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National Aeronautics and Space Administration

# Aeronautical Engineering Aer

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# AERONAUTICAL ENGINEERING

# A Continuing Bibliography

## Supplement 138

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 1981 in

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# **INTRODUCTION**

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

This supplement to Aeronautical Engineering -- A Continuing Bibliography (NASA SP-7037) lists 366 reports, journal articles, and other documents originally announced in July 1981 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA).

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

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# **TABLE OF CONTENTS**

347
A-1
B-1
C-1

# TYPICAL CITATION AND ABSTRACT FROM STAR



# TYPICAL CITATION AND ABSTRACT FROM IAA



# AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 138)

### AUGUST 1981

# IAA ENTRIES

A81-30653 # A theoretical treatment of lifting surface theory of an elliptic wing. T. Kida (Osaka Prefecture, University, Sakai, Japan). Zeitschrift für angewandte Mathematik und Mechanik, vol. 60, Dec. 1980, p. 645-651. 13 refs.

An exact theoretical treatment of the three-dimensional lifting surface theory as treated in Krienes (1940) is presented. A new technique for the numerical approach is given in order to improve the accuracy of Krienes' results. An elliptic wing is analyzed and the singularity of the lift distribution near the wing tips is examined in detail, using the trigonometric series expressions of Lamé polynomial functions. The asymptotic behavior of circulation near the wing tips is also calculated. D.K.

A81-30689 The USAF Armament Division Structural Dynamics Lab. W. O. Dreadin (USAF, Structural Dynamics Laboratory, Eglin AFB, Fla.). *Journal of Environmental Sciences*, vol. 24, Mar. Apr. 1981, p. 45-48.

The aircraft/weapon certification programs of the Structural Dynamics Laboratory are discussed. A variety of static structural and dynamic tests are conducted on weapons, suspension equipment, and aircraft to assure safe carriage limits for numerous tactical configurations. Loads testing conducted in the facility include load path verification studies and nondestructive load limit testing. Modal tests and analyses are performed in support of analytical flutter studies which are used to determine aircraft/weapon flight envelopes free of dynamic instabilities. Random input ground vibration testing has also shown itself to be a viable and useful technique. D.K.

A81-30705 On the design of modern airfoil sections by numerical methods. D. J. Jones (National Aeronautical Establishment, Ottawa, Canada) and B. Eggleston (de Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada). In: Innovative numerical analysis for the engineering sciences; Proceedings of the Second International Symposium, Montreal, Canada, June 16-20, 1980.

Charlottesville, Va., University Press of Virginia, 1980, p. 169-178. 10 refs.

Numerical procedures are described for the design of advanced supercritical and multielement airfoils, including a direct, simplex approach to performance optimization subject to certain constraints. The method has as its unique advantage the fact that real airfoil profiles are always considered, by contrast to the inverse design approach in which, for a given pressure distribution, upper and lower airfoil surfaces may cross upstream of the trailing edge. It is shown that a combination of various techniques is often needed to arrive at an optimum airfoil design. O.C.

A81-30710 A computer code for the calculation of aircraft trailing vortices. G. J. Saint-Cyr (Poseidon Research, Los Angeles, Calif.). In: Innovative numerical analysis for the engineering sciences; Proceedings of the Second International Symposium, Montreal, Canada, June 16-20, 1980. Charlottesville, Va., University Press of Virginia, 1980, p. 239-249. 6 refs. The governing equations, numerical methods and examples of code output are presented for a computer program developed for calculating the trajectory and duration of aircraft trailing vortices. The program consists of the synergistic combination of a flux-corrected transport algorithm, a block-cyclic reduction method, and a two-equation turbulence model. Having specified the initial conditions, the stream function is computed by using Biot-Savart integration over vorticity at the borders of the computational grid and by using a block-cyclic reduction algorithm for Poisson's equation at the interior of the grid. Differentiation of the stream function yields the velocity field. Computational results are compared to measurements obtained in laboratory experiments. O.C.

A81-30717 A time marching finite volume method for blade-to-blade flows using a body-fitted curvilinear mesh. M. E. Younis (Pratt and Whitney Aircraft of Canada, Ltd., Longueil, Canada) and R. Camarero (Ecole Polytechnique, Montreal, Canada). In: Innovative numerical analysis for the engineering sciences; Proceedings of the Second International Symposium, Montreal, Canada, June 16-20, 1980. University Press of Virginia, 1980, p. 321-328. 10 refs.

An efficient and accurate approach to the time-dependent finite volume method, applied to blade-to-blade flows in two dimensions, is presented. The approach consists of the solution of the Euler equations in conservation law form, on a curvilinear, body-fitted mesh. In addition to the advantage of an automatic and very efficient generation of the curvilinear mesh, the solutions are more accurate than existing alternatives and stationary solutions can be obtained with briefer computations. O.C.

A81-30730 Approximations and short cuts based on generalized functions. R. P. Kanwal (Pennsylvania State University, University Park, Pa.). In: Innovative numerical analysis for the engineering sciences; Proceedings of the Second International Symposium, Montreal, Canada, June 16-20, 1980.

Charlottesville, Va., University Press of Virginia, 1980, p. 531-542. 11 refs.

Various applications of the Dirac delta function and its distributional derivatives are demonstrated by including the viscous terms in the equations of motion. The aerofoil theory is discussed in these terms. The concept of an impulse or a concentrated force at a point is extended, and the generalized functions are distributed over a segment of a coordinate axis. This method is then extended to include a segment on any straight line in the plane, not necessarily a coordinate axis. The applicability of generalized functions to two branches of mathematical analysis is demonstrated. Here, a simple example illustrates the use of the functions are then shown to be applicable to the study of orthogonal polynomials. C.R.

A81-30776 A 7.5-GHz microstrip phased array for aircraft-to-satellite communication. F. W. Cipolla (Ball Corp., Ball Aerospace Systems Div., Boulder, Colo.). *IEEE Transactions on Antennas and Propagation*, vol. AP-29, Jan. 1981, p. 166-171. Contract No. F30602-78-C-0329. The design features of a 7.5 GHz microstrip phased array fabricated for the super high frequency SATCOM communications system are given. The receive-only array is left-hand circularly polarized and has 3-bit digital p-i-n diode phase shifters for steering the beam. A microprocessor-based beam steering controller is included for calculating the phase shifter settings for each beam position. The entire array, including the radiating elements, quadrature hybrid, phase shifters, corporate feed, RF chokes, and dc bias, is in a microstrip medium. The array achieves a gain of 19.6 dBic for the broadside beam. L.S.

A81-30779 An extremely lightweight fuselage-integrated phased array for airborne applications. J. S. Yee and W. J. Furlong (Boeing Military Airplane Co., Advanced Airplane Branch, Seattle, Wash.). *IEEE Transactions on Antennas and Propagation*, vol. AP-29, Jan. 1981, p. 178-182.

A design of a lightweight low volume electronically scanned antenna is described. This antenna, besides being the radiating aperture, serves as a load-sharing fuselage panel in a small weightsensitive remotely piloted vehicle (RPV). A demonstration array incorporating the microstrip radiating elements, stripline feed circuit, and microstrip-line p-i-n diode phase shifters was assembled to evaluate the electrical characteristics and scanning capabilities of the array. The demonstration array was tested on the antenna range and operated successfully as part of a radar/communication subsystem demonstration. An eight-element lightweight section of the demonstration array was subsequently designed and fabricated in a modern production facility utilizing numerically controlled machines and state-of-the-art printed circuit board etching and plating equipment. Successful operation of this lightweight section sufficiently demonstrated that a lightweight and low volume electronically steerable phase-array antenna can be fabricated and integrated into a structural panel in production quantities. (Author)

A81-30785 The displacement-thickness theory of trailing edge noise. M. S. Howe (Bolt Beranek and Newman, Inc., Cambridge, Mass.). Journal of Sound and Vibration, vol. 75, Mar. 22, 1981, p. 239-250. 19 refs.

A theory of edge noise is developed which is valid at low Strouhal numbers and which accounts for changes occurring at the edge in the boundary layer inhomogeneities. Two-dimensional problem of boundary layer flow over the edge of a semi-infinite rigid plate with the boundary layer disturbances taken as uniform in the spanwise direction is considered. Expressions are given for the far field sound and for the surface pressure fluctuations close to the edge of the plate. It is shown that the use of Liepmann's (1954) method leads to the prediction of an additional acoustic dipole source at the trailing edge, the axis of which is orientated in the direction of the mean flow. At very low Mach numbers, comparison with evanescent wave theory indicates that this dipole makes a negligible contribution to the radiated sound, although it can lead to a significant modification of the hydrodynamic pressure on the surface of the plate near the trailing edge. At higher Mach numbers, the dipole also modifies the acoustic field shape in the region downstream of the edge within which evanescent wave theory predicts a relatively weak radiation intensity. 1.5

A81-30786 Non-linear oscillator models in bluff body aeroelasticity. E. H. Dowell (Princeton University, Princeton, N.J.). *Journal of Sound and Vibration*, vol. 75, Mar. 22, 1981, p. 251-264. 17 refs. NSF Grant No. CME-79-16933.

A critique of nonlinear oscillator models is offered and a systematic and self-consistent procedure for constructing such a model is proposed based upon theoretical and experimental fluid mechanical information. Numerical studies are conducted for the proposed model as well as for the earlier one of Skop and Griffin. A comparison with Jones' experimental results is also made. (Author)

A81-30802 Computation of wall temperature and heat flux distributions of the film cooled walls. S.-Y. Ko (Academia Sinica, Mechanics Institute, Beijing, Communist China). In: Heat and mass transfer in metallurgical systems; Proceedings of the Seminar, Dubrovnik, Yugoslavia, September 3-7, 1979. Seminar sponsored by the International Centre for Heat and Mass Transfer. Washington, D.C., Hemisphere Publishing Corp., 1981, p. 635-649. 8 refs.

A computational algorithm and a computer program have been developed for determining the wall temperature distribution of film-cooled gas turbine flame tube. In the computer program, the Newton-Raphson iteration method is used for the solution of heat balance equation; a graphic method has been also proposed for the same purpose. Results indicate that a 1% reduction in the turbulent mixing coefficient of the combustion chamber would reduce the wall temperature by about 20 C, which would substantially increase the service life of turbine components. V.L.

A81-30914 Coriolis effect on the vibration of flat rotating low aspect ratio cantilever plates. S. Sreenivasamurthy and V. Ramamurti (Indian Institute of Technology, Madras, India). Journal of Strain Analysis for Engineering Design, vol. 16, Apr. 1981, p. 97-106. 17 refs.

The Coriolis effect on the first bending and first torsional frequencies of flat rotating low aspect ratio cantilever plates has been investigated using finite element method. The cantilever plate has been modelled using plane triangular shell elements with three nodes and eighteen degrees of freedom. Three typical skew angles (0, 45, and 90 degrees) and two aspect ratios (1 and 2) are considered in the analysis. In addition to the Coriolis effect other effects, namely the geometric stiffness and the supplementary stiffness, have been considered. The mass and stiffness matrices have been derived using area coordinates. It has been found that the effect of including Coriolis effect is to lower the first two frequencies. This effect is negligible when the skew angle is 90 degrees. In the other two cases, skew of 0 and 45 degrees, there is a noticeable effect on the first torsional mode frequency when the aspect ratio is unity and on the first bending mode frequency when the aspect ratio is 2. An increase in the Coriolis effect is observed when the aspect ratio is increased from 1 to 2, with the skew angles of 0 and 45 degrees and a decrease when the skew angle is 90 degrees. The difference between the two frequencies (with and without Coriolis effect) becomes more and more noticeable as the rotational speed increases. (Author)

A81-30915 Tensile stress/strain characterization of nonlinear materials. J. Margetson (Propellents, Explosives and Rocket Motor Establishment, Aylesbury, Bucks., England). Journal of Strain Analysis for Engineering Design, vol. 16, Apr. 1981, p. 107-110.

A modified Ramberg-Osgood equation is used to empirically represent a uniaxial stress/strain curve, with values improved iteratively by a least-squares fit using all the experimental points on the curve. The procedure is used to generate stress/strain relationships for a variety of materials, and good agreement is found with experimental values. The method is also applied to an aerodynamic heating simulation experiment. O.C.

A81-30956 # Influence of hinge line gap on aerodynamic forces acting on a harmonically oscillating thin profile in an incompressible flow. I, II. S. Filipkowski and M. Nowak (Polska Akademia Nauk, Instytut Podstawowych Problemow Techniki, Warsaw, Poland). Archiwum Mechaniki Stosowanej, vol. 32, no. 4, 1980, p. 517-548. 28 refs.

The method of strongly singular integral equations is used to derive the solution of the Birnbaum-Possio equations for a system of two profiles lying on one straight line parallel to the direction of flow at infinity. The full linearization of the model of the phenomenon is retained, and the solution of the problem of the effect of a gap on the pressure distribution acting on the harmonically oscillating profile with the control surface, and on the aerodynamic coefficients of the profile is presented. Both the pressure distribution over the profile and the aerodynamic coefficients are expressed in terms of elementary functions and canonical forms of elliptic integrals. Only a few integrals which depend on the geometry of the system and on the frequency coefficient require numerical procedures. The method of calculating the aerodynamic coefficients can be applied in the analysis of the flutter of the profile. Some examples of numerical calculations illustrating the influence of the size of the gap on the pressure distributions and the aerodynamic coefficient are given. D.K.

A81-30975 # GPS Navstar, the universal positioning system of the future. B. Owen and J. O'Toole (Amalgamated Wireless /Australasia/, Ltd., Sydney, Australia). *Navigation* (Australia), vol. 6, Dec. 1980, p. 859-866.

A brief description of the Navstar Global Position System (GPS) is presented. The GPS, a DOD program, designed to provide instant three-dimensional navigation information, will employ 18 satellites and is expected to be fully operational for military as well as civilian use by 1987. The 18 satellites (which will circle the earth twice daily at 11,000 n mi above earth) will be in three orbital planes, six per orbit, and they will give global coverage under all weather conditions by 1985. The GPS set, a combination radio receiver and computer, will lock onto Navstar signals from the four satellites most favorably located and compute the signals' time, range, and co-ordinates into navigational data. A highly accurate atomic clock is a key component of the system. A master control station, an upload station, and four monitor stations will daily monitor, update, and maintain positioning and clock accuracy of the satellites. An unlimited number of GPS sets can receive the satellite signals. Attention is given to potential problems of a commercial users, i.e., position fixing, velocity, order of accuracy, and signal matching. The concept validation program has been completed, whereas full-scale development and the system test program are not under way. K.S.

A81-31034 # Subsonic gas flow past a wing profile (Obtekanie krylovogo profilia dozvukovym potokom gaza). N. A. Meller. *Zhurnal Vychislitel'noi Matematiki i Matematicheskoi Fiziki*, vol. 21, Jan.-Feb. 1981, p. 139-149. In Russian.

Doronitsyn's (1978) small-parameter integration method is used to analyze subsonic gas flow past a symmetric profile at angle of attack. Solutions are obtained for flow past a cylinder and a Zhukovskii profile at angle of attack. Velocity fields are obtained for various Mach numbers. B.J.

