends on civil air traffic control systems are discussed. The use of automation programs to increase air traffic control safety by providing the air traffic controller with better information on which to base decisions is examined. The development of a network of computers, displays, and communications which will process, store, and distribute instrument flight rules is reported. The operation of the system is described by illustrations and block diagrams. Author

N73-23697 Singer-Kearfott, Fairfield, N.J.
AREA NAVIGATION: COST VERSUS OPERATIONAL BENEFITS
Jefferson Z. Amacker *In* AGARD Air Traffic Control Systems Apr. 1973 9 p refs

Cost, complexity, and cockpit workload were compared for seven potential area navigation system configurations. Cockpit workload was found to be minimum for the very simple and most sophisticated systems. However, the sensitivity of the cost parameter is such that it increases dramatically with system complexity with relatively little gain in operational benefit. A detailed study of the Mark 1, Mark 13, and ATA Operations Committee requirements document discerned that almost all required operational functions could be accomplished with minimum systems. Author

N73-23698 Litton Systems, Inc., Woodland Hills, Calif. Aero Products Div.
AIRBORNE AREA NAVIGATION EQUIPMENT
C. S. Bridge and R. J. Holm *In* AGARD Air Traffic Control Systems Apr. 1973 13 p

A broad base of area navigation equipment, manufacturers and users exists. Types of equipment extend from simple adaptation of VOR to triple inertial systems with multiple radio position inputs and digital computer processing. Air transport equipment is grouped into Mark I, Mark II and Mark 13 systems which are described. Area navigation systems are based upon, or augmented by, air data, VOR, Doppler, inertial, Loran A/C,

Omega, and satellite. Demonstrations and performance in recent flight tests show state-of-the-art for area navigation systems with consideration of projected requirements. Examples of enroute navigation, vertical navigation, terminal area and landing are shown. Controls, pictorial displays, automatic data entry and data link are discussed. Author

N73-23699 Systems Control, Inc., Palo Alto, Calif.
AN ATC/SURVEILLANCE MODELING APPROACH FOR SPECIFYING LANE SEPARATION STANDARDS
J. S. Tyler, D. E. Stepner, and J. A. Sorensen *In* AGARD Air Traffic Control Systems Apr. 1973 12 p refs

(Contract DOT-TSC-260)

The reduction in separation standards for both domestic and oceanic air routes because of increased travel demand is discussed. The overall problem of relating lane separations to safety for different navigation systems, surveillance systems, and air traffic control procedures are considered. A model is described which has the same general input/output format as the Reich model that has been used for specifying North Atlantic route separations. Numerical results are presented to show the impact of inertial navigation systems and satellite surveillance on the separation standards and safety for the North Atlantic route structure. Author

N73-23700 Aerospace Systems, Inc., Burlington, Mass.
ANALYSIS OF TERMINAL ATC SYSTEM OPERATIONS
Richard B. Noll, John Zvara, and Robert W. Simpson (MIT) *In* AGARD Air Traffic Control Systems Apr. 1973 15 p refs

(Contract DOT-TSC-103)

The effects of automation in terminal air traffic control are analyzed with respect to the impact of the automation on the controller. The present air traffic control system based on radar information and manual techniques is discussed and compared with an advanced system which uses a computer to generate alphanumeric radar displays and automated features. A typical control operation is presented to demonstrate controller activity in both the present and an advanced system. ARTS I is used to represent the advanced air traffic control system. The principal features of ARTS I are described and the interface of the controller with the computer and the display equipment is discussed. Author

N73-23701* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTIC STUDY OF NEAR TERMINAL AREA OPTIMAL SEQUENCING AND FLOW CONTROL TECHNIQUES
Stephen K. Park, Terry A. Straeter, and John E. Hogge *In* AGARD Air Traffic Control Systems Apr. 1973 18 p refs

Optimal flow control and sequencing of air traffic operations in the near terminal area are discussed. The near terminal area model is based on the assumptions that the aircraft enter the terminal area along precisely controlled approach paths and that the aircraft are segregated according to their near terminal area performance. Mathematical models are developed to support the optimal path generation, sequencing, and conflict resolution problems Author

N73-23702 Air Line Pilots Association, International, Washington, D.C.
A REAL WORLD SITUATION DISPLAY FOR ALL WEATHER LANDING
J. L. DeCelles, E. J. Burke, and Ken Burroughs *In* AGARD Air Traffic Control Systems Apr. 1973 9 p

A flight data display for use in aircraft approach and landing under all conditions of visibility is described. The device provides airborne self-contained glide path guidance for use in visual flight conditions. In its most sophisticated form it provides total information for manual landing, or monitoring automatic landing and roll-out during reduced visibility. It is stated that the heads-up display symbology similar to that described is urgently required for see-to-land approaches and will be essential for pilot acceptance of automatic landings in actual nonvisual conditions. Author

N73-23703 Royal Aircraft Establishment, Bedford (England). Blind Landing Experimental Unit.
THE INFLUENCE OF THE FUTURE LANDING GUIDANCE SYSTEM ON INTEGRATION OF SHORT TAKE-OFF AND LANDING AND CONVENTIONAL AIR TRAFFIC AT A MAJOR AIRPORT
Nigel H. Hughes *In* AGARD Air Traffic Control Systems Apr. 1973 17 p refs

Some of the benefits to air traffic control which may result from deploying landing guidance systems are identified. The characteristics of short takeoff and landing aircraft intercept of the instrument landing system localizer and final approach path are studied and the final approach geometry is established. STOL approach sequencing requirements are defined and sequencing geometry suggested. The ability of nonvisual approach and landing guidance systems to ease air traffic control problems is discussed. Avionics developments which are required to allow aircraft to take advantage of future landing guidance systems are described. Author

N73-23704 Army Electronics Command, Fort Monmouth, N.J.
US ARMY AIR TRAFFIC MANAGEMENT NOW THROUGH 1980
Charles Grossman and Thomas E. Daniels *In* AGARD Air Traffic Control Systems Apr. 1973 11 p

The requirements of an air traffic management system which will be capable of providing for the safe operation of large numbers of aircraft under instrument meteorological conditions (IMC), and thus afford the commander maximum utilization of his combat capability within reasonable constraints of money and equipment, a totally integrated ground and airborne system, are discussed. The requirements are based upon the assumption that the Army will continue to exploit and expand the air mobility concept in the future. In order to accrue the maximum benefits from such a concept the field commander must be afforded the means to effectively use his aircraft with minimum constraints. The absence of such a system currently precludes effective field exploitation of Army aircraft under adverse weather and visibility conditions, and furthermore precludes the onset of operations until weather predictions give reasonable assurance of resupply/evacuation. Author

N73-23705 Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
FUNCTIONAL DESIGN OF MICROWAVE LANDING SYSTEM (MLS) AIRBORNE EQUIPMENT AS INFLUENCED BY GROUND EQUIPMENT CONFIGURATION AND AIRCRAFT TYPE
Donald N. Carlson and Charles L. Seacord *In* AGARD Air Traffic Control Systems Apr. 1973 10 p refs

A description of a proposed microwave landing system (MLS) is presented, with particular emphasis on the functional design requirements of the airborne equipment. This system has the potential of meeting the expanded, more precise, and more complex needs generated by a growing aircraft population consisting of both conventional and unconventional (V/STOL) types. A modular approach to both ground and airborne equipment is identified as a means of achieving desired flexibility and low cost required for a truly universal system serving the full spectrum of user aircraft and aircraft types. Elements of the ground system are identified and their influence on the nature of the transmitted signal is described. Author

N73-23706 ITT Gilfillan, Inc., Van Nuys, Calif.
THE PERFORMANCE OF THE DOPPLER MICROWAVE LANDING SYSTEM IN A MULTIPATH ENVIRONMENT
R. A. Rosien and L. L. Sanders *In* AGARD Air Traffic Control Systems Apr. 1973 9 p

The success of the Doppler microwave landing system in meeting the multipath challenge is described. Techniques, which can be used to eliminate the effects of multipath are described. The various multipath sources are listed together with the specific requirements for each. Performance data is given which has been gathered from three sources: (1) computer simulation; (2) laboratory tests of an equipment model; and (3) field tests on two experimental Doppler systems. The data indicates that the Doppler MLS, utilizing the simplest form of signal processing, namely, a filter and zero crossing counter, may be adequate under limited accuracy and siting conditions. For performance in heavy multipath, some form of narrowband device will probably have to be employed in order to satisfy the accuracy and minimum coverage angle requirements. Author

N73-23707 Informasjonskontroll A/S, Asker (Norway).
LANDING GUIDANCE SYSTEM: HERMES
Nils Holme *In* AGARD Air Traffic Control Systems Apr. 1973 8 p

The basic principles of the landing guidance system Hermes are described. The system is based on the establishment and detection of a coded pattern of gamma radiation from radioactive sources. This principle offers a remarkable combination of high accuracy, extreme reliability and low cost, especially when applied to the final approach and runway for conventional/short takeoff and landing operations. The ground installation is purely mechanical, with no moving parts. All information is air-derived. Author

N73-23708 Royal Aircraft Establishment, Farnborough (England). Radio Dept.
A FORWARD AREA HOMING AND LANDING GUIDANCE CONCEPT FOR MILITARY AIRCRAFT
Ian M. Hunter *In* AGARD Air Traffic Control Systems Apr. 1973 8 p

The characteristics of a forward area homing and landing guidance concept for military aircraft are discussed. The relative advantages of air-derived and ground-derived concepts are compared. It is concluded that a pure air-derived system cannot meet the military requirements. The development of a hybrid solution is proposed. Author

N73-23709 Aerospace Corp., Los Angeles, Calif. Development Planning Div.
THE POTENTIAL OF A SYSTEM OF SATELLITES AS A PART OF AN AIR TRAFFIC CONTROL SYSTEM
P. M. Diamond *In* AGARD Air Traffic Control Systems Apr. 1973 17 p