A81-31039 # Mathematical model of the linear unsteady aerodynamics of the entire aircraft (Matematicky model linearni nestacionarni aerodynamiky celeho letadla). Z. Skoda. Zpravodaj VZLU, no. 5, 1980, p. 195-199. 6 refs. In Czech.

A mathematical model of the linear unsteady aerodynamics of an aircraft as a whole is developed on the basis of the response of the aircraft to stepwise changes of the parameters of motion. The aerodynamic force acting on the aircraft is replaced by a system of discrete forces acting on elementary parts of the aircraft. The system of discrete forces is obtained by solving the system of algebraic equations that describe stepwise changes of the parameters of aircraft motion. B.J.

A81-31041 # Calculation of the flow pattern behind an aircraft wing (Vypocet obrazu proudeni za kridlem letounu). M. Zadnik. Zpravodaj VZLU, no. 5, 1980, p. 207-215. 6 refs. In Czech.

A numerical method for calculating the flow pattern behind a wing is presented. Results of calculation are compared with those of a wind tunnel test for the case of an isolated rectangular wing. The numerical method is applied to symmetrical flow past a jet aircraft with an all-moving tail and deflected flaps. B.J.

A81-31042 # Measurement of the aerodynamic forces acting on a harmonically oscillating wing at high subsonic speeds (Mereni aerodynamickych sil pusobicich na harmonicky kmitajici kridlo pri vysokych podzvukovych rychlostech). J. Lebduska. Zpravodaj VZLU, no. 5, 1980, p. 217-220. 8 refs. In Czech.

The damped oscillation method was used to obtain the unsteady aerodynamic derivatives of a half-wing undergoing harmonic pitching oscillations in a wind tunnel in the Mach number range of 0.4-1.0. Such factors as the effect of walls, the effect of the gap between the model and the wall, and the dynamic characteristics of the oscillating body, are examined.

A81-31044 # New interpretations in the theory of viscous incompressible fluid flow past airfoil profiles (Novejsi interpretace v teorii vazkeho nestalacitelneho obtekani leteckych profilu). P. Berak. Zpravodaj VZLU, no. 6, 1980, p. 255-259. 8 refs. In Czech.

Methods of the theoretical prediction of the aerodynamic characteristics of airfoils are discussed. An extended formula for the friction drag on a plate is given; and the application of a generalized function to the flows of viscous and ideal fluids is considered. The use of a double expansion for the analytical solution of the Navier-Stokes equations by the perturbation method is examined. A practical iterative procedure for determining the aerodynamic characteristics of airfoils is described; it is shown that the parallel solution of the Navier-Stokes equations by the perturbation method and the iterative procedure assures a correct iterative solution. B.J.

A81-31045 # Concerning Khristianovich's transformation of a subsonic flow past an airfoil into a low-speed flow (Poznamka k Christianovicove transformaci mezisubsonickym a nizkorychlostnim obtekanim profilu). V. Broz. Zpravodaj VZLU, no. 6, 1980, p. 261-265. 6 refs. In Czech.

Khristianovich's (1940) method that can be used to transform a subsonic flow past an airfoil into a low-speed flow is described. It is shown that a ratio between the pressure coefficients of the subsonic flow and the low-speed flow can be deduced from the transformation.

A81-31109 Operator training systems/simulators. G. Wergeni (Datasaab AB, Jarfalla, Sweden). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 117-139.

The design criteria and operational capabilities of a family of training simulators for Air Defence and Air Traffic Control operators are described, with stress on the tactical flexibility and the maintainability of the systems. All training exercises are preprogrammed and define the position of trainee controllers and pilots, radar characteristics, direction-finding stations, etc. It is also possible to run several simultaneous exercises independently, with full freedom of assignment to each trainee. O.C.

A81-31110 A simulator to test compressor research facility control system software. R. H. Byers, M. Snider, and B. Brownstein (Battelle Columbus Laboratories, Columbus, Ohio). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980.

Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 140-153.

A simulator employed in control software integrity testing and operator training for a compressor research facility is described, which is of critical importance in software integrity verification when a new compressor is to be tested or changes made to the facility's control network software. Detailed descriptions of the simulator system architecture, function, task timing and priorities, and simulated test facilities are given. O.C.

A81-31113 Rapport tactical self protection systems design. J. D. Sparno (Loral Corp., Yonkers, N.Y.). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 207-212.

The performance requirements and capabilities of the Rapport tactical combat aircraft self-protection electronics are considered, with stress on the system's adaptation to the F-16 fighter. As installed in the F-16, the Rapport 3 system occupies only 2.8 cu ft, weighs 366 lb, and has minimum impacts on aircraft cooling and power requirements. Rapport eliminates hardware duplication and improves response time through integration of warning and ECM functions, permits programmable power management, distributes transmitter location to allow full power jamming both forward and aft, and is entirely stored internally in the aircraft. O.C.

A81-31114 Helicopter rotor blade effects on mastmounted sensor images. H. E. Matuszewski (Bell Helicopter Textron, Fort Worth, Tex.). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 249-262.

This paper reviews the background and general requirements for helicopter mast-mounted infrared, TV, and laser sensors. Tests and analyses conducted are summarized. The objective of the tests was to obtain conclusive empirical data on the change in quality of sensor images while looking through the helicopter rotor blade plane. Test data was recorded on video tape. Analytical extrapolations of the video are presented. There was no apparent degradation of target images for any test condition. Further analyses showed no major degradation for most helicopters, rotors, sensor types, and sensor modes of operation. (Author)

A81-31115 A high performance TV camera for use in target acquisition and laser designator systems. L. Arlan (RCA, Government Systems Div., Burlington, Mass.). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 287-304. Research supported by Northrop Corp.

A family of low-power, high-performance miniaturized TV sensors are described, which are ideally suited for such military applications as mast-mounted sights, remotely piloted vehicles, and other systems in which small optical sensors must operate in extreme electromagnetic interference environments. The results of electrical and mechanical performance tests for these devices are discussed in detail. O.C.

A81-31122 An X-band power GaAs FET amplifier for military avionics radar applications. K. R. Broome and D. S. James (Ferranti Electronics, Ltd., Microwave Div., Poynton, Ches., England). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980.

Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 453-460. Research supported by the Ministry of Defence (Procurement Executive).

An all-FET power amplifier, incorporating hermetically sealed GaAs devices of flip-chip configuration, is discussed. It is noted that the RF design includes a PIN attenuator for on-aircraft gain preset and gain/temperature compensation. RF power sensors are employed at input and output to provide overall BITE indication of satisfactory power gain. The construction is modular, and care has been taken to satisfy the stringent thermal and vibration requirements. The modules making up the RF portion include three circuit boards of metal-backed low dielectric constant material and a stripline double isolator unit. Details are also given on the screening and burn-in procedures, and reliability estimates are discussed. C.R.

A81-31125 Passive location finding with a multiwavelength two element interferometer. R. B. Scher (Litton Industries, Amecom Div., College Park, Md.). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 517-528. Contract No. F33615-78-C-1496.

A81-31126 Applications of new technology in the infrared. D. B. Duke, G. S. Walton, and P. J. Griffiths (British Aerospace, Dynamics Group, Hatfield, Herts, England). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 529-533.

Current infrared reconnaissance system technologies are reviewed, and areas where new technology is being applied to improve the design and capability of such systems are pointed out. It is noted that the areas of particular interest to the system designer are the recent developments and future expectations in infrared detector technology and the new techniques available for signal processing and data handling; these will greatly improve the exploitation of reconnaissance information. C.R.

A81-31131 AN/TPX-54 interrogator. J. M. Dano and R. W. Fischer (Hazeltine Corp., Greenlawn, N.Y.). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 859-865.

The AN/TPX-54 IFF interrogator/receiver processor is discussed. The flexibility imparted to the system by the modular building block approach is noted. Among the features of the system are military-qualified solid-state transmitters, an extensive built-in test (for detecting and isolating faults), and a surface acoustic wave oscillator (ensuring high stability). Predicted mean time between failure of the basic interrogator is more than 2,800 hr in a ground environment. A block diagram of the interrogator system is included. Optional features include a destagger circuit, an automatic and programmable countdown circuit, and a suppression gate circuit.

C.R.

A81-31132 A new generation IFF - The AN/APX-100/V/ transponder. J. L. Shagena, Jr. and J. T. Shaul (Bendix Corp., Communications Div., Baltimore, Md.). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 866-877. 6 refs.

An integrated panel-mounted transponder developed by the Bendix Communications Division through the use of microminiaturization in both digital and RF circuitry is discussed. It is noted that the transponder eliminates the need for much of the interconnecting cables, connectors, and associated components of older system configurations. The advantages accruing from system integration are enumerated, and the design of the system is discussed (with a listing of the principal performance features of the main modules). Other aspects of the system discussed include the diversity feature, automatic overload control, antijamming features, the built-in-test, and the solid state transmitter. C.R.

A81-31133 New technology applied to an IFF diversity transponder. D. Panisset (Le Matériel Téléphonique, Boulogne-Billancourt, Hauts-de-Seine, France). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980. Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 878-896.

The NRAI 7, a fully solid state diversity transponder developed for the French Air Force, is discussed. The major characteristics of the transponder are given, namely diversity operation (in SIF and mode 4 separately), cross channel automatic overload control, cross desensitization with respect to the strongest antenna signal, and high reliability due to the solid state technology. The electrical and physical characteristics are also set forth, and attention is given to the transponder's subassemblies, among them the receiver, transmitter, switching/duplexing circuit, analog processor, test signals generator, and power supply. C.R.

A81-31134 Discrete Address Beacon System. N. Solat (FAA, Communications and Surveillance Div., Washington, D.C.). In: Military Electronics Defence Expo '80; Proceedings of the Conference, Wiesbaden, West Germany, October 7-9, 1980.

Cointrin, Geneva, Switzerland, Interavia, S.A., 1980, p. 897-909.

The Discrete Address Beacon System (DABS), developed as the next generation secondary surveillance radar (SSR) for air traffic control in the United States, is discussed. It is noted that while DABS occupies the same frequency channels as the present SSR system (1030 and 1090 MHz), the signal wave forms are totally compatible, allowing full use of the present civil/military beacon system while proceeding with the implementation of the DABS. The basic concept of radar beacon surveillance is explored in order to show how both compatibility and improved performance for aircraft surveillance are achieved through the DABS. Attention is also given

to the Automatic Traffic Advisory and Resolution Service (ATARS), which uses data from the DABS. It is noted that the focus of the DABS program through the remainder of the decade will be on the use of the high capacity data link to increase safety and efficiency.

A81-31249 # Subsonic and transonic flow on a wing at different sweep angles. I (Oplyw poddzwiekowy i przydzwiekowy na skrzydle przy roznych katach skosu. I). J. Staszek. *Technika Lotnicza i Astronautyczna*, vol. 36, Feb. 1981, p. 5-8. In Polish.

Experimental and theoretical studies of the properties of variable-sweep wings examined flow separation and vortices at subsonic and transonic velocities as well as the formation and shape of shock waves in the transonic range. Results measured with variable-sweep wing models were compared to calculations by several different methods. Tables and graphs illustrate flow characteristics as functions of wing parameters for different speed ranges. T.M.

A81-31250 # Subsonic and transonic flow on a wing at different sweep angles. II (Oplyw poddzwiekowy i przydzwiekowy na skrzydle przy roznych katach skosu. II). J. Staszek. Technika Lotnicza i Astronautyczna, vol. 36, Mar. 1981, p. 5-8. In Polish.

Results of experimental and theoretical studies on models of swept rectangular wings are given as fundamental data for characterizing three-dimensional flows at sweep angles from zero to 60 degrees. These data can be used for analysis of flow evolution as a function of sweep angle, angle of attack, and Mach number. They are also useful in evaluating the accuracy and applicability of numerical methods for flow determination. T.M.

A81-31258 # Numerical methods for studying the stressstrain state and service life of aircraft gas-turbine engine disks (Chislennye metody issledovaniia napriazhenno-deformirovannogo sostoianiia i dolgovechnosti diskov aviatsionnykh GTD). I. V. Dem'ianushko and Iu. M. Temis. *Problemy Prochnosti*, Apr. 1981, p. 49-55. 33 refs. In Russian.

Numerical methods currently used for the design of aircraft gas turbine engines are briefly reviewed with emphasis on finite element methods and methods based on thin-plate theory. It is shown that the most reliable results are obtained by comparing calculated stresses and deformations in the disk with experimental long-term and low-cycle fatigue curves. Service life can be also estimated using empirical formulas relating the strain amplitude to the number of cycles to failure. V.L.

A81-31264 # Experimental determination of the stress intensity factor for cracks with a curvilinear front in complex parts /gas turbine blades/ (Eksperimental'noe opredelenie koeffitsienta intensivnosti napriazhenii dlia treshchin s krivolineinym frontom v slozhnykh detaliakh /lopatkakh GTD/). A. V. Prokopenko (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR). Problemy Prochnosti, Apr. 1981, p. 105-111. 9 refs. In Russian.

An experimental procedure has been developed whereby a relationship between the crack growth rate and stress intensity factor obtained for a known specimen type under cyclic loading is used to derive the stress intensity factor in a gas turbine blade with a crack of any length. The method is demonstrated for turbine blades of steels 20Kh13, Kh17N2, and 1Kh12N2VMF. V.L.

A81-31285 The behavior of quartz oscillators in the presence of accelerations (Comportement des oscillateurs à quartz en présence d'accélerations). J. Beaussier (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). L'Aéronautique et l'Astronautique, no. 86, 1981, p. 65-75. 20 refs. In French. Research supported by the Direction des Recherches, Etudes et Techniques.

The replacement of atomic clocks by high-quality quartz oscillators in missile and aircraft time-frequency navigation systems is discussed. The problems presented by the behavior of such oscillators when subjected to acceleration loads are considered in detail, and methods by which the accelerometric effects encountered may be compensated for are described. Current research is concerned with characterization of the effect of acceleration on frequency in both 5 MHz bulk wave oscillators and 100 MHz acoustic wave oscillators.

O.C.

A81-31287 Hydrodynamic modelling of the starting process in liquid-propellant engines. V. M. Kalnin and V. A. Sherstiannikov (Akademiia Nauk SSSR, Moscow, USSR). Acta Astronautica, vol. 8, Mar. 1981, p. 231-242.

A brief description of the scheme and the method of hydrodynamic modelling of the working process in the systems of the liquid-propellant engines on the starting regime is given. Experimental investigation results of the hydraulic system filling with the modelling liquid are presented. Dynamic characteristics of the screw-centrifugal pump and axial and centrifugal turbines obtained in the modelling conditions are discussed. The joint effects of mechanical and hydrodynamic forces on the pump rotor occurring during transient regime are studied. (Author)

A81-31288 Application of signal detection theory to decision making in supervisory control - The effect of the operator's experience. A. Bisseret (Institut National de Recherche en Informatique et en Automatique, Rocquencourt, Yvelines, France). *Ergonomics*, vol. 24, Feb. 1981, p. 81-94. Research supported by the Direction Générale de l'Aviation Civile and Ecole Nationale de l'Aviation Civile.

Signal detection theory (SDT) was used as a model for a supervisory activity: the decisions of the air traffic controller using radar. Of particular interest was the professional experience factor which was studied by comparing the performance of trainee and experienced controllers. Through a distinction allowed by SDT between information processing and the decision process, it was shown that trainees discriminate better than experienced controllers, but that the latter manifest a greater degree of caution. These results are interpreted in terms of different information processing methods (judgement versus calculation) and different evaluations of the costs of possible outcomes. The practical interest of these results is demonstrated both for the evaluation of an operator-aiding computer system and for methods of training operators. (Author)

A81-31295 # The variable-speed tail-chase aerial combat problem. B. S. A. Jarmark (Saab-Scania AB, Linkoping, Sweden), A. W. Merz (Analytical Mechanics Associates, Inc., Mountain View, Calif.), and J. V. Breakwell (Stanford University, Stanford, Calif.). *Journal of Guidance and Control*, vol. 4, May-June 1981, p. 323-328. 10 refs.

The differential-game version of the coplanar tail-chase aerial combat problem is analyzed by the numerical differential dynamic programming method. The faster pursuer and the more maneuverable evader have only their turn rates as input controls, but their speeds fail as their turn rates are increased to the specified normal acceleration limit. The turn rate of the pursuer is such as to minimize the final mist-distance, while the evader's control maximizes this quantity. Solutions to the fifth-order problem are given for a range of flight conditions. Optimal control variations and sensitivities are discussed with respect to the conflicting requirements of high turn rates and high speed, which cannot be exploited simultaneously. (Author)

A81-31297 \* # Airborne method to minimize fuel with fixed time-of-arrival constraints. J. A. Sorensen (Analytical Mechanics Associates, Inc., Mountain View, Calif.) and M. H. Waters. *Journal of Guidance and Control*, vol. 4, May-June 1981, p. 348, 349. 5 refs. Contract No. NAS1-15497.

A method for generating a minimum-fuel, fixed-range, fixedtime-of-arrival flight path in an on-board flight management system computer for commercial aircraft is described. It is shown that up to 6% of the fuel otherwise used can be saved by means of this capability, despite time-of-arrival delays of up to 30 min, by a medium-range, tri-jet transport aircraft. O.C. A81-31367 \* # Adaptive-wall wind-tunnel development for transonic testing. B. Satyanarayana (Stanford University, Stanford, Calif.), E. Schairer, and S. Davis (NASA, Ames Research Center, Moffett Field, Calif.). Journal of Aircraft, vol. 18, Apr. 1981, p. 273-279. 17 refs.

Experimental techniques for rapid assessment and correction of wall interference in an adaptive-wall wind tunnel are described. The experimental arrangement allows laser velocimetry measurements on two control surfaces and incorporates a dedicated computer for data processing. The apparatus and its instrumentation are described, and typical results from an experiment on a nonlifting NACA 0012 airfoil at M = 0.78 are discussed. It is concluded that the time to acquire laser Doppler velocimeter data should be decreased, and the possibility of using one-step algorithms should be investigated. O.C.

A81-31368 \* # Effectiveness of leading-edge vortex flaps on 60 and 75 degree delta wings. J. F. Marchman, III (Virginia Polytechnic Institute and State University, Blacksburg, Va.). Journal of Aircraft, vol. 18, Apr. 1981, p. 280-286. NASA-supported research.

A series of wind tunnel tests were run on 60 and 75 deg sweep delta wings to examine the effectiveness of leading edge vortex flaps. Tests results showed that leading-edge vortex flaps are effective in giving large increases in lift-to-drag ratio and decreases in drag over a wide range of angle of attack. Tests on inverted flaps on the 60 deg delta wing showed substantial increases in lift and drag and may indicate a possibility of using inverted flaps on delta wings in the landing portion of flight. The 60 deg data were compared with that for a 75 deg sweep delta wing confirming that leading-edge vortex flap effectiveness is stronger as sweep is increased. Pitching moment effects due to vortex flaps use were also examined. (Author)

A81-31369 # Installation effects on propeller noise. H. K. Tanna, R. H. Burrin, and H. E. Plumblee, Jr. (Lockheed-Georgia Co., Marietta, Ga.). (American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 6th, Hartford, Conn., June 4-6, 1980, Paper 80-0993.) Journal of Aircraft, vol. 18, Apr. 1981, p. 303-309. 5 refs.

The installation effects on propeller noise and propeller wake flow in flight have been examined experimentally by operating a model-scale propeller in the Lockheed anechoic open-jet wind tunnel. In particular, two aspects of propeller operation in a real situation have been quantified. These are: (1) the effects of nonzero angle of attack or propeller inflow angle relative to the flight path, and (2) the propeller inflow distortion due to the upwash generated by the presence of wing and flap behind the propeller. The results show that not only are these installation effects very important, but they are predicted inadequately using existing methods. (Author)

A81-31370 # Inflight aircraft vibration modes and their effect on aircraft radar cross section. S. M. Correa, D. L. Sengupta, and W. J. Anderson (Michigan, University, Ann Arbor, Mich.). Journal of Aircraft, vol. 18, Apr. 1981, p. 318, 319. 6 refs. Contract No. F19628-77-C-0232.

A short feasibility study concerning the identification of aircraft types through the modulation of radar cross section by elastic in-flight vibration modes is described. The scheme requires unique elastic mode shapes and/or frequencies for each aircraft, with modes (1) remaining distinct as airspeeds and loads are varied, and (2) having vibration amplitudes comparable to the wavelength of the radar, so that unique vibration characteristics cause equally unique dynamic radar cross section modulation. It is concluded on the strength of 3-cm wavelength simulations for three aircraft types that elastic mode shapes and frequencies vary too much with airspeed and loading to permit accurate identification. O.C.

A81-31376 Implementing Aircraft Structural Life Management to reduce structural cost of ownership. T. D. Gray and D. J. White (Vought Corp., Dallas, Tex.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1331. 18 p. 8 refs. The methods of Aircraft Structural Life Management (SLM), which allow maximum economic utilization of structural life without compromising fleet safety, are described. The method incorporates load spectra definition, life prediction, service monitoring, and structural maintenance planning. It is shown that great cost-savings may be derived from inclusion of SLM as a prime consideration early in the design process, and the requirements for such integration of the method into airframe design, development qualification, and monitoring tasks are detailed. Structural elements of the A-7D aircraft are given as examples of SLM application. O.C.

A81-31377 The 'light-weight' system - A novel concept for on-board weight and balance measurement using fiber optics. A. C. Macdougall (Dynamic Sciences, Ltd., Montreal, Canada) and R. M. H. Cheng (Dynamic Sciences, Ltd.; Concordia University, Montreal, Canada). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1336. 19 p. Research supported by the Transport Canada.

The theoretical and experimental development of an Onboard Weight and Balance System (OBWB) suitable for small transport aircraft is presented. The optical device chosen is the fiber-optic strain gage, which operates on the principle that the time in which light passes through a glass fiber is affected by tension and compression. An interferometer incorporating this effect was built and shown in laboratory tests to be capable of accurately measuring axle deflections in transport aircraft landing gears. The inherently digital device calls for only infrequent calibration, permits automatic error detection, and may have its sensitivity range extended to cover the full dynamic range of landing gear operation without sacrifice of resolution and accuracy. O.C.

A81-31378 Operational responses to aft empty C.G. J. R. McCarty (United Airlines, Inc., Chicago, III.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1338. 18 p.

A development history is given for the modification and test program by which the adverse influence of the 727-200 airframe's stretching on centers of gravity, and therefore landing gear loadings, was reduced. The particularly severe influence of airframe redesign on the nose landing gear called for the redistribution of fuel tankage in addition to such measures as radome lead ballast. O.C.

A81-31379 Test procedures used in determining aircraft suitability for STAN integral weight and balance system. B. J. Hawkins (Fairchild Camera and Instrument Corp., Industrial Products Group, Commack, N.Y.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1339. 21 p.

The methods by which the numerous pertinent characteristics of new aircraft types are assessed, in preparation for the fitting and calibration of a STAN integral weight and balance system, are described. The system, which requires the precise determination of landing gear striction and static friction and damping, uses landing gear oleo strut pressures as the signal source for transducer pickup. The landing gear taxi test procedures and instrumentation are described in detail. O.C.

A81-31380 Design considerations for future turboprop transports. D. P. Marsh (Douglas Aircraft Co., Long Beach, Calif.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1340. 7 p. 9 refs. (Douglas Paper-6975)

Preliminary design studies have been completed, and a flight demonstrator program is being planned, for a new-generation, propfan-driven passenger aircraft of DC-9 Super 80 size whose configuration incorporates the two engines either on the wings or on the horizontal stabilizers. Average fuel savings of 20% per nautical mile are anticipated for a near-term, Mach 0.8 cruise aircraft of such design. Extensive details of the structural adjustments performed on the airframe of the DC-9 to accommodate the engine placement alternatives are furnished. O.C. A81-31381 Development and testing of a new technology weight and balance indicator. H. K. Nelson (WEICO Corp., Lynnwood, Wash.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1341. 16 p.

A weight and balance cockpit indicator for commercial aircraft incorporating new microcomputer and transducer technology is described. The system overcomes design, reliability, and maintainability deficiencies of previous systems, and will become operational on most types of transport aircraft early in this decade. Unique features of the indicator are in-flight weight/center of gravity data, auto-calibration, and low tire pressure detection. O.C.

A81-31382 Flatbed - The universal transport airplane. W. E. Warnock (Lockheed-Georgia Co., Marietta, Ga.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1343. 27 p.

The configurational possibilities and performance capabilities of the 'Flatbed' multiuse transport aircraft concept are demonstrated. The structurally novel aircraft consists of a flat central spine, integrating cockpit, wings, engines and tail surfaces, on which a variety of containerized payloads or passenger cabins may be carried. At the expense of a degree of aerodynamic efficiency, outsize payloads such as tanks and earth-moving machinery may be flown on the flatbed without additional covering. The flexibility of this concept recommends it as an ideal solution to the proposed Civil Reserve Air Fleet next-generation commercial aircraft requirements. O.C.

A81-31383 An Interactive Weight Accounting Program /IWAP/. P. R. Kraus (McDonnell Aircraft Co., St. Louis, Mo.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1345. 17 p.

The Interactive Weight Accounting Program (IWAP), a system for the collection and reporting of mass properties data, is described. The system comprises a series of on-line computer programs selectively activated by the user through an IBM 370 direct access connection and allows the interactive addition, modification, or deletion of data to generate a variety of different weight, balance, and inertia reports. IWAP has shown reduced operating costs and improved engineer control while eliminating the need for special programming skills. O.C.

A81-31384 Computer aided technology interface with weights engineering. R. W. Ridenour (McDonnell Aircraft Co., St. Louis, Mo.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1346. 20 p.

The intensive use of Computer Aided Technology with interactive graphics in the design and analysis work of weight engineers is described, and the improvements in calculation speed and accuracy derived are assessed. The range of functions analyzed by the system include (1) weight, center-of-gravity, and inertia profile, (2) mass distributions, (3) individual part and subsystem weights, and (4) material breakdowns. Special attention is given such features of the system as a program for the calculation of mass matrices for flutter and loads analyses and a fuel tank analysis program which calculates fuel volume and mass properties as functions of fuel depth and vehicle attitude. O.C.

A81-31385 Weights information systems using minicomputers. B. W. Soodik (Douglas Aircraft Co., Long Beach, Calif.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1347. 11 p.

The Weights Information System, a bookkeeping system with the additional scientific capabilities needed for weight engineering, is described. Implemented on an HP-3000 minicomputer, the system operates in both on-line and batch modes and uses a network data base for information storage. Because the system is modular in design, and completely menu-driven, implementation and maintenance may be easily handled by the user. O.C.

A81-31386 The Modular Life Cycle Cost Model for advanced aircraft systems - An overview. N. L. Sternberger (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1351. 16 p.

The Modular Life Cycle Cost Model (MLCCM), a methodology and mathematical model with which to enhance engineering tradeoff studies and predict life cycle, production, operations and support costs for advanced-technology aircraft, is described. This methodology consists of a complete set of life cycle cost estimating relationships, providing the design engineer the means by which to effectively conduct detailed and credible design/performance/cost studies for both small, fighter-attack and large, cargo-tankertransport aircraft. O.C.

A81-31387 The structural weight fraction - Revisited for fighter/attack type aircraft. K. L. Sanders (Northrop Corp., Aircraft Group, Hawthorne, Calif.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1365. 11 p. 12 refs.

An historical review is presented of the trend in airframe structural weight fraction among fighter and attack aircraft, with attention to such factors as the unique characteristics of V/STOL aircraft and necessary differences in structural detailing between Navy and Air Force aircraft. It is shown that despite continuous improvements in structural and 'materials technologies, growing performance demands have kept structural weight fractions within a nearly constant range of between 30 and 40%. These findings suggest that the structural design and development methods of such aircraft as the F-101A, which resulted in exceptionally low structural weight, may deserve consideration along with advanced, and expensive, composite materials technologies. O.C.

A81-31388 RAPIDLOADS - A preliminary design loads prediction technique for aircraft. A. L. Curry (Vought Corp., Dallas, Tex.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1366. 79 p. 13 refs.

RAPIDLOADS, an outgrowth of the Fighter Aircraft Structural Loads program, consists of a set of computer programs controlled by an executive routine and incorporates both batch and interactive operational modes. The following types of symmetric and antisymmetric flight maneuvers may be used in the analyses: (1) symmetrical push-over and pull-up, (2) abrupt pitch, (3) rudder kick and reversed rudder, and (4) roll initiation, reversed roll, and roll termination. Loads data for the body and each lifting surface are in the form of shear, bending moment, and torsion distributions, and all calculations are based on the assumption of a rigid structure. O.C.

A81-31389 PARAM - A new weight sizing routine. T. R. Smith (McDonnell Aircraft Co., St. Louis, Mo.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1367. 34 p.

A series of comparative aircraft design studies is used to illustrate the advantages of PARAM, a subroutine created for use in the initial stages of aircraft design in order to iterate a baseline aircraft to some scaling required for the performance of a given mission. The subroutine is shown to provide those engaged in the advanced design stage with a simplicity of formats which saves time and effort. A typical PARAM computer run costs \$30-35, while costs for more sophisticated sizing programs approach twice this amount. Among the figures of merit given by the program are takeoff weight, fuel weight, mission radii, wing loadings, and thrust-to-weight ratio at takeoff.

A81-31399 Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems. C. R. Ursell (Southwest Research Institute, San Antonio, Tex.) and J. D. Godsey (USAF, Kelly AFB, Tex.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1383. 44 p.

Knowledge gained during the development of an individual load cell and read out system was applied to the design, fabrication, assembly, calibration and demonstration of a weighing system consisting of on-top-of-jack load cells for level weighing and under-tire platforms for ground attitude weighing of aircraft such as the F-5. The result of the development program is a weighing system yielding an accuracy of plus or minus one pound per load cell (three pounds in all, in the case of a fighter aircraft tricycle landing gear). Due to the risk associated with the weighing of aircraft on-top-ofjacks, it is recommended that the ground attitude weighing system be considered with development of the appropriate correction curves.