The air traffic control (ATC) performance potential of satellite systems utilized in a data acquisition and communications role within a continental United States (CONUS) ATC system is discussed. The unique properties of satellite-based relays provide the only viable means of achieving complete coverage to ground level of the entire airspace, coupled with uniform and highly accurate surveillance position fixing. Position determination, identification, flow control, and collision avoidance functions can be implemented through the use of regional centralization of ground computation, resulting in important benefits to the utilization of the airspace and adaptability of the ATC system. It is shown that the concept of intermittent positive control (IPC) requires aircraft speed/acceleration restrictions and leads to the requirement for surveillance accuracies of 100 to 200 ft within the densely populated regions of airspace expected in the 1980s. A class of satellite systems is described which offers the requisite performance for both commercial carriers and general aviation with low anticipated costs of aircraft equipment. Author

N73-23710 Service Technique de la Navigation Aerienne, Paris (France).
TAM-TAM SYSTEM [SYSTEME TAM-TAM]
Jacques Louet *In* AGARD Air Traffic Control Systems Apr. 1973 11 p In FRENCH

The TAM-TAM (automatic transmission of messages of air traffic by multiplex) system as a possible data link in air-ground-air transmission during oceanic, continental, and terminal control area flight, is discussed. Problems encountered and solutions to those problems are included. Transl. by E.H.W.

N73-23711 Mitre Corp., Bedford, Mass.
DERIVATION OF A WIDE AREA POSITION LOCATION CAPABILITY USING A SYNCHRONIZED TIME DIVISION, MULTIPLE ACCESS COMMUNICATION SYSTEM
Victor A. DeMarines and R. L. Thompson (ESD) *In* AGARD Air Traffic Control Systems Apr. 1973 10 p ref

A concept for the use of a high bandwidth time division communications system to provide a ground based, wide area, position location system is presented. General principles upon which the system is based and a discussion of computational techniques employed are covered. A discussion of system behavior as a function of systematic and random errors caused by individual element position uncertainty and geometric effects is included. Control mechanisms required to produce stable and reliable performance are also described. Results of a computer simulation are presented to provide estimates of capability under various conditions and to establish the system performance envelope. Author

N73-23712 Radio Corp. of America, Van Nuys, Calif. Electromagnetic and Aviation Systems Div.
SECANT: A SOLUTION TO THE PROBLEM OF MID-AIR COLLISIONS
J. L. Parsons *In* AGARD Air Traffic Control Systems Apr. 1973 11 p ref

The principal characteristics of SECANT, a system for the separation and control of aircraft using non-synchronous Techniques, are described. This cooperative, transponding collision-avoidance system, designed to be compatible within the entire aviation community, is capable of accommodating the dense air traffic anticipated for the 1980s and beyond. It makes available to the pilot evasion or escape maneuvers in any direction - vertical, horizontal, or a combination. SECANT helps the pilot to avoid mid-air collisions by transmitting probes and receiving replies with a 1 microsecond pulse at 1000 pulses per second on 24 different frequencies. Various discriminants are used to eliminate undesired signals, and the false alarm rate is near zero. Author

N73-23713 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A FRENCH COLLISION: AVOIDANCE SYSTEMS OF TIME-FREQUENCY TYPE. CRITICAL ANALYSIS OF TEST RESULTS
Roland Moreau *In* AGARD Air Traffic Control Systems Apr. 1973 9 p refs In FRENCH; ENGLISH summary

Performance tests of a system for air traffic control and collision avoidance are discussed. The system is described and the method of operation is outlined. The precision obtained is analyzed and compared with established standards. Modifications of the signal format are examined. Problems raised by the introduction of the new air traffic control system are reported. Author

N73-23714 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HUMAN FACTORS PROBLEMS IN CONFLICT DETECTION AND RESOLUTION
V. D. Hopkin IN AGARD Air Traffic Control Systems Apr.

1973 6 p ref

Conflict detection and resolution as human factors problems in air traffic control are discussed. It is contended that this assumption is probably incorrect, primarily because of the large differences in urgency, information, procedures and facilities in various phases of flight. The controller's responses depend on the confidence he has in the data available to him, and on his knowledge of how accurate it is likely to be. Automated aids may not be properly used if they include no indication of the accuracy, quality and comprehensiveness of the data on which automated computations are being made. Relevant research methods for human factors studies on conflict detection and resolution are indicated. Author

N73-23715 Ferranti, Ltd., Bracknell (England). Digital Systems Div.

PROBLEMS INVOLVED IN ATC AUTOMATION

David L. Stoddart *In* AGARD Air Traffic Control Systems Apr. 1973 11 p

The two major problems involved in A.T.C. automation, suitable man-machine interfaces and system reliability, are considered. These problems are placed in perspective by examining the need for automation and by considering the information required by the controller, and how this should be displayed. Suggested man-machine interfaces are examined, including synthetic plan displays, tabular displays, touchwires, keyboards, rolling balls and light pens. The operational and technical advantages and disadvantages of these devices are discussed. The problem of reliability is introduced and the need for fail safe systems explained. Various methods of achieving reliability are considered, including triplicated hardware, and systems having preferred and reconfigured functional organization. The implications of these systems are discussed and a system design suggested. Author