A81-31400 CH-53E combat survivability assessment and survivability enhancement program. J. J. Morrow (U.S. Naval Weapons Center, China Lake, Calif.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1384. 25 p.

O.C.

Data of two sequential research programs were discussed with reference to a definition of an optimized helicopter configuration. Combat survivability was considered to be a major criterion in the evaluation of the overall effectiveness of the helicopter. The first program was designed to assess the configuration of the helicopter, the subsystem, component characteristics and features related to potential attrition when exposed to hostile weapons. The second program was geared to quantify and rank combat survivability enhancement concepts. Although several lightweight survivability enhancement concepts were considered, the studies showed that survivability enhancement will generally necessitate increased weight of the helicopter and greater complexity in design and maintenance, besides an increase in the overall cost of the system. E.B.

A81-31401 V/STOL advanced technology rewards and risk. R. S. Hamm (Lockheed-California Co., Burbank, Calif.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1385. 13 p.

A preliminary design exploration is presented for the Navy 'Type A' V/STOL aircraft, aimed at a characterization of the advances that must be forthcoming in systems, propulsion, materials and fuel management technologies before the weight savings required for adequate performance are achieved. Attention is given to the potential penalties incurred by falling short of requirements in any one of the technologies mentioned without compensating with overachievement in one of the others. It is concluded that substantial work is called for in all fields concerned. O.C.

A81-31402 A design analysis technique for evaluating size and weight of V/STOL lift fans. P. F. Piscopo (U.S. Naval Air Propulsion Test Center, Trenton, N.J.) and R. S. Saint John (Vought Corp., Dallas, Tex.). Society of Allied Weight Engineers, Annual Conference, 39th, St. Louis, Mo., May 12-14, 1980, Paper 1386. 32 p.

An analytic method for optimizing V/STOL lift fan components is presented. The data base used to develop the methods consists of nine fans representing a range of fan diameters from 34 to 92 inches. Although emphasizing weight, the component-by-component estimation approach also provides considerable design analysis capability. The lift fan is separated into eleven major elements with each major element further separated into sub-components. The methods provide accountability for design factors such as blade containment, variable geometry rotor blades and vanes, dynamic tuning, foreign object damage, and materials technology. The trade study capability of the fan size and weight estimation methodology is discussed. L.S.

A81-31561 Developments in the analysis and repair of cracked and uncracked structures. R. Jones and R. J. Callinan (Department of Defence, Aeronautical Research Laboratories, Melbourne, Australia). In: Finite element methods in engineering; Proceedings of the Third International Conference, Sydney, Australia, July 2-6, 1979. Kensington, New South Wales, Australia, Unisearch, Ltd., 1980, p. 231-245. 13 refs.

A finite element method for analyzing the behavior of structures which are patched with a bonded overlay of composite material is described. The analysis includes the separate responses of the structure, composite and adhesive and allows for the variation of the transverse shear stresses through the thickness of the patch, adhesive, and structure. As an illustrative example the repair of a cracked sheet is considered. (Author) A81-31598 # Equilibrium spinning of a typical single-engine low-wing light aircraft. B. W. McCormick (Pennsylvania State University, University Park, Pa.). Journal of Aircraft, vol. 18, Mar. 1981, p. 192-199. 16 refs.

A study is performed of rotary balance data, spin tunnel model, radio-controlled (R/C) model, and full-scale flight test results relating to the spinning of light aircraft. A method is presented for predicting steady spin modes using rotary balance data. Differences in spin characteristics of various wing, tail, and fuselage modifications are discussed as well as scale effects. It is concluded that an equilibrium flat spin is governed primarily by the yawing moment coefficient.

(Author)

A81-31601 # Noise characteristics of two parallel jets with unequal flow. B. N. Shivashankara and W. V. Bhat (Boeing Commercial Airplane Co., Seattle, Wash.). (American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0168.) AIAA Journal, vol. 19, Apr. 1981, p. 442-448. 8 refs.

A model experiment was conducted with two parallel jets to investigate the suppression mechanisms of jet noise control devices. It is shown that noise from a high-velocity jet can be reduced by placing a second jet of lower velocity parallel to it, on the same side as the listener. Noise reduction is maximum at the point of complete occultation of the fast jet by the slow, and decreases as one moves azimuthally around the jets from this plane until zero reduction is reached at approximately 75 deg to this plane. It is concluded that for the test configuration, with a separation of about 1.5 diameters, acoustic shielding is the dominant reduction mechanism, rather than mean flow interaction. O.C.

A81-31612 # Transonic viscous-inviscid interaction over airfoils for separated laminar or turbulent flows. R. Gordon and J. Rom (Technion - Israel Institute of Technology, Haifa, Israel). AIAA Journal, vol. 19, May 1981, p. 545-552. 26 refs.

A new technique is presented for the calculation of the interaction of the inviscid external flow and the separated boundary layer in the case of the transonic flow over airfoils. A finitedifference method is used for the boundary-layer solution. On the forward portion of the airfoil the boundary-layer equations are solved for a given pressure distribution boundary condition, while on the rear portion of the airfoil and beyond, where separated flow occurs, the equations are solved for a given displacement thickness distribution boundary condition. The inviscid transonic flow solution and the boundary-layer solution are matched by a local point relaxation algorithm, incorporating the two methods of boundarylayer equations solution. Results are obtained for separated laminar, transitional, and turbulent flows on circular-arc airfoils at zero angle of attack. These results are in good agreement with available experimental data. The effects of Reynolds and Mach numbers are also examined. (Author)

A81-31613 # Role of laminar separation bubbles in àirfoil leading-edge stalls. B. van den Berg (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands). *AIAA Journal*, vol. 19, May 1981, p. 553-556. 18 refs.

It is argued that there are two possible mechanisms for leading-edge stalls: (1) burst of the laminar separation bubble near the airfoil leading edge, and (2) turbulent boundary-layer separation in the leading-edge region. To investigate the relative importance of both mechanisms for leading-edge stalls, a theoretical analysis is made of the flow around airfoil noses. The analysis suggests that turbulent boundary-layer separation in the nose region may well be the dominant cause of leading-edge stalls, especially at higher Reynolds numbers. This conclusion is confirmed by an analysis of measured wall shear-stress data in the nose region of two modern airfoil sections. By using a suitable parameter for indicating proximity of separation, the likelihood of turbulent boundary-layer separation in the nose region is demonstrated for these two airfoil sections. (Author)

A81-31622 # Wing-body carryover at supersonic speeds with finite afterbodies. S. R. Vukelich and J. E. Williams, Jr. (McDonnell

Douglas Corp., St. Louis, Mo.). AIAA Journal, vol. 19, May 1981, p. 661-664.

A method is presented which evaluates the additional lift on a cylindrical body imparted by its interaction with the shock cone of lifting surfaces at supersonic speeds. Specific attention is given the character of this effect on finite afterbodies. Extension of the method to cantilever surfaces is also possible. O.C.

A81-31668 Mechanical properties of aluminum coatings on heat-resistant steels. N. V. Abraimov (Voenno-Vozdushnaia Inzhenernaia Akademiia, Moscow, USSR). (*Fiziko-Khimicheskaia Mekhanika Materialov*, vol. 16, May-June 1980, p. 46-50.) Soviet Materials Science, vol. 16, no. 3, Nov. 1980, p. 233-236. 6 refs. Translation.

A81-31673 Fatigue strength of gas turbine engine rotor blades in connection with structural changes in service. O. I. Marusii, B. A. Griaznov, and I. A. Makovetskaia (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR). (*Fiziko-Khimicheskaia Mekhanika Materialov*, vol. 16, May-June 1980, p. 97-99.) Soviet Materials Science, vol. 16, no. 3, Nov. 1980, p. 282-284. 6 refs. Translation.

The structure, chemical composition, and cyclic strength of the rotor blades (E1826 alloy) of a stationary gas turbine have been investigated after 20,000 hr of service using metallographic methods, X-ray spectrography, and mechanical testing. It is found that the greatest structural changes occur in the surface layers of the blades and are caused by redistribution of the alloying elements due to high temperature and sulfur diffusion from a sulfur contaning environment. The changes in the structure of the surface layer significantly reduce the cyclic strength of the alloy. V.L.

A81-31686 Steady flow and static stability of airfoils in extreme ground effect. E. O. Tuck (Adelaide, University, Adelaide, Australia). Journal of Engineering Mathematics, vol. 15, Apr. 1981, p. 89-102. 8 refs.

Steady flow over a thin airfoil-like body in close proximity to a plane ground surface is analysed on the basis of a one-dimensional, but non-linear, gap-region flow, matched to the outside via a trailing edge which may possess significant flap-like appendages. The resulting lift and moment predictions are used to estimate quasisteady stability derivatives in heave and pitch. The results are applied to longitudinal stability of tail-less uncambered airplanes, and to manoeuvring of ships near to a bank, indicating instability in both cases. (Author)

A81-31687 Leading-edge separation from a thick, conical, slender wing at small angles of incidence. J. Nutter (East Anglia, University, Norwich, England). *Journal of Engineering Mathematics*, vol. 15, Apr. 1981, p. 103-117. 11 refs.

The inviscid separated flow past slender rhombic cones at incidence is considered. A complex potential is constructed, in a suitable cross-flow plane, which satisfies the conditions on the wing, at infinity, and on the vortex system which models the separated flow. The results obtained both extend earlier results to small incidence, and explain an anomaly within those results. (Author)

A81-31699 Airships - Transport of the future. B. J. Russel. High-Speed Surface Craft, vol. 20, Apr. 1981, p. 18-21.

The latest airship developments in Britain are reviewed. The airship could find application as a freight and passenger carrier, and it could also be of use to the naval forces due to its ability to patrol and observe a larger area than surface vessels. Among the three new designs expected to be built and tested by 1984 or 1985, is the NR500, which is 50-m long, has a volume of 5,000 cu m, and can carry a payload of 2 tons. It is now under construction, should fly in mid 1981, and is expected to be used for offshore patrol. A larger craft, the NR5000, should find application as a passenger and freight carrier. The largest design is the R150, a 172-m long rigid airship, having a volume of 153,500 cu m, which will be capable of carrying payloads up to 80 tons. Wind tunnel tests on a scale model of the TS100 short-range airships are currently in progress. The airship

capital costs are between 1/4 and 1/3 of the costs of a transport aircraft, and the operating costs are about 30% lower. K.S.

A81-31767 # Study of the secondary flow in the downstream of a moving blade row in an axial flow fan. T. Adachi, T. Kawai (Tsukuba, University, Sakura, Ibaraki, Japan), and H. Sashikuma (Kawasaki Heavy Industries, Ltd., Aircraft Manufacturing Div., Kakamigahara, Gifu, Japan). JSME, Bulletin, vol. 24, Feb. 1981, p. 332-339, 12 refs.

The secondary flow downstream of a rotor row in a single-stage axial flow fan with a stator row ahead of the fan wheel is investigated. A circulating flow due to the apparent vorticity is found behind the rotor row when observed in a rotating frame fixed to the rotor. The averaged outlet angle from the rotor row is larger near the outer casing but smaller in the main flow region compared with the designed value. The loss in the vicinities of the inner and outer end walls as well as in the wakes of the moving blades is large, particularly in the neighborhood of the outer casing wall. As the hub ratio increases, the flow rate of the secondary flow decreases, and loss in the annular passage increases. L.S.

A81-31799 # Principles of aircraft-engine assembly (Osnovy sborki aviatsionnykh dvigatelei). A. I. Il'iankov and M. E. Levit. Moscow, Izdatel'stvo Mashinostroenie, 1980. 248 p. 15 refs. In Russian.

Various aspects of aircraft-engine assembly are considered. These include assembly engineering procedures, the organization of assembly operations, the overall and component assembly of piston engines and gas turbine engines, reassembly after testing, and safety measures relating to assembly. The quality and reliability of engines, the mechanical properties of engine materials, and engine design are also examined. B.J.

A81-31800 # Principles of aircraft structural design /2nd revised and enlarged edition/ (Osnovy konstruirovaniia v samoletostroenii /2nd revised and enlarged edition/). A. L. Gimmel'farb. Moscow, Izdatel'stvo Mashinostroenie, 1980. 368 p. 35 refs. In Russian.

Various aspects of aircraft structural design are reviewed. Consideration is given to the design of joints for profiles and tube elements, riveted joints, structures with welded joints, adhesive bonds, composite structures, butt joints, monolithic structures, panels, and the choice of construction materials. B,J.

A81-31823 # Aircraft equipment /2nd revised and enlarged edition/ (Oborudovanie samoletov /2nd revised and enlarged edition/). A. P. Volkoedov and E. G. Palenyi. Moscow, Izdatel'stvo Mashinostroenie, 1980. 232 p. 33 refs. In Russian.

The work considers aircraft electrical, radioelectronic, navigation, control, and safety equipment. The theoretical concepts underlying this equipment are discussed along with design principles, operation, construction, and assembly. B.J.

A81-31872 # Aircraft assembly (Sborka letatel'nykh apparatov). V. A. Tur'ian. Moscow, Izdatel'stvo Mashinostroenie, 1980. 176 p. 6 refs. In Russian.

The principles of aircraft assembly are reviewed. Attention is given to principles of aircraft design, pre-assembly procedures, engineering features of the assembly procedure, the assembly of structures with riveted joints, welding procedures, adhesive bonding, mechanical assembly work, the overall assembly of aircraft, mounting, and quality and reliability of assembly. B.J.

A81-32006 Crashworthiness versus cost based on a study of severe Army helicopter accidents during 1970 and 1971. J. L. Haley (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, Ala.) and J. E. Hicks (U.S. Army, Safety Center, Fort Rucker, Ala.). American Helicopter Society, Journal, vol. 25, Apr. 1980, p. 10-16. 6 refs.

This paper discusses the economic benefits of providing improvements in crashworthiness within future Army aircraft. The crashworthiness improvements considered are those of Military Standard 1290, 'Light Fixed- and Rotary-Wing Aircraft Crashworthiness'. The benefits in reduced personnel losses and airframe damage were studied, using 299 severe accidents occurring to Army rotary-wing aircraft, during 1970 and 1971. The benefits of crashworthiness are compared with the costs of providing them in Army UH-60A Black Hawk aircraft. The features which contribute most heavily to the projected personnel and hardware savings are discussed in an estimated order of priority according to their relative cost effectiveness. Crashworthiness features are shown to be cost effective within the life span of the Black Hawk. (Author)

A81-32007 Design and testing of float landing gear systems for helicopters. A. M. Alcedo (Bell Helicopter Textron, Fort Worth, Tex.). American Helicopter Society, Journal, vol. 25, July 1980, p. 3-9.

Since the use of helicopters over water has become wide-spread, the U.S. Federal Aviation Agency and the British Civil Aviation Authority have developed new regulations for flotation capabilities and ditching operations. These requirements and the design and testing of flotation landing gear systems are discussed. Differences in flotation systems pertaining to cost, weight, efficiency, and capability are presented, including differences in their supporting systems; such as, float, inflation, and actuation system designs. Model tests used to verify the capability of the designs are also discussed. Flotation and ditching model tests, methods, and scaling laws are described. (Author)

A81-32008 The bearingless main rotor. P. G. C. Dixon and H. E. Bishop (Boeing Vertol Co., Philadelphia, Pa.). American Helicopter Society, Journal, vol. 25, July 1980, p. 15-21.

The design, development, and flight-testing of a bearingless helicopter main rotor intended to have loads, stability, flying qualities and vibrational characteristics similar to those of conventional rotors is described. It was found that ground resonance damping is inadequate, and that air resonance and vibration levels are similar to the baseline, conventional blade. Maneuvering stability showed a significant improvement. Improvements to the bearingless rotor, such as advanced airfoil profiles and integrated, high-modulus composite single-beam flexure, are recommended for the achievement of significant reductions in hub size and resultant torsional stiffness. O.C.

A81-32009 Reduction of helicopter vibration through control of hub-impedance. S. P. Viswanathan and A. W. Myers (Bell Helicopter Textron, Fort Worth, Tex.). American Helicopter Society, Journal, vol. 25, Oct. 1980, p. 3-12. 15 refs.

A mathematical model of a vibration problem in a 206L Bell helicopter encountered in transition is presented. The model has one degree of freedom to represent the rotor and another degree of freedom to represent the nonrotating system. The model indicates that the magnitude of hub impedance is the single most dominant variable in determining the vertical hub shear on a given rotor in the transitional flight regime. The hub shear can vary from very small to very large magnitudes depending on hub impedance. Hub-mounter bifilar pendulum absorbers increase the hub impedance because of their large damping-type impedance. The resulting hub shear distributes itself between the absorbers and the fuselage in the same ratio as their impedances. Hence, in order for the absorbers to be efficient, their impedance must be high compared to that of the pylon-fuselage system. L.S.

A81-32010 \* Use of multiblade sensors for on-line rotor tip-path plane estimation. R. W. Du Val (NASA, Ames Research Center, Helicopter Technology Div., Moffett Field, Calif.). *American Helicopter Society, Journal*, vol. 25, Oct. 1980, p. 13-21. 5 refs.

Techniques are investigated for on-line estimation of rotor states in the nonrotating frame from multiple, simultaneous measurements in the rotating frame. The multiplade coordinate transformation is first applied to transform both flapping and flapping rate measurements into the nonrotating frame. The 'observer' approach is then used to generate algorithms for estimating tip-path plane rate and attitude from transformed flapping and flapping rate measurements. A numerical evaluation using simulated measurements is conducted to evaluate the performance of the algorithms and recommendations are made. (Author)

A81-32013 Application of an aerodynamic configuration modeling technique to the design and analysis of X-Wing aircraft configurations. D. R. Clark (Analytical Methods, Inc., Bellevue, Wash.) and R. T. Leitner (U.S. Naval Material Command, David W. Taylor Naval Ship Research and Development Center, Bethesda, Md.). (European Rotorcraft and Powered Lift Aircraft Forum, 5th, Amsterdam, Netherlands, Sept. 4-7, 1979.) American Helicopter Society, Journal, vol. 26, Apr. 1981, p. 3-8. 14 refs. Research supported by the Lockheed-California Co. and DARPA.

The correlation of an advanced aerodynamic configuration modeling method with wind-tunnel data for a baseline X-Wing flight demonstrator aircraft model is discussed. Modifications to the method required to handle circulation control airfoils are also described. In general, the predicted pressures are in close agreement with the experimental values on both the wing and body. Also accurately predicted are the three-dimensional separation locations. This correlated method is then used to design an unconstrained separation free hub-pylon, which is then modified to include the constraints of rotor rotation. Comparisons of pressure distributions of the baseline and new designs show significant improvement in eliminating or reducing the adverse pressure gradients at the leading and trailing edges of the hub-pylon, reducing the separation contour to a manageable thick trailing edge airfoil type. The analysis shows that a practical low drag X-Wing configuration is indeed possible. (Author)

A81-32014 Modern techniques of conducting a flight loads survey based on experience gained on the Black Hawk helicopter. W. P. Groth, G. M. Chuga, and V. S. Nelson (United Technologies Corp., Sikorsky Aircraft Div., Stratford, Conn.). (American Helicopter Society, Specialists' Meeting on Helicopter Fatigue Methodology, St. Louis, Mo., Mar. 1980.) American Helicopter Society, Journal, vol. 26, Apr. 1981, p. 9-17. 5 refs.

Flight loads survey methods developed and utilized during the U.S. Army Black Hawk qualification program are described. The role of the flight loads survey in flight envelope definition, mission utilization, fatigue analysis as well as in providing correlation data to update predicted loads is discussed. It is demonstrated that new equipment and methods can be used effectively to provide standardization in the areas of data acquisition and processing. Similar standardization of procedures is recommended in the areas of data analysis and application. L.S.

A81-32015 Drive system technology advancements. C. Albrecht and J. Mack (Boeing Vertol Co., Philadelphia, Pa.). American Helicopter Society, Journal, vol. 26, Apr. 1981, p. 18-24.

The most recent state-of-the-art drive system advancements have been applied to the design and development of the CH-47D transmission. The gearing-related developments include the use of high-hot-hardness, premium quality steel, gear stress measurement and correlation with material allowables, elimination of fretting and wear surfaces, and control of resonant stresses. Testing that developed and qualified this new drive system is discussed, and the methodology of analysis and test substantiation is described.

(Author)

A81-32016 Floor and fuel vibration isolation systems for the Boeing Vertol commercial Chinook. R. A. Desjardins and V. Sankewitsch (Boeing Vertol Co., Philadelphia, Pa.). (European Rotorcraft and Powered Lift Aircraft Forum, 5th, Amsterdam, Netherlands, Sept. 4-7, 1979.) American Helicopter Society, Journal, vol. 26, Apr. 1981, p. 25-30.

A vibration isolation system is in development for the passenger cabin and the long-range fuel tanks of the Boeing commercial Chinook. The passenger floor is isolated from the airframe on a series of passive isolation units. The fuel tanks are also isolated so that their dynamic mass is effectively nulled at all fuel levels, thereby avoiding any deleterious effect on airframe natural frequency placement. Analyses, component tests, and an aircraft shake test were conducted to verify the effectiveness of the system. The aircraft test demonstrated that the floor isolation could lower the 0.15g midcabin airframe vibration to an average of 0.05G on the passenger floor. The fuel isolation also was successful, maintaining an important airframe natural frequency within + or - 0.2 Hz of its normal value for any fuel level from 0 to 100 percent. (Author)

A81-32017 Unsteady aerodynamics of an aerofoil at high angle of incidence performing various linear oscillations in a uniform stream. C. A. Maresca, D. J. Favier, and J. M. Rebont (Aix-Marseille I, Université, Marseille, France). (European Rotorcraft and Powered Lift Aircraft Forum, 5th, Amsterdam, Netherlands, Sept. 4-7, 1979.) American Helicopter Society, Journal, vol. 26, Apr. 1981, p. 40-45. 8 refs.

The basic features of complex three-dimensional unsteady flows over advancing or retreating helicopter blade sections are investigated using two-dimensional models for aerofoils performing various linear oscillations in a uniform airstream. Three kinds of cyclic time-dependent motions are studied to simulate the variations of incidence and velocity simultaneously and separately. If velocity fluctuations at very low Mach numbers only are considered, the unsteady effects are weak if the incidence remains below the angle of static stall. Above the angle of static stall, the effects of unsteadiness are very strong and depend on the frequency and amplitude of the velocity fluctuations. L.S.

A81-32018 Comparison of calculated and measured helicopter rotor lateral flapping angles. W. Johnson (U.S. Army, Research and Technology Laboratories, Moffett Field, Calif.). *American Helicopter Society, Journal*, vol. 26, Apr. 1981, p. 46-50. 7 refs.

Calculated and measured values of helicopter rotor flapping angles in forward flight are compared for a model rotor in a wind tunnel and an autogyro in gliding flight. The lateral flapping angles can be accurately predicted when a calculation of the nonuniform wake-induced velocity is used. At low advance ratios, it is also necessary to use a free wake geometry calculation. For the cases considered, the tip vortices in the rotor wake remain very close to the tip-path plane, so the calculated values of the flapping motion are sensitive to the details of the wake structure, specifically the viscous core radius of the tip vortices. (Author)

A81-32252 A review of current and future components for electronic warfare receivers. J. H. Collins and P. M. Grant (Edinburgh, University, Edinburgh, Scotland). *IEEE Transactions on Microwave Theory and Techniques*, vol. MTT-29, May 1981, p. 395-403, 38 refs.

This paper addresses the role of conventional and new components in passive electronic warfare (EW) receivers. The various areas of EW are defined before restricting the discussion predominantly to the radar intercept problem at microwave frequencies. The operational parameters of conventional components are then reviewed including the multiplexer; crystal video, instantaneous frequency measurement (IFM), and scanning superheterodyne receivers. The significance of modularity, digital control, and hybrid combinations of components is highlighted. A brief description follows of the operational Cutlass EW equipment. New components based on surface-acoustic waves (SAW) and acoustooptic (AO) Bragg cells are then presented and their particular importance in channelized receivers, IFM's, and microscan receivers noted. Finally, a number of conclusions are drawn covering likely trends in EW receivers and the need for continuing development of large-scale integrated (LSI) circuits for signal sorting and overall digital management. (Author)

A81-32401 Measurement of aircraft speed and altitude. W. Gracey. New York, Wiley-Interscience, 1981. 276 p. 151 refs. \$29.95.

Among the topics discussed are typical aircraft speed and altitude instrument systems and their errors; the 'standard atmo-

sphere' concept and equations for airspeed, Mach number, and true airspeed; total- and static-pressure measurement; static pressure tubes and installations; and the aerodynamic compensation of position errors. Also considered are flight calibration methods; errors due to pressure-system lag and leaks; mechanical and electrical instrument errors; operational aspects of altimetry; and a variety of other altitude-measuring methods such as radio, radar and laser altimetry. O.C.

A81-32490 Forward-looking infrared /FLIR/ sensor for autonomous vehicles. S. R. King and A. E. Asch (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, Calif.). In: Electro-optical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 66-68.

A compact, lightweight, reliable, high performance Mini-FLIR designed for autonomous operation is described. The heart of the unit is the scanner which includes the mechanical raster scanner, the detector array, and the electronics. The basic scanner unit is a cylinder 4 inches in diameter by 5 inches long, weighing only 3.5 lb. It operates in the 8 to 12 microns spectral region and has a field of view (FOV) of 30 by 40 degrees. It can be combined with different optical systems to provide a wide range of capability for a variety of military and commercial applications. Mechanical scanning of the FOV is accomplished with a 525-line raster a field/frame rate of 60/30 per second. Serial scan techniques are employed, using two multi-element arrays of mercury cadmium telluride (HgCdTe) detectors, with the two arrays time-shared and combined through an acoustic delay line. The number of detectors can be chosen for the degrees of sensitivity required. Thermal compensation of the optical system is provided to maintain the FLIR in focus over a wide temperature range. (Author)

A81-32491 Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles. A. Roberts and B. Mathews (Fairchild Camera and Instrument Corp., Syosset, N.Y.). In: Electro-optical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980.

Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 69-76.

An expendable, autonomous vehicle by definition and implication will require small, low-cost sensors for observation of the outside world and interface to smart, decision-making avionics. This paper describes results of several interrelated CCD camera projects directed toward achieving such an integrated sensor package. A shuttered high resolution CCD detector combined with a CCD analog frame store memory is described. This system results in a full resolution frame rate reduced, deinterlaced image. This image data is suitable for transform or differential pulse code data compression as well as various other 3 x 3 element operators directed at extracting image intelligence for on-board decision-making. (Author)

A81-32492 Analysis, design and simulation of line scan aerial surveillance systems. M. Oron (Technion - Israel Institute of Technology, Haifa, Israel) and M. Abraham (Fibronics, Ltd., Haifa, Israel). In: Electro-optical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980. Bellingham, Wash., Society of Photo-Optical

Instrumentation Engineers, 1980, p. 77-84.

The analysis of an airborne line-scan surveillance system based on a linear-array solid state sensor mounted parallel to the longitudinal axis of the aircraft with a scanning mirror providing cross-track area coverage, resulted in a simple kinematic model which can be useful in the systematic design of such systems. Practical implementation of the model using state-of-the-art technology was considered prior to the actual design and construction of a laboratory prototype and simulation system. Experimental evaluation of the system confirmed that a digital data rate of 4-8 Mbit per second is feasible for acquisition and realtime display of visual information at a ground area coverage rate of almost 200 sq km/hr for relative flight altitude of 3000 ft and velocity of 80 knots, attaining a ground pixel size of 0.25 m. A digital image processing facility was interfaced to the system providing off-line processing capabilities for selected image-frames. On-line analog and digital processing was performed to provide compensation for errors due to image motion and aircraft attitude, as well as acquisition errors due to oureven illumination. Restoration of some geometrical distortions was also performed. (Author)

A81-32496 Airborne ground velocity determination by digital processing of electro-optical line sensor signals. M. Oron and O. Firschein (Lockheed Research Laboratories, Palo Alto, Calif.). In: Electro-optical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980.

Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 112-120.

Signals from a solid state electro-optical line sensor, which samples a two-dimensional image brightness function in time and space, can be digitally processed to extract the ground velocity vector of relatively slow, autopilot-controlled aircraft such as mini-RPVs. This sensor can be rotated into the direction of motion by a stepping motor which is controlled by a computational unit using simple easily realizable algorithms to keep the sensor in alignment with the velocity vector as well as to compute its magnitude. Together with other instruments already installed onboard the aircraft, this combination of sensor and computational unit may form an instrumentation setup which can be used in passive, autonomous navigation systems. Computer simulated experimental runs proved that a sufficient degree of directional sensitivity and overall accuracy can be attained with the proposed method.

(Author)

A81-32498 Autonomous target handoff from an airborne sensor to a missile seeker. L. E. Kossa and G. E. Tisdale (Westinghouse Electric Corp., Systems Development Div., Baltimore, Md.). In: Electro-optical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980.

Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 142-147. 6 refs.

The need for handoff capability arises when a target is acquired with an aircraft sensor (e.g., a FLIR) and it is desired to transfer the target position data to a second imaging sensor associated with an onboard missile, or possibly another aircraft. This paper describes Westinghouse scene-matching algorithms which can accomplish this task. It is noted that, for reasons of survivability and successful attack, target transfer should be accomplished within a fraction of a second; for tracking purposes, a precision of less than one pixel is required. A laboratory demonstration of handoff capability has been implemented as a result of an Army problem. B.J.

A81-32499 Advanced target tracking by dynamic scene analysis, P. M. Narendra, B. Westover, and D. P. Panda (Honeywell Systems and Research Center, Minneapolis, Minn.). In: Electrooptical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980.

Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 148-155. Grant No. DAAK70-79-C-0150.