N73-23716 Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

THE MAN-COMPUTER INTERFACE PROBLEM IN TERMINAL AUTOMATION

Leslie Innes *In* AGARD Air Traffic Control Systems Apr. 1973 5 p refs

The main concern in the several large air traffic control automation programs which have been implemented has been the provision of information to the controller in a more accurate and more easily assimilable form. The aim was, if not to reduce the controller's workload, to at least keep it within acceptable limits. Experience with these systems to date is reviewed, and the conclusion reached that in few instances has this aim been achieved. Without adequate isolation of the controller from the requirement to continually interact with the computer, workload is inevitably increased to an unacceptable degree, due to the additional tasks imposed on the controller by the demands of the automated aspects of the system. The development of the Canadian Forces automated terminal control concept involved evaluation of several methods of simplified man-computer interaction, carried out within constraints imposed by limited available manpower in the controller trade, and limited funding for the program. A solution has been developed which appears to adequately act as a compromise between these conflicting requirements. Author

N73-23717 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

INTEGRATION OF COMMUNICATION FUNCTIONS, NAVIGATION, IDENTIFICATION, AND TRAFFIC CONTROL [INTEGRATION DES FONCTIONS DE COMMUNICATION, DE NAVIGATION, D'IDENTIFICATION ET DE CONTROLE DE TRAFIC]

Lj. Milosevic and P. Mollie (Service Tech. des Telecomm. de l'Air) *In* AGARD Air Traffic Control Systems Apr. 1973 11 p In FRENCH

The economic aspects of replacing separate aircraft landing and anticollision equipment with an integrated time-frequency system are discussed in detail. A comparison was also made of the relative cost value of replacing equipment mounted on the aircraft. Transl. by E.H.W.

N73-23718 Department of Transportation, Washington, D.C.

SATELLITE CONSIDERATIONS IN FUTURE AIR TRAFFIC CONTROL SYSTEMS

D. E. Findley *In* AGARD Air Traffic Control Systems Apr. 1973 9 p

A program for improving the air traffic control system of the United States is discussed. The program is involved with deployment and implementation of major improvements for certain enroute and terminal area air traffic control functions. Development efforts are proposed for the following subjects: (1) traffic surveillance; (2) conflict prediction; (3) resolution and avoidance; (4) landing guidance; and (5) automation of air traffic control functions. The background for the formulation of a concept of the air traffic control system for the 1980 time period and beyond is considered. Emphasis is placed on the use of artificial satellites to meet the air traffic demands. Author

N73-23719 TRW Systems Group, Redondo Beach, Calif.

CONCEPTUAL ANALYSIS OF ICNI SYSTEMS

J. H. Craigie *In* AGARD Air Traffic Control Systems Apr. 1973 7 p refs

The development of an improved communications, navigation, and identification (ICNI) system for command and control, air traffic control, and mission execution is discussed. The program is mainly directed toward the requirements of four major Air Force Commands. The special requirements for each type of Air Force mission are analyzed to show the variations required in the proposed system. Author

N73-23720 Mitre Corp., Bedford, Mass.

A PRACTICAL DESIGN OF AN ICNI SYSTEM

C. Eric Ellingson *In* AGARD Air Traffic Control Systems Apr. 1973 14 p

The key factors which have resulted in the proliferation of communications, navigation, and identification equipment in aircraft are discussed. The advantages of interconnective communications capability and common position location capability in reducing complexity of the system while improving operational capability are examined. A specific candidate communication system is proposed and its capabilities are analyzed. Author

N73-23721 Office of the Secretary of Defense (Research and Engineering), Washington, D.C.

INTEGRITY OF ICNI SYSTEMS

Robert Lyle Linden *In* AGARD Air Traffic Control Systems Apr. 1973 3 p

An analysis of integrated communications, navigation, and identification systems for aircraft operation is presented. Advances in electronics, solid state devices, logic circuits, and discrete function modules are described to show application to systems integration. The anticipated improvements in operational capability through system integration are analyzed. Author

N73-23743# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

INVESTIGATION OF JET NOISE USING OPTICAL HOLOGRAPHY Interim Report, Mar. 1971 - Mar. 1972

Richard F. Salant Jun. 1972 66 p refs

(Contract DOT-TSC-146)

(PB-214112/5; DOT-TSC-146-1) Avail: NTIS HC $3.00 CSCL 20A

Holographic interferograms have been made of a cold, laboratory scale, supersonic jet in the Mach number range of

2.1 to 3.4. These holograms demonstrate that the acoustic field in the vincinity of such a jet is dominated by mach waves, each of which can be traced back to a generating disturbance within the jet. The Mach waves are generated from an axial position slightly downstream of the nozzle exit to a position near the tip of the potential core. Measurements of mach angle indicate that the average convection velocity of the generating disturbances is approximately 90 percent of the jet velocity. The disturbances appear to be coherent instabilities rather than turbulent eddies, and extend into the potential core.
Author (GRA)

N73-23802*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF FINENESS RATIO ON BOATTAIL DRAG OF CIRCULAR-ARC AFTERBODIES HAVING CLOSURE RATIOS OF 0.50 WITH JET EXHAUST AT MACH NUMBERS UP TO 1.30
David E. Reubush and Jack F. Runckel Washington May 1973 94 p *refs*
(NASA-TN-D-7192; L-8705) Avail: NTIS HC $3.00 CSCL 01A