An integrated approach to the target tracker and target screener functions based on dynamic scene analysis is described. Computer simulations on FLIR imagery demonstrated the viability of the approach for tracking multiple targets in highly cluttered environments and with fast-moving high-speed sensor platforms, conditions typical of the combat vehicle, AAH, and high-speed air-to-ground fighter scenarios. This approach eliminates the need for separate tracker hardware, because it can be implemented as an integral part of the Honeywell target screener and shares a substantial part of the computational load with the screener. In addition, the integrated approach results in improved target screener performance through moving target detection, which was demonstrated in the presence of significant platform motion. B.J. A81-32502 Moving target identification /MTI/ algorithm for passive sensors. R. D. Holben (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, Calif.). In: Electrooptical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980.

Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 165-172.

An algorithm has been developed to compensate for apparent background motion in images taken from a moving platform by a passive sensor. Correlation tracking over subregions in a scene is used to determine a model for the velocity changes in the entire scene. The algorithm was tested on three short sequences of infrared imagery taken from an airborne FLIR. Successful scene registration has been demonstrated for translation, scene growth, and spatially nonuniform rotation measured in the images. The method was also used to extract moving objects which are not detectable by simpler means. B.J.

A81-32504 Optics in metrology and quality assurance; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980. Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by H. L. Kasdan (Recognition Systems, Inc., Van Nuys, Calif.). Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 220), 1980. 202 p. Members, \$30; nonmembers, \$37.

Optical technology used in metrology and quality assurance is reviewed with reference to specific techniques and approaches, methods of distance, surface, and profile analysis, circuit inspection, and image processing. Papers are presented on computer image processing and recognition, techniques for evaluation of aircraft windscreen optical distortion, aircraft quality assurance using closerange photogrammetry, and image processing applications in nondestructive examination. V.L.

A81-32507 Techniques for evaluation of aircraft windscreen optical distortion. J. S. Harris, K. G. Harding, and S. H. Mersch (Dayton, University, Dayton, Ohio). In: Optics in metrology and quality assurance: Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 56-70. 29 refs.

Results of a program to experimentally evaluate existing techniques and develop new high-speed techniques for evaluation of optical distortion in aircraft windscreens are described. Present techniques for evaluation of aircraft windscreens' optical quality are based on grid board photography and point-by-point measurement of optical deviation errors. Experimental evaluation of the grid board techniques have shown them to be simple and easy to perform, but errors as large as 20 percent occur because of the associated data reduction. The approaches to point-by-point measurement of windscreen deviation errors provide high accuracy, but the time required to evaluate a single windscreen is typically eight to 24 hours. New techniques were studied, developed, and evaluated in order to permit real-time evaluation of aircraft windscreens. Two approaches described will provide the capability for high speed evaluation of windscreen optical distortion. These techniques utilize raster scanned laser probe beams in conjunction with retro-reflecting screens and holographic lenses. In addition to high-speed scanning techniques, a speckle photographic technique is described that can be used to evaluate binocular disparity in a transparent aircraft windscreen. (Author)

A81-32508 Aircraft quality assurance using close-range photogrammetry. G. L. Danielson (General Dynamics Corp., Fort Worth, Tex.). In: Optics in metrology and quality assurance; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980. Bellingham, Wash., Society of Photo-Optical

Instrumentation Engineers, 1980, p. 89-94. Possible applications of close-range industrial photogrammetry

as a basic metrology tool in support of airframe design, manufacture,

and quality control are discussed. Special reference is made to the direct linear transformation technique which establishes a direct linear relationship (ratio) between film plane coordinates and other space coordinates. Aside from dimensional integrity of production tooling, another short-range goal for photogrammetry is major assembly coordination, i.e., mating of primary aircraft sections. Some of the longer-term goals include: calibration of aircraft control surface position, proof load and deflection testing, and detailed parts inspection in conjunction with real-time optical scanners and image recognition devices. V.L.

A81-32521 \* # Quiet propulsive-lift technology ready for civil and military applications. J. A. Cochrane (NASA, Ames Research Center, Moffett Field, Calif.) and S. J. Queen (U.S. Naval Air Test Center, Patuxent River, Md.). Astronautics and Aeronautics, vol. 19, Apr. 1981, p. 42-45. 7 refs.

The Quiet Short-Haul Research Aircraft (QSRA) was designed as research aircraft for investigating terminal-area operations with an advanced propulsive-lift aircraft. The QSRA is a modified De Havilland C-8 Buffalo. The modification to the C-8 consisted of adding a new swept wing with four top-mounted Lycoming YF-102 turbofan engines to provide high levels of propulsive-lift through upper-surface blowing. The state of the art has reached the point where consideration can be given to various applications, including military transport aircraft, civil transports, and business jets. Attention is also given to a ground attack plane with QSRA, the payload advantage resulting from applying propulsive-life technology, and aspects of takeoff performance. G.R.

A81-32534 # Improvement of the imaging of moving acoustic sources by the knowledge of their motion. J. Hay (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). (Institute of Electrical and Electronics Engineers, International Conference on Acoustics, Speech and Signal Processing, Atlanta, Ga., Mar. 30-Apr. 1, 1981.) ONERA, TP no. 1981-17, 1981. 7 p. 7 refs.

An analytical and experimental study is presented showing that, due to a more precise definition of nonstationary noises of a certain class, and to the preprocessing of microphone signals (termed 'coherent dedopplerization'), one can obtain acoustic imaging for sources whose velocity is greater than may be processed by conventional methods without the generation of blurrs of the same order as the antenna field. A useful application of these techniques would be to two-dimensional antennas. O.C.

A81-32541 # Comparison of computed and measured unsteady pressure fields on a supercritical wing. M. Couston, J. J. Angélini, and J. L. Meurzec. (Cycle de Conférences, 81st, Rhode-Saint-Genèse, Belgium, Mar. 9-13, 1981. J ONERA, TP no. 1981-12, 1981. 29 p. 16 refs. Research sponsored by the Bundesministerium für Forschung und Technologie and Office National d'Etudes et de Recherches Aérospatiales.

Unsteady pressure fields for supercritical wings of transport aircraft were computed and then experimentally measured. A basic two-dimensional method was used to solve the nonlinear transonic small perturbation equation. A steady pressure field was generated by its parameters and the concept of unsteady three-dimensional induced incidence as evaluated by a three-dimensional doublet lattice calculation was introduced in the nonlinear method as a threedimensional correction. This correction was found to be adequate even when there were shock waves. If unsteady three-dimensional effects are not introduced, computed pressures are higher than experimental results. Viscosity is also significant. It is thought that the method can also deal with flutter as lifts and moments can be superimposed and show harmonic and linear characteristics. D.B.

A81-32547 \* # High temperature electronic requirements in aeropropulsion systems. W. C. Nieberding and J. A. Powell (NASA, Lewis Research Center, Cleveland, Ohio). NASA, DOE, and IEEE, High-Temperature Electronics Conference, Tucson, Ariz., Mar. 25-27, 1981, Paper. 3 p.

This paper discusses the needs for high temperature electronic and electro-optic devices as they would be used on aircraft engines in either research and development applications, or operational applications. The conclusion reached is that the temperature at which the devices must be able to function is in the neighborhood of 500 to 600 C either for R&D or for operational applications. In R&D applications the devices must function in this temperature range when in the engine but only for a moderate period of time. On an operational engine, the reliability requirements dictate that the devices be able to be burned-in at temperatures significantly higher than those at which they will function on the engine. The major point made is that semiconductor technology must be pushed well bevond the level at which silicon will be able to function. (Author)

A81-32549 \* # Factors which influence the behavior of turbofan forced mixer nozzles. B. H. Anderson and L. A. Povinelli (NASA, Lewis Research Center, Aerodynamics Analysis Section, Cleveland, Ohio). American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 19th, St. Louis, Mo., Jan. 12-15, 1981, Paper 81-0274. 28 p. 14 refs.

A finite difference procedure was used to compute the mixing for three experimentally tested mixer geometries. Good agreement was obtained between analysis and experiment when the mechanisms responsible for secondary flow generation were properly modeled. Vorticity generation due to flow turning and vorticity generated within the centerbody-lobe passage were found to be important. Results are presented for two different temperature ratios between fan and core streams and for two different free-stream turbulence levels. It was concluded that the dominant mechanisms in turbofan mixers is associated with the secondary flows arising within the lobe region and their development within the mixing section. (Author)

A81-32642 Application of the parameter space method to aerospace vehicle digital control system design. S. M. Seltzer (Control Dynamics Co., Huntsville, Ala.). *IEEE Transactions on Automatic Control*, vol. AC-26, Apr. 1981, p. 530-534. Grant No. DAAK40-78-C-0226.

The parameter space method is a technique for determining stability and dynamic characteristics of a control system in terms of several selected system parameters. The digital form of the technique requires that the system characteristic equation be available in the complex z-domain. The method is extended and applied to a model of a digitally controlled aerospace vehicle. (Author)

A81-32691 Maximum likelihood elevation angle estimates of radar targets using subapertures. B. H. Cantrell, W. B. Gordon, and G. V. Trunk (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *IEEE Transactions on Aercspace and Electronic Systems*, vol. AES-17, Mar. 1981, p. 213-221. 18 refs.

The paper considers the maximum likelihood estimation of the elevation angles of two closely spaced targets within the beamwidth. For an array divided into three subapertures, a simple closed form solution is obtained, the accuracy of which compares favorably with the maximum likelihood estimate that uses all the individual elements. Furthermore, since the complex reflection coefficient is estimated, the system can be used to characterize forward scatter. Simulation results are presented for the case of a radar target located over a smooth reflecting surface.

A81-32694 Accuracy of noise-modulated radio altimeter. S. A. El-Soud, E. Garas (Military Technical College, Cairo, Egypt), and I. M. El-Dokany (Menufia University, Menufia, Egypt). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-17, Mar. 1981, p. 248-253.

The operation of a noise-modulated radio altimeter is based on the dependence of the cross-correlation function of the random modulation (Gaussian noise) on the finite correlator bandwidth, the smoothing time, the effect of extraneous noise disturbance, and the change of altitude of the aircraft during measurement. An optimuum value of integration time is determined which minimizes the errors that enable the meter to measure short and very short distances. It is suggested that the correlation method of height measurement is sufficiently accurate to be used in systems of automatic aircraft landing. B.J. A81-32695 Application of endfire arrays at contemporary glide-slope problem sites. R. H. McFarland (Ohio University, Athens, Ohio). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-17, Mar. 1981, p. 261-270. 18 refs. Research sponsored by the Watts Antenna Co. and FAA.

It is shown that the endfire glide-slope system using slotted cables as radiating elements can provide a very high quality glide-slope structure for the user despite limited real estate for the transmitting system. An endfire glide-slope system has been successfully evaluated and tested at a problem site (Sweetwater County Airport, Rock Springs, Wyoming), using conventional image system transmitting equipment, including the second transmitter typically used for clearance with the capture-effect system. It is found that, unless spare monitor channels are available, it is necessary to time-multiplex sample signals for 'adequate monitoring of the relatively large aperture associated with the slotted-cable array. In addition, it is found that the endfire system produces a path in space that is completely compatible with contemporary airborne equipment. B.J.

A81-32696 Detection of target multiplicity using monopulse quadrature angle. S. J. Asseo (Northrop Corp., Hawthorne, Calif.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-17, Mar. 1981, p. 271-280. 5 refs. Research supported by Calspan Corp.

An analysis is presented of the feasibility of using the indicated quadrature angle of arrival of a monopulse radar to discriminate a single target from multiple targets, separated in angle within a radar resolution cell. The analysis is carried out for fixed and Rayleigh fluctuating targets, which cover a broad range of target characteristics. Detection and false alarm probabilities are determined analytically and the receiver operating characteristics are obtained for both fixed and fluctuating target cases. It is shown that multiple targets can be discriminated from a single target condition by integrating the indicated monopulse quadrature angle of arrival from several independent pulses. The probability of detecting multiple targets increases as the fluctuation in the target radar cross section decreases, approaching the fixed amplitude case in the limit. B.J.

A81-32697 Orientation of measurement sensors for optimum end-of-life performance. P. K. Mazaika (Aerospace Corp., Los Angeles, Calif.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-17, Mar. 1981, p. 281-287. 8 refs.

Relative orientations of onboard measurement sensors are derived that optimize end-of-life measurement accuracy in the worst case when all but three sensors have failed. For five and six sensors, the results are the well-known single-cone and dodecahedron configurations, respectively. New configurations are found for seven and eight sensors. The seven-sensor configuration is roughly described as six vectors lying unequally spaced on a cone with a half-angle of 61.2 deg while the seventh points 24.3 deg away from the cone axis. The eight-sensor configuration somewhat resembles a ten-sensor icosahedron arrangement with two sensors removed. The new configurations are at least 20% more accurate in end-of-life performance than previously proposed configurations, but are less accurate in the intermediate lifetimes when only two or three sensors have failed. B.J.

A81-32777 # Experimental investigation of oscillating subsonic jets. D. J. Collings, M. F. Platzer (U.S. Naval Postgraduate School, Monterey, Calif.), J. C. S. Lai, and J. M. Simmons (Queensland, University, Brisbane, Australia). In: Symposium on Numerical and Physical Aspects of Aerodynamic Flows, Long Beach, Calif., January 19-21, 1981, Proceedings. Long Beach, Calif., California State University, 1981. 10 p. 30 refs. Research supported by the Australian Research Grants Committee, University of Queensland, and U.S. Navy.

The entrainment mechanisms in turbulent jets and methods to increase the entrainment have been a subject of considerable basic and applied interest for many years. Recently, this problem has attracted increased attention because of the need to develop compact, yet highly efficient thrust augmenting ejectors for VSTOL applications. Several new techniques have been introduced or proposed to increase the jet entrainment, e.g. hypermixing, swirling, acoustic interactions, and unsteady jet flows. Measurements are described for two-dimensional turbulent free jets which are excited by forced vibration of a small vane located in the jet potential core. Mean velocity measurements using pitot tubes and hot wire or laser-doppler anemometry show significantly increased entrainment rates over the steady turbulent jet. Measurement details and the effect of various parameters, such as nozzle pressure ratio, amplitude and frequency of vane oscillation, are summarized. (Author)

A81-32779 \* # Fluid mechanics mechanisms in the stall process of airfoils for helicopters. W. H. Young, Jr. (NASA, Langley Research Center, Hampton, Va.). In: Symposium on Numerical and Physical Aspects of Aerodynamic Flows, Long Beach, Calif., January 19-21, 1981, Proceedings. Long Beach, Calif., California State University, 1981. 10 p. 19 refs.

Phenomena that control the flow during the stall portion of a dynamic stall cycle are analyzed, and their effect on blade motion is outlined. Four mechanisms by which dynamic stall may be initiated are identified: (1) bursting of the separation bubble, (2) flow reversal in the turbulent boundary layer on the airfoil upper surface, (3) shock wave-boundary layer interaction behind the airfoil crest, and (4) acoustic wave propagation below the airfoil. The fluid mechanics that contribute to the identified flow phenomena are summarized, and the usefulness of a model that incorporates the required fluid mechanics mechanisms is discussed. V.L.