An investigation was conducted to determine the effect of fineness ratio on the drag of circular-arc boattails at subsonic and low supersonic speeds. The boattails had closure ratios of 0.50 and incorporated convergent nozzles. The investigation was conducted statically and at Mach numbers from 0.40 to 1.30 at 0 deg angle of attack with jet total-pressure ratios varying from jet off to about 6, depending on Mach number. Low-fineness-ratio boattails had large separated-flow regions and the highest drag at all Mach numbers. Subsonic pressure-plus-friction drag levels were generally similar for boattails which did not have large separated regions. Drag-rise Mach number increased as boattail fineness ratio increased. Author

N73-23803*# Kanner (Leo) Associates, Redwood City, Calif.
CONTRIBUTION TO THE SELECTION OF THE PARAMETERS OF THE THERMODYNAMIC CYCLE IN DOUBLE FLOW TURBOJETS
Mario Albin and Massimo Feola Washington NASA May 1973 45 p refs Transl. into ENGLISH from the 27th Congr. Natl. ATI, Naples, 27-29 Sep. 1972 35 p
(Contract NASw-2481)
(NASA-TT-F-14904) Avail: NTIS HC $4.25 CSCL 21E

Double flow turbojet propulsion is discussed in terms of secondary flow capacity. The two most characteristic elements of this process are the ratios of compression and bypass of the fan. Studies are presented which show that as the bypass ratio improves global thermopropulsive efficiency it simulataneously lowers the specific thrust. Thus, in order to attain the necessary thrust, a considerable increase in the dimensions of the secondary flow (fan) is required. It is found to be possible, by manipulating the compression ratio and the temperature, to improve efficiency without appreciably reducing specific thrust. Author

N73-23805# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL DETERMINATION OF TURNING ANGLE AND LOSSES OF AXIAL COMPRESSOR INLET GUIDE VANES M.S. Thesis
William Richard Wheeler Dec. 1972 48 p *refs*
(AD-757250) Avail: NTIS CSCL 21/5

The investigation experimentally determined the minimum loss incidence angle, deviation angle, and total-pressure loss coefficient for a cascade with airfoil-type blade profiles used as inlet guide vanes for an axial-flow compressor with an equivalent camber angle of 37.6 degrees and unit solidity. The experimental values were compared with values predicted using correlations based on compressor cascade tests. Author (GRA)

N73-23806# Naval Postgraduate School, Monterey, Calif.
A THEORETICAL ANALYSIS OF UNSTEADY TRANSONIC CASCADE FLOW M.S. Thesis
Philip Robert Elder Dec. 1972 162 p refs
(AD-757255) Avail: NTIS CSCL 21/5

The report presents an analysis of transonic potential flow through an oscillating unstaggered thin plate cascade. A collection technique is used involving the superposition of adjacent blade isolated foil potentials with interference potentials of unknown strength. Imposition of flow tangency requirements leads to integral equations for the unknown source distributions of the interference potentials. Results presented include the interference coefficients for the steady and oscillating cases. The steady case is extended to the determination of the potentials along the blade and compares favorably with a parellel solution using a Laplace transform approach to the sonic wind tunnel wall interference problem. Author (GRA)

N73-23809# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Lab.
THE LOW HUB-TIP RATIO SUPERSONIC AXIAL-FLOW COMPRESSOR, VOLUME 2 Final Report, 1 Jul. 1971 - 30 Jun. 1972
Frans A. E. Breugelmans Nov. 1972 73 p refs
(Grant AF-AFOSR-2104-71; AF Proj. 7065)
(AD-757217; VKI-TN-41-Vol-2; ARL-73-0057) Avail: NTIS CSCL 21/5

The report describes the test results of a supersonic axial-flow compressor stage with a tip Mach number of 2.0. This volume discusses a method to eliminate the inlet problem.
Author (GRA)

N73-23811# Hamilton Standard, Windsor Locks, Conn.
FEASIBILITY INVESTIGATION FOR DETERMINING ARMY HELICOPTER GAS TURBINE ENGINE MAXIMUM POWER AVAILABLE Final Report
Joseph M. Kos, Anthony J. Martin, Peter D. Miller, John Saunders, and Roy W. Schneider Feb. 1973 130 p
(Contract DAAJ02-72-C-0003; DA Proj. 1F1-62203-A-434)
(AD-758461; USAAMRDL-TR-72-58) Avail: NTIS CSCL 21/5

The purpose of the investigation was to determine the feasibility of developing a method to predict, with an accuracy of better than plus or minus 1%, the maximum power which can be produced by a helicopter gas turbine engine at full-power conditions. The prediction was to be made using information obtained from the engine while the engine was operated prior to lift-off at a partial-power condition of no more than 30% of normal rated power. The prediction method was to be capable of identifying the changes in maximum engine power available due to all possible types of engine deterioration and all ambient conditions. The study was based on a Lycoming T53-L13 gas turbine engine currently being used in Army UH-1 helicopter. (Author Modified Abstract) GRA

N73-23886 Consiglio Nazionale delle Ricerche, Genoa (Italy).
DETERMINATION OF AN OPTIMAL TRAJECTORY IN THE PRESENCE OF RISK
A. Tiano; P. Dagnino, and M. Piattelli *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p refs

A controlled dynamic system is considered that displaces within an assigned space, where r moving targets are contained. An optimal control sequence transfers the system from an initial point to a preset terminal point so that the optimal trajectory is the one which, complying with some safety constraints imposed by the targets, minimizes a given cost function. Assuming that the system may be supplied with periodical information about the motion of the targets, a numerical algorithm utilizing a dynamic programming procedure is determined. This procedure is applied to two practical problems: (1) Marine anticollision aided by computerized radar systems in the presence of N targets; and (2) determination of an optimal evasion strategy in the presence of cyclonic disturbances. Author

N73-23889 Saab Aircraft Co., Linkoping (Sweden). Systems and Avionics Dept.
SOME DEVELOPMENT TRENDS IN THE INTEGRATION OF ELECTRONIC SYSTEMS IN THE SWEDISH AIRCRAFT 37 VIGGEN
Bengt Sjoebert *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 8 p

The Swedish 37 VIGGEN aircraft is being developed in several versions and the electronic systems of the attack version and the later fighter version are compared and some development trends are discussed. An increased role of the central computer is recognized as well as a trend towards digitalization of several subsystems. Author

N73-23895 Societe Nationale Industrielle Aerospatiale, Paris (France).
INERTIALESS FLIGHT METHODS [PROCEDE DE SURVOL NON INERTIEL]
P. J. Bigeon, J. Langlois, and R. Berrqir *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p In FRENCH

An automatic inertialess flight control and guidance system is reported that determines aircraft position by precisely calculating actual flight course deviation for telemetric guidance correction. An onboard computer processes data from a platform containing directional and vertical gyroscopes, from an automatic pilot, and from an atmospheric pressure sensor. Transl. by G.G.

N73-23896 Royal Aircraft Establishment, Farnborough (England).
THE EXPERIMENTAL EVALUATION OF AUTOMATED NAVIGATION SYSTEMS
J. G. Carr *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 13 p

Certain aspects of automated avionics systems which are being examined in the RAE Comet exercise are described. The emphasis is on navigation systems and includes the work on digital computers and on-board digital communication techniques, software developments including the use of high level programming languages, and the use of computer controlled electronic displays. The laboratory work using simulated navigation sensor inputs into an experimental system comprising a digital computer and electronic displays is described. A Comet 4 aircraft has been re-equipped as a flying laboratory for this work. The installation in the cabin of the aircraft and some of the current experimental investigations are described. The cockpit of the Comet has also been modified by the addition of experimental electronic displays to the second pilot's instrument panel. Author

N73-23898 Royal Aircraft Establishment, Bedford (England).
MANUAL LANDING IN FOG
R. R. Newbery *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p refs

The results of 18 fog flying sorties using a Category II operation terminated by a manual landing have been analyzed in an attempt to learn more about the pilot's capabilities in this environment. Measurements were made to correlate the pilot's decision making process with actual fog structures in real operation. A wide variety of fog structure and visual sequences are illustrated which demonstrate the lack of relationship between the visual segment at high decision heights, the height at which visual contact is first made and the runway visual range measurement. The pilots felt that Category II operation was straightforward provided that good quality approach performance, strict crew drills a accurate RVR reporting to give warning of shallow or changing fog conditions along the runway, were maintained. Author

N73-23900 Marconi-Elliott Avionic Systems Ltd., Rochester (England).
DEVELOPMENTS IN AIRCRAFT DIGITAL SYSTEMS
R. Ruggles and E. M. Scott *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 11 p

The effects of the relationship between user need and technological capability are considered for flight control as opposed to navigation and some physical characteristics of current digital autopilots are given. The functional division and integration of avionic subsystems are considered and it is concluded that integration in the form of loosely federated groups of related systems is preferred to the centralized computer complex in spite of its apparent conceptual simplicity. The concept of task oriented computers is discussed and the main parameters of some existing examples are given. Some details of the architecture, software and hardware for this type of computer are given. An example of the application to automatic flight control with a requirement for a fail operative capability is given and the problem of dealing with tolerances between operating lanes is briefly discussed. Author

N73-23902 Air Force Systems Command, Wright-Patterson AFB, Ohio. Airborne Computer Engineering Branch.
AVIONIC SYSTEMS INTEGRATION USING DIGITAL COMPUTERS
Erwin C. Gangl *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 5 p

Present weapon systems use a multiplicity of signal formats and transmission techniques for information transfer within an integrated avionics system. The implementation of a serial digital data bus as the primary means of functionally communicating and interconnecting the various equipments is described. If a system is logically partitioned to the data it supplies, requires or processes, then with a flexibly designed digital data bus and standard interfaces, it can easily be integrated through the computer software. Modification of redesign of the multiplexed data bus concept is a matter of reconfiguration of the building blocks, adding and deleting as required and then changing the software to reintegrate the new configuration, saving the costly rewiring and redesigning of the computer converter box. The computer is now a separate line replaceable unit, not subject to obsolescence due to systems modifications. Author