A81-32825 \* # Concepts for improving the damage tolerance of composite compression panels. M. D. Rhodes and J. G. Williams (NASA, Langley Research Center, Structures and Dynamics Div., Hampton, Va.). U.S. Department of Defense and NASA, Conference on Fibrous Composites in Structural Design, 5th, New Orleans, La., Jan. 27-29, 1981, Paper. 42 p. 11 refs.

The results of an experimental evaluation of graphite-epoxy composite compression panel impact damage tolerance and damage propagation arrest concepts are reported. The tests were conducted on flat plate specimens and blade-stiffened structural panels such as those used in commercial aircraft wings, and the residual strength of damaged specimens and their sensitivity to damage while subjected to in-plane compression loading were determined. Results suggest that matrix materials that fail by delamination have the lowest damage tolerance, and it is concluded that alternative matrix materials with transverse reinforcement to suppress the delamination failure mode and yield the higher-strain value transverse shear crippling mode should be developed. O.C.

A81-32833 A microprocessor based land navigator. L. J. Little and J. Ingegneri (U.S. Army, Missile Laboratory, Redstone Arsenal, Ala.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 1. Research Triangle Park, N.C., Instrument Society of America, 1980, p. 77-82.

This paper presents the development of a microprocessor based land navigator. The navigator is to have the virtue of low cost, reliability, less mechanical parts, portable and minimum operator's effort. One gyro and one odometer are used as primary sensors. The former provides the heading information and the latter tracks the distance traveled. Using the microprocessor's rapid computation capability, the navigator gives the present position on a grid system, navigator's heading, distance traveled, and the distance-to-go for a given destination. (Author)

A81-32847 # Centralized in-place pressure calibration system for multiple turbine engine aerodynamic pressure measurement systems. W. N. Brock (ARO, Inc., Arnold Engineering Development Center, Arnold Air Force Station, Tenn.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 1. Research Triangle Park, N.C., Instrument Society of America, 1980, p. 353-360.

A81-32849 # An opto-electronic method for wind tunnel model alignment. C. B. Jett (ARO, Inc., Arnold Engineering Development Center, Arnold Air Force Station, Tenn.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 1. Research Triangle Park, N.C., Instrument Society of America, 1980, p. 379-392.

Application of optical sensors and fiber optics to the problem of aligning the store model with the carriage mechanism on the parent aircraft is discussed. The optical sensors tested included a sensor consisting of a gallium arsenide, infrared, light-emitting diode mounted with a silicone N-P-N phototransistor in a single plastic package; a sensor identical to the above except that a photodarlington circuit replaces the phototransistor; and an emitter-photodiode pair mounted in a locally designed and fabricated enclosure. The thermal stabilities and long-term amplitude stabilities of the phototransistor optical sensor and the fiber-optics sensor are found to be adequate for the application. V.L.

A81-32857 In-flight fatigue crack monitoring using acoustic emission. P. H. Hutton and J. R. Skorpik (Battelle Pacific Northwest Laboratories, Richland, Wash.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 2. Research Triangle Park, N.C., Instrument Society of America, 1980, p. 553-560. Research supported by the Department of Defence of Australia and DARPA.

A program has been designed to develop, fabricate, and use routinely in flight on a small high-performance jet aircraft a miniaturized acoustic emission (AE) monitor system to detect fatigue crack growth in aircraft structure during operation. AE detected during these tests has shown direct correlation with slow crack growth over the past year and a half. Analysis of AE results relative to sustained load versus varying load conditions suggests that continuous in-flight AE monitoring would be more effective than proof load monitoring in detecting subcritical cracks. V.L.

A81-32858 Microprocessor-based digital air data computer for flight test. R. M. Lundy and M. L. Roginsky (Lockheed-Georgia Co., Marietta, Ga.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 2.

Research Triangle Park, N.C., Instrument Society of America, 1980, p. 561-571.

This paper describes the development of a highly accurate airborne digital air data computer useful for general flight tests. This device has pressure inputs for aircraft static and aircraft total pressures, and analog voltage inputs for aircraft gross weight, free air temperature, and wing flap position. Its outputs consist of indicated and corrected altitude, airspeed, true airspeed, Mach number, and rate-of-climb. Its embedded microprocessor performs the conversions from pressure measurements to engineering parameters, and corrects for the position error and system lag that are inherent in the pressure system plumbing of the aircraft. The microprocessor software employs a sophisticated table look-up technique to solve the complicated mathematical formulae necessary for the instrument corrections. This paper includes an error analysis of the system.

#### (Author)

A81-32859 Measuring dynamic stresses on helicopter transmission gear teeth utilizing telemetry. R. F. McCann (Boeing Vertol Laboratory Operations and Electronics Test Engineering Laboratory, Ridley Township, Pa.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 2. Research Triangle Park, N.C., Instrument Society of America, 1980, p. 573-582. 5 refs.

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The implementation of a radio telemetry system for use in testing helicopter transmissions is discussed with reference to system design, transmitter tuning and installation, data acquisition system, and test data. It is shown that the use of telemetry to obtain gear tooth stresses from an operating helicopter transmission makes it possible to evaluate dynamic tooth load effects and actual tempera-

ture effects on gear stresses as well as gear resonance characteristics over the operating rpm range. \$V.L.\$

A81-32860 A flight test real-time GW-CG computing system. D. M. Brockman (Boeing Commercial Airplane Co., Seattle, Wash.). (n: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 2.

Research Triangle Park, N.C., Instrument Society of America, 1980, p. 583-589.

A real-time, distributed microprocessor system has been developed to compute gross weight and center-of-gravity for display (for test conduct) and recording (for postflight processing) on flight test aircraft. The various transducer-level processors (up to eight) are connected in a star configuration to a master processor by a simple, serial communications network. The system performance has been verified by extensive laboratory and flight testing and is now in routine service. (Author)

A81-32872 A mobile emissions laboratory for on-line analysis of combustion products from gas turbine engines. J. L. Mathason, R. C. Backer, and D. G. Gardner (United Technologies Corp., Pratt and Whitney Aircraft Group, West Palm Beach, Fla.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 2. Research Triangle Park, N.C., Instrument Society of America, 1980, p. 731-737.

A Mobile Emissions Laboratory for on-line analysis of combustion products from gas turbine engines is described. The Mobile Laboratory comprises a self-propelled, noise insulated vehicle equipped with an emissions measurement system, a data acquisition system and all support equipment necessary for performing accurate on-line emissions measurements. Special features of the facility and the supporting data system are presented. (Author)

A81-32874 # Development of a noninterference compressor blade stress measurement system. P. E. McCarty, J. W. Thompson, Jr., and R. S. Ballard (ARO, Inc., Arnold Engineering Development Center, Arnold Air Force Station, Tenn.). In: International Instrumentation Symposium, 26th, Seattle, Wash., May 5-8, 1980, Proceedings. Part 2. Research Triangle Park, N.C., Instrument Society of America, 1980, p. 745-757. 7 refs.

A noninterference technique for measuring stress in compressor blades of turbine engines is being developed to alleviate disadvantages associated with conventional strain-gage measurement systems. This technique utilizes blade-tip deflection measurements and special data-processing algorithms to infer local blade stress. A prototype noninterference processing system for inferring blade stress from a single compressor stage has been developed for blade vibrations nonintegral to engine speed. (Future efforts will address vibrations integral to engine speed). Blade stress amplitude and spectral information is displayed on conventional strain-gage-type displays, with which the blade stress analyst is intimately familiar. The prototype noninterference system with the nonintegral blade vibration data processing algorithm has been field validated by comparing the test results of the noninterference system and strain-gage blade stress data system during an aeromechanical test of a turbine engine instrumented with both strain gages and blade-tip deflection sensors. (Author)

A81-32886 # High frequency angular vibration measurements in vehicles. L. Sher and P. Merritt (USAF, Weapons Laboratory, Kirtland AFB, N. Mex.). American Astronautical Society, Annual Rocky Mountain Guidance and Control Conference, Keystone, Colo., Jan. 31-Feb. 4, 1981, Paper 81-024. 17 p. 8 refs.

The requirements for accurate and high-frequency response angular sensing in vehicles are examined. It is demonstrated that, in connection with the growth in the size of optical systems, it will not be sufficient any longer to provide devices for wide-bandwidth angular measurements, correlated about each axis. It will be necessary to conduct measurements at several locations of interest and to correlate the measurements from location to location. A description is given of results obtained with angular sensors capable of these measurements. The sensors have been used to measure several aircraft at the Air Force Weapons Laboratory. Attention is given to strapdown sensor errors, strapdown system level errors, the design of angular sensing devices, and information provided by measurements in vehicles. G.R.

A81-32909 # The impact of the All Electric Airplane on production engineering. M. J. Cronin (Lockheed-California Co., Burbank, Calif.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0848. 9 p. 22 refs.

The emergence of an All Electric Airplane in the role of an energy efficient transport is described in relation to the increasing fuel problems, which are impacting on the economic viability of the aerospace industry. The paper reviews the All Electric Airplane (which performs electrically all those functions normally powered by hydraulics, pneumatics and engine bleed air) for its impact upon the design/implementation of the aircraft systems, the advanced technology engines, the aircraft's ground-logistic support, and the producibility aspects of these advanced transport aircraft. The simplification of engine design and the prospective improvements in its specificfuel-consumption are highlighted along with the overall simplification of the aircraft production aspects of the All Electric Airplane. - --

(Author)

Control, navigation, and guidance. C. S. A81-32910 # Draper (Charles Stark Draper Laboratory, Inc., Cambridge, Mass.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0859. 16 p.

A comprehensive theoretical introduction is presented for the family of self-contained systems, providing control and navigation for vehicles that uses gyroscopic elements to maintain reference directions with respect to inertial space. In these, sensors for resultant gravity field and inertial reaction forces along input axes determine the vertical and linear velocities with respect to inertial space, which, divided by an equivalent earth radius, transfer the motion to earth coordinates in which integration gives location. Corrections for earth's rotation, projected in and perpendicular to the horizontal plane, are made as computed cosine and sine projections of the earth's angular velocity. Current systems based on these principles are routinely capable of fractional-miles-per-hour 0.0 accuracies.

Aircraft applications of titanium - A review of A81-32918 # the past and potential for the future. F. A. Crossley. American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0893. 14 p. 32 refs.

The historical development of the titanium alloys industry, its products, and their applications is related, and existing and prospective developments in alloy compositions, fabrication methods, and aerospace application of numerous components are discussed. Major problems encountered have been hydrogen embrittlement, sea water stress-corrosion, and low cycle fatigue under plane strain conditions, to which may be added current difficulties with long lead times and materials costs. The most attractive of the new alloys and advantages of their applications over competing alternatives are considered for next-generation aircraft component designs. 0.C.

A81-32920 # Advanced composites - Evolution of manufacturing technology. R. L. Rapson (USAF, Materials Laboratory, Wright Patterson AFB, Ohio). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0895. 10 p.

A detailed introduction is presented of the Automated Integrated Manufacturing System (AIMS) for advanced graphite-epoxy composite structures fabrication development. The purpose of the system is the demonstration of significant savings in labor costs, which have thus far been a major disadvantage. The recent incorporation of robotic laminating and drilling devices is also

2

discussed. It is concluded that the test facility will demonstrate not only reduced costs, but increased and more easily verifiable quality. O.C.

A81-32921 # Past and future trends in structures and dynamics. R. M. Bader, W. H. Goesch, and J. J. Olsen (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0896. 7 p.

An historical review and a series of prognostications based on current developments are presented for the fields of structural design and structural dynamics analysis. It is shown that while weight and cost reduction and improved durability have been the primary forces in structural technology development in the past, emphasis has shifted to such things as productivity, quality assurance, low observables for military aircraft and increased fuel efficiency. Prominent among recent advances in future developments are damage tolerance durability, computer-aided design, active flutter suppression, adhesive bonding of primary structures, cast aluminum structures, titanium and graphite-epoxy primary aircraft structures, aeroelastic tailoring composites, metal matrix composites, and radar-absorbing structures. O.C.

A81-32922 # Structural optimization - Past, present and future. G. N. Vanderplaats (U.S. Naval Postgraduate School, Monterey, Calif.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0897. 10 p. 60 refs.

A review is given of developments from the 1960s to date, and into the foreseeable future, of the use of numerical methods in structural optimization. It is shown that an automated structural synthesis technology already exists with which to efficiently design structures defined by several hundred design variables under multiple loading conditions and subject to sizing, stress, displacement, buckling, frequency and flutter constraints. Two recommendations are made for numerical method development: (1) the realization of computer codes incorporating a variety of state of the art algorithms, with a clear set of guidelines for their coding, testing and documentation; and (2) the development of algorithms for the efficient solution of large-scale nonlinear programming problems. O.C.

A81-32926 # Design of low powered aircraft, a philosophy for future personal sport aircraft. J. T. Monnett (Monnett Experimental Aircraft, Inc., Elgin, III.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0905 6 p.

An approach to design for low cost kit built personal aircraft accepting the challenges of airframe, fuel and production efficiency, FAA regulations, and the limits of the average home-builder is discussed. Methods of blending traditional construction techniques with advanced technology materials and new lightweight power plants toward the future development of a series of lightweight 'interchangeable modular component' kit aircraft are examined relative to the goals of such aircraft. (Author)

Jet aircraft design. D. J. Grommesh and R. E. A81-32930 # Etherington (Gates Learjet Corp., Wichita, Kan.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0912. 7 p.

The purpose of this paper is to trace the process of design of a business jet aircraft from conception through development and certification. The process involves determination of market and marriage of available engines and technology. Some systems design considerations that are the results of high altitude performance requirements are discussed. The effect of the certification process and certification requirements are reviewed. Finally, some observations toward future evolution will be discussed. (Author)

A81-32931 # Commuter aircraft design. R. E. McKelvey (Fairchild Swearingen Corp., San Antonio, Tex.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0913. 4 p.

The design of commuter aircraft is strongly influenced by conditions in demography, regulatory agencies, economic policies, fuel supply, and technology. Demand for safe and economical transportation to and from metropolitan areas emphasizes the necessity for throughly researched designs. Regulatory agencies continue to take active roles in passenger safety. Operating costs affect both current and potential commuter airlines, as do conditions in fuel producing countries. Interrelationships among these factors result in greater use of analysis in determining optimum commuter design criteria. Advances in design, analysis and technology will continue to make significant contributions to the growth of the commuter industry. (Author)

A81-32932 \* # Sun powered aircraft design. P. B. MacCready, P. B. S. Lissaman (AeroVironment, Inc., Pasadena, Calif.), W. R. Morgan (AeroVironment, Inc., Sun Valley, Calif.), and J. D. Burke (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12:14, 1981, Paper 81-0916. 14 p.