N73-23914*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
STUDY OF AN EXPERIMENTAL TECHNIQUE FOR APPLICATION TO STRUCTURAL DYNAMIC PROBLEMS
R. F. Snell Mar. 1973 74 p refs
(Contract NAS9-12873)
(NASA-CR-128911; MDAC-G4157) Avail: NTIS HC $5.75 CSCL 20K

An experimental program was conducted to determine the feasibility of using subscale plastic models to determine the response of full-scale aerospace structural components to impulsive, pyrotechnic loadings. A monocoque cylinder was impulsively loaded around the circumference of one end, causing a compressive stress wave to propagate in the axial direction. The resulting structural responses of two configurations of the cylinder (with and without a cutout) were recorded by photoelasticity, strain gages, and accelerometers. A maximum dynamic stress concentration was photoelastically determined and the accelerations calculated from strain-gage data were in good agreement with those recorded by accelerometers. It is concluded that reliable, quantitative structural response data can be obtained by the experimental techniques described in this report. Author

N73-23921# Kaman Aerospace Corp., Bloomfield, Conn.
RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 1: STRUCTURAL

SYSTEM IDENTIFICATION FROM MULTIPOINT EXCITATION Final Report
William G. Flannelly, Alex Berman, and Nicholas Giansante Nov. 1972 152 p refs
(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)
(AD-756389; R-1001-1-Vol-1; USAAMRDL-TR-72-63A-Vol-1)
Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume I presents the results of an analytical and numerical investigation of the practicality of system identification using fewer measurement points than there are degrees of freedom. The parameters in Lagrange's equations of motion, mass, stiffness, and damping for a mathematical model having fewer degrees of freedom than the linear elastic structure it represents may be determined directly from measured mobility data. Author (GRA)

N73-23922# Kaman Aerospace Corp., Bloomfield, Conn.
RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 2: STRUCTURAL SYSTEM IDENTIFICATION FROM SINGLE-POINT EXCITATION Final Report
William G. Flannelly, Alex Berman, and Nicholas Giansante Nov. 1972 88 p refs
(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)
(AD-756390; R-1001-2-Vol-2; USAAMRDL-TR-72-63B-Vol-2)
Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume II describes the method of system identification wherein the necessary impedance data are experimentally determined by applying a force excitation at a single point on the structure. Author (GRA)

N73-23923# Kaman Aerospace Corp., Bloomfield, Conn.
RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 3: FREE-BODY RESPONSE Final Report
Alex Berman, Nicholas Giansante, and William G. Flannelly Nov. 1972 53 p refs
(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)
(AD-756391; R-1001-3-Vol-3; USAAMRDL-TR-72-63C-Vol-3)
Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume 3 presents a method of determining the free-body dynamic responses from data obtained on a constrained structure. Author (GRA)

N73-23924# Kaman Aerospace Corp., Bloomfield, Conn.
RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 4: SUBSYSTEMS Final Report
Nicholas Giansante, William G. Flannelly, and Alex Berman Nov. 1972 53 p refs
(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)
(AD-756392; R-1001-4-Vol-4; USAAMRDL-TR-72-63D-Vol-4)
Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume 4 describes a method of obtaining the equations for the combination of measured mobility matrices of a helicopter and its subsystems. The response of the combination of a helicopter and its subsystems is determined from data based on the experimental results of the main system and subsystems separately. Author (GRA)

N73-23943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF PRIMARY-ZONE WATER INJECTION ON POLLUTANTS FROM A COMBUSTOR BURNING LIQUID ASTM A-1 AND VAPORIZED PROPANE FUELS
Robert D. Ingebo and Carl T. Norgren Washington May 1973 19 p refs
(NASA-TN-D-7293; E-7355) Avail: NTIS HC $3.00 CSCL 21B

A combustor segment 0.457 meter (18 in.) long with a maximum cross section of 0.153 by 0.305 meter (6 by 12 in.) was operated at inlet-air temperatures of 590 and 700 K, inlet-air pressures of 4 and 10 atmospheres, and fuel-air ratios of 0.014 and 0.018 to determine the effect of primary-zone water injection on pollutants from burning either propane or ASTM A-1 fuel. At a simulated takeoff condition of 10 atmospheres and 700 K, multiple-orifice nozzles used to inject water at 1 percent of the airflow rate reduced nitrogen oxides 75 percent with propane and 65 percent with ASTM A-1 fuel. Although carbon monoxide and unburned hydrocarbons increased with water injection, they remained relatively low; and smoke numbers were well below the visibility limit. Author

N73-23949# Institute for Defense Analyses, Arlington, Va.
ON THE PROBLEM OF ELIMINATING NITRIC OXIDE FROM JET ENGINE EXHAUST
J. W. Chamberlain Aug. 1972 8 p refs
(AD-757059; N-815; IDA/HQ-72-14447) Avail: NTIS CSCL 04/1

The report discusses the possibility that nitric oxide (NO) in the exhaust of a fleet of SSTs could seriously affect the ozone equilibrium of the stratosphere. In this connection it has been suggested that artificial excitation (vibrational or electronic) of NO in the combustion chamber could increase its reaction rate so that NO is converted into the more inert N2. The maximum rate that could likely be thus obtained seems inadequate to deplete the NO abundance appreciably. However, there are still uncertainties in the parameters and the mechanism cannot be totally discounted. Author (GRA)

N73-23951# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF THE KINETICS OF THE AFTERBURNING PROCESS UPON INJECTING AN OXIDIZER INTO A HIGH TEMPERATURE FLOW
Z. G. Shaikhutdinov 26 Jan. 1973 15 p refs Transl. into ENGLISH from Tr. Ufimsk. Aviats. Inst. (Ufa), no. 17, 1970 p 3-8
(AD-756098; FTD-HT-23-1695-72) Avail: NTIS CSCL 21/2

When N2O4 is injected into a high temperature gas flow containing the products of the incomplete combustion of CO and H2, effective aterburning of these products can be expected. This article deals with the calculation tables used for a rough analysis of the kinetic laws governing these processes. Author (GRA)

N73-23954# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BURNING RATE STUDIES ON THE CLOSED CHAMBER COMBUSTION OF A FUEL AIR PROPELLANT Final Memorandum Report
John D. Knapton and Irvin C. Stobie Feb. 1973 40 p refs
(AD-757634; BRL-MR-2273) Avail: NTIS CSCL 19/1

Closed chamber studies were performed on the combustion of the fuel air propellant JP4 and air. Densities of loading were varied from 0.18 to 0.36 gm/cubic centimeters. Equivalence ratios were varied from 0.6 to 2.7 fuel to air. A method for calculating the effective burning rate is presented. It was found that a wide variation in the actual burning rate can be obtained depending, approximately, on the inverse of the fuel air mixing time and, to a lesser extent, on the equivalence ratio. The pressure-time data is used to interpret the pressure rise predicted by an isothermal model, an adiabatic model, a reduced pressure model, and a volumetric model. Comparison of the results demonstrated that the reduced pressure model and the volumetric model offer the best pressure-time correlation. (Author Modified Abstract) GRA

N73-23962# RAND Corp., Santa Monica, Calif.
GROWTH RATES WITHIN THE TRANSPORTATION SECTOR
W. E. Mooz Jan. 1973 10 p Presented at Sem. on Energy as a Scarce Resource, Pasadena, Calif., 9 Dec. 1972; sponsored by Environ. Qual. Lab., the Sierra Club, and League of Women Voters
(P-4935) Avail: NTIS HC $3.00

Report is made of an investigation into the nature of transportation in terms of energy depletion and fuel consumption. Graphic profiles are presented which trace the growth rates of specific modes of passenger and freight transportation from 1955 to 1968. A summary of likely transportation energy demands for the future is also included. J.M.M.

N73-23967# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1974, PART 4
Washington GPO 1973 1323 p refs Hearings on HR 4567 (superseded by HR 7528) before Comm. on Sci. and Astronaut., 93d Congr., 1 Sess., No. 1, 6-8 and 13-15 Mar. 1973 4 Vol. Avail: Subcomm. on Aeronaut. and Space Technol.

The proceedings of the hearings on aeronautics and space technology are presented which were conducted to determine policy, program priorities, and funding these priorities. Testimony by NASA personnel dealt with the aeronautical technology required for: (1) superiority in military aeronautics, (2) removal of air transport growth constraints, (3) efficient high-density short-haul systems, (4) U.S. long-haul aircraft and engine leadership, (5) aviation safety, and (6) general aviation. Space technology requirements identified include those for civil needs, for exploration of space, and for low cost exploitation of space. D.L.G.

N73-23979* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELICOPTER VISUAL AID SYSTEM
R. L. Baisley *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 72-86 ref
CSCL 01C

The results of an evaluation of police helicopter effectiveness revealed a need for improved visual capability. A method was developed that would enhance visual observation capability for both day and night usage and demonstrated the feasibility of the adopted approach. This approach made use of remote pointable optics, a display screen, a slaved covert searchlight, and a coupled camera. The approach proved feasible through field testing and by judgement against evaluation criteria. Author

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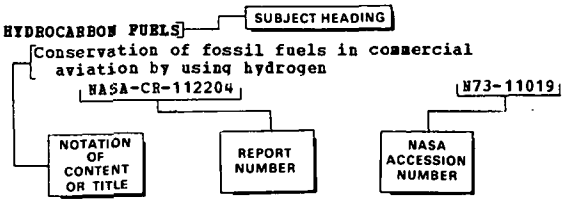

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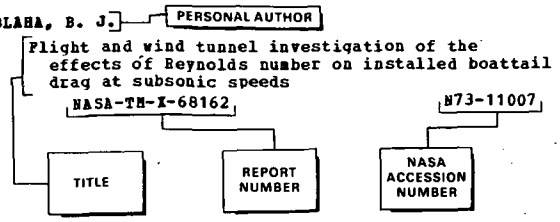

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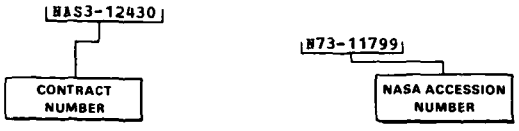

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