Two piloted aircraft have been developed and flown powered solely by photovoltaic cells in a program sponsored by the DuPont Company. The 30.8-kg (68-lb), 21.6-m (71-ft) span, Gossamer Penguin was used as a solar test bed, making a 2.6-km (1.6-mile) flight in August 1980. The 88.1-kg (194-lb), 14.3-m (47-ft) span Solar Challenger was developed for long flights in normal turbulence. Stressed to +9 G, it utilizes Kevlar, Nomex honeycomb-graphite sandwich wall tubes, expanded polystyrene foam ribs, and Mylar skin. With a 54.9-kg (121-lb) airframe, 33.1-kg (73-lb) propulsion system, and a 45.4-kg (100-lb) pilot, it flies on 1400 watts. In summer, the projected maximum climb is 1.0 m/s (200 ft/min) at 9,150 m (30,000 ft). Sixty purely solar-powered flights were made during winter 1980-1981. Using thermals, 1,070 m (3,500 ft) was reached with 115-minute duration. (Author)

A81-32933 # Aircraft design then and now. E. H. Heinemann (Heinemann Associates, Rancho Santa Fe, Calif.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0917.7 p.

An autobiographical account is given of important trends in the design of military and experimental aircraft, covering the period from 1927 to 1970. Stress is placed on such social aspects of design work as the gradual promotion of the most successful aeronautical engineers to administrative positions, the increasing costs of experimental and prototype aircraft development that prevents the emergence of such innovative designers as those of the older generation, an overemphasis on academic credentials that cannot directly reflect the true aptitude of an aircraft designer, and a strict adherence to the letter of requests for proposals rather than a determination to design beyond mere requirements. The A4 Skyhawk design, for example, weighed 14,600 pounds, yet met all had 100 mph greater speed. O.C.

A81-32934 # European approaches to transport aircraft design. R. H. Beteille (Airbus Industrie, Blagnac, Haute-Garonne, France). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display of Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0926. 12 p.

An historical account is presented of the unique-development path taken by European transport aircraft shaped by the economic, political and military experiences of the European aircraft industries since before the First World War. Among the aircraft reviewed are such early designs as the Breguet 14T, Junkers F.13, and Fokker F.11; airliners of the 1920s such as the Farman Goliath, A.W. 155 Argosy, Leo 213 and Fokker FVII-3m; among trimotors, the Junkers Ju 52, S.M. 73, and Dewoitine D.338; modern transports such as the Fiat G.18V, Bloch 220 and Fw 200A Condor; and the Viscount and Fokker F.27 turboprops and first-generation Comet, Caravelle and BAC 111 jet airliners of the 1950s. The value of exerience with the first SST, the Concorde, is touched upon, and the extensive and more economically realistic development program of the multinational Airbus is discussed. O.C.

A81-32935 # Army aviation A perspective into the eighties. R. D. Kenyon (U.S. Army, Washington, D.C.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0931. 6 p.

A brief review of Army Aviation, which came into its own during the Vietnam conflict, is presented. Army Aviation elements are employed with the intent of optimizing the ability of the ground commander to accomplish his mission to close with and capture or destroy the enemy, and to gain hold of the terrain. The Army aircraft fleet consists of over 8,000 aircraft, about 90% of which are helicopters. A brief description of the aircraft is given, including scout/observation helicopters, attack helicopters, utility helicopters (the Sikorsky UH-60A Black Hawk provides the Army with greatly enhanced speed, payload, and flexibility), cargo helicopters, and electronic warfare aircraft (the RV-1D Quicklook aircraft can detect and identify hostile radar). Attention is given to research and development in areas such as lightweight composites, rotors and fuel efficient engines, and to the modernization program begun in the 1970's. The Army has set design parameters for new aircraft which include features to facilitate loading, transporting, and unloading of aircraft when using strategic air or sea lift for deployment; and it is developing the capability to self-deploy helicopters in Europe. K.S.

A81-32937 # Lecnnology growth in mini-RPV systems. G. F. Christensen (U.S. Army, Aviation Research and Development Command, St. Louis, Mo.), F. D. Schnebly, and R. J. Niewald (Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0936. 8 p.

A review is presented of the technological evolution of the mini-RPVs (weighing 100 to 300 lbs and flying at low subsonic speeds) being developed for the U.S. Army. The initial mini-RPV activities utilized remotely controlled models as a basis for their aerodynamic configuration, engines, and radio link for command and control. The Aequare, developed in 1973-1974, included such technological improvements as an aerodynamic configuration in which the wings were telescoped and rotated to stow in a pod, and the use of elevators and rudders in a rear propeller duct for control. The Acquila target acquisition and reconnaissance system, initiated by the Army in 1974, to determine the feasibility and utility of a mini-RPV system for future Army missions, consisted of a ground control station, an air vehicle, a launcher, and a recovery system. The current Aquila development, begun in September, 1979, is a militarized version of the earlier Aquila system with greater emphasis on mobility, reliability, and maintainability, having additional performance capabilities for meeting mission requirements in target location accuracy, target designation, and enhanced survivability. The impact of technology on air vehicle structure, propulsion system, electrical power requirements, navigation, guidance and flight control system, and payloads is discussed. In the future, the RPV may be used for harassment missions or to carry ECM equipment for radar or communications jamming. K.S.

A81-32939 # The art of designing experimental aircraft - An overview. P. H. Poberezny (Experimental Aircraft Association, Hales Corners, Wis.). American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display on Frontiers of Achievement, Long Beach, Calif., May 12-14, 1981, Paper 81-0944. 8 p.

The history of the homebuilt aircraft movement is surveyed, with attention given to the changing technology, the need to adjust to dwindling but more expensive aviation gasoline supplies, and the effect of the search for alternate lightweight materials and energy sources on safety factors relating to aircraft design. Emphasis is placed on the basic craftsmanship required to sustain the experimental aircraft movement into the future. Predictions are made of the design characteristics of tomorrow's sport, racing, and recreational aircraft.

A81-32999 Airborne electronic displays. G. H. Hunt (Royal Aircraft Establishment, Flight Systems Dept., Farnborough, Hants., England). *IEE Proceedings, Part A - Physical Science, Measurement and Instrumentation, Management and Education, Reviews*, vol. 128, pt. A, no. 4, May 1981, p. 225-243. 79 refs.

The paper reviews available and potentially promising display technologies and the possible integration of electronic displays into the total avionic systems. It is shown that improvements in on-board data processing relieves the crew of much routine monitoring. The efforts of the crew can therefore be directed to displays requiring more intelligence in design and interpretation of usage of applied symbology. The complexity of the human visual system is analyzed, taking into consideration the physical characteristics of the eye itself, and the perceptual mechanisms of the eye and brain together as an optical sensor and interpreter of visual images. The electronic display devices described include monochrome and color CRTs, digitally addressed CRTs, besides a range of solid-state matrix and alphanumeric displays, both emissive and reflective. Additionally, image intensifiers for use in night operations are discussed. Some displays reviewed incorporate optical elements for magnification, collimation and image combination, and the use of both refractive and diffractive optical techniques. Integration of electronic displays with digital data highways in the design of future complete display systems is considered one of the greatest potential advantages. F B

A81-33047 Helicopter vibration control - A survey. G. Reichert (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany). (Royal Aeronautical Society, Society of British Aerospace Companies, and University of Bristol, European Rotorcraft and Powered Lift Aircraft Forum, 6th, University of Bristol, Bristol, England, Sept. 16-19, 1980.) Vertica, vol. 5, no. 1, 1981, p. 1-20. 44 refs.

The complexity of the helicopter vibration problem and the procedures necessary for considering vibration throughout the development phase are presented. The stringent vibration requirements of modern helicopters necessitate special methods and devices to control and reduce vibration to an acceptable level. A review of past, current and future possibilities and methods for reducing helicopter vibrations is given, including structural optimization of the rotor and the whole helicopter, blade and rotor pendulum absorbers, rotor isolation concepts following the antiresonance principle (nodal isolation), and also the possibilities of active isolation devices. In the whole field, the helicopter industry has obtained a broad experience from special test programs as well as from new development programs with installed antivibration devices. Vibration will always remain a helicopter problem. There are effective means of reducing the levels, but vibration specifications must be realistically determined to avoid excessive weight penalties and development costs.

(Author)

A81-33049 Transonic rotor noise - Theoretical and experimental comparisons. F. H. Schmitz and Y. H. Yu (U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.). (Royal Aeronautical Society, Society of British Aerospace Companies, and University of Bristol, European Rotorcraft and Powered Lift Aircraft Forum, 6th, University of Bristol, Bristol, England, Sept. 16-19, 1980.) Vertica, vol. 5, no. 1, 1981, p. 55-74. 17 refs.

Two complementary methods of describing the high-speed rotor noise problem are discussed. The first method uses the second-order transonic potential equation to define and characterize the nature of the aerodynamic and acoustic fields and to explain the appearance of radiating shock waves. The second employs the Ffowcs Williams and Hawkings equation to successfully calculate the acoustic far-field.

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Good agreement between theoretical and experimental waveforms is shown for transonic hover tip Mach numbers from 0.8 to 0.9.

(Author)

A81-33050 \* A Galerkin type finite element method for rotary-wing aeroelasticity in hover and forward flight. F. K. Straub and P. P. Friedmann (California, University, Los Angeles, Calif.). (Royal Aeronautical Society, Society of British Aerospace Companies, and University of Bristol, European Rotorcraft and Powered Lift Aircraft Forum, 6th, University of Bristol, Bristol, England, Sept. 16-19, 1980.) Vertica, vol. 5, no. 1, 1981, p. 75-98. 24 refs. Army-supported research; Grant No. NsG-1578.

A Galerkin finite element method for the spatial discretization of the nonlinear, nonselfadjoint, partial differential equations governing rotary-wing aeroelasticity is presented. This method reduces algebraic manipulative labor significantly when compared to the global Galerkin method based on assumed modes. Furthermore, the Galerkin finite element method is ideally suited to treat rotor blades with discontinuous mass and stiffness distribution and structurally redundant configurations as they appear in bearingless rotors. Implementation of the method is illustrated for the coupled flap-lag aeroelastic problem of hingeless rotor blades in hover and forward flight. Numerical results for stability and response illustrate the numerical properties and convergence behavior of the method. It is concluded that the Galerkin finite element method is a practical tool for solving rotary-wing aeroelastic stability and response problems.

(Author)

A81-33149 SIMCAT - A modular air traffic control simulator. G. Denancé (Thomson-CSF, Paris, France). The Controller, vol. 20, Mar. 1981, p. 5-8.

A modular aiç traffic control simulator (SIMCAT), used as a teaching aid in the training of future air traffic controllers and refresher training for operational controllers is discussed. The design principles of SIMCAT are treated from the educational and technical point of view, providing realistic situation capabilities during training, resembling those during high density traffic and peak periods at the control tower. The system is programmable, and all data required can be stored, retrieved, and modified at any time. Details on the control consoles equipped with radar screens, the pilot positions, and the central unit are given. E.B.

A81-33150 The use of airspace - One way to save fuel. J. S. Savage. *The Controller*, vol. 20, Mar. 1981, p. 9-11, 13.

An apparent disagreement between airlines and pilots on the topics of optimal fuel consumption and the present use of airspace is discussed from the viewpoint of a pilot. The problems are seen mostly in terms of restrictions imposed upon the pilot by Air Traffic Services and the Performance Management Systems of Airlines. Some requirements for an ideal flight and economic use of airspace and fuel are briefly outlined. They include: (1) air traffic control clearance to be given before the engine is started; (2) take-off, climb-out, and descent to be as unrestricted as possible; (3) initial cruise at optimum level for fuel economy and access to higher levels as weight is reduced; (4) freedom to deviate from track to avoid weather build-ups. To economize fuel consumption a complete redesigning of airways and the introduction of one-way airways in areas of high traffic density is proposed. Comparative data are given to support the proposal with regard to actual fuel cost savings during climb and descent phases and cruising, E.B.

A81-33168 Method for evaluating the resistance of gasturbine installation disks to thermal cycling. L. B. Getsov, M. G. Kabelevskii, V. K. Dondoshanskii, O. F. Cherniavskii, A. E. Ginzburg, L. I. Stoliarova, and E. F. Cherniaev (Tsentral'nyi Nauchno-Issledovatel'skii Institut Tekhnologii i Mashinostroeniia, Moscow; Cheliabinskii Politekhnicheskii Institut, Chelyabinsk, USSR). (Problemy Prochnosti, Sept. 1980, p. 46-53.) Strength of Materials, vol. 12, no. 9, May 1981, p. 1105-1113. 9 refs. Translation.

Various aspects are considered of the methods used for numerical determinations of disk resistance to thermal cycling. The results for disk cyclic tests are compared with calculated data. The methods include disk evaluation by adaptability theory, evaluation of irreversible disk strains, evaluation of conditions for crack formation at the rim, and evaluation of crack propagation rate. It is contended that the problem of disk damage connected with low-cycle or thermal fatigue can be solved only through an approach involving several methods. C.R.

A81-33169 Thermoplastic strengthening of a gas-turbine engine disk lock joint - Determination of the residual stresses. B. A. Kravchenko, G. N. Gutman, L. E. Batrin, and V. G. Fokin (Kuibyshevskii Politekhnicheskii Institut, Kuibyshev, USSR). (Problemy Prochnosti, Sept. 1980, p. 54-56.) Strength of Materials, vol. 12, no. 9, May 1981, p. 1113-1116. Translation.

A unit is created for investigating thermoplastic strengthening of turbine disk lock grooves in special imitator samples. A method is then developed for determining the residual stresses at the bottom of a disk lock groove with consideration given to the influence of the cutting of a sample. The residual stresses occurring in lock grooves after various thermoplastic strengthening cycles are investigated on disk imitators. C.R.

A81-33173 Efficiency of the methods and algorithms used for estimating the reliability in aviation techniques. A. K. Ianko (Kiivs'kii Institut Inzheneriv Tsivil'noi Aviatsii, Kiev, Ukrainian SSR). (Problemy Prochnosti, Sept. 1980, p. 102-106.) Strength of Materials, vol. 12, no. 9, May 1981, p. 1169-1175. 5 refs. Translation.

The various methods and algorithms used in estimating the generalized exponential distribution (GED) are compared in order to work out practical recommendations for selecting the most efficient method for estimating the reliability in aviation technique. The required analytic relationships are derived and algorithms are developed for estimating the parameters of the GED by applying the method of moments, the method of quantiles, and the method of maximum probability. The efficiency of the algorithms is determined by applying the method of numerical statistical modeling, which requires the derivation and application of an algorithm formulating the sequential statistics of the GED. C.R.

A81-33174 Increasing the strength properties of sheet parts by explosive forming of them with optimization of the production parameters. V. K. Borisevich, S. N. Solodiankin, V. P. Sabel'kin, and V. I. Isaenko (Khar'kovskii Aviatsionnyi Institut, Kharkov, Ukrainian SSR). (Problemy Prochnosti, Sept. 1980, p. 113-116.) Strength of Materials, vol. 12, no. 9, May 1981, p. 1184-1188. 8 refs. Translation.

A method is presented of promoting an increase in the strength properties of sheet parts by explosive forming with optimization of production parameters. This approach makes it possible to incorporate, even in the design stage, a substantial increase in strength properties. It is pointed out that explosive forming makes it possible to obtain parts with a high surface quality and in a single piece without breaks and welded and riveted joints. C.R.

A81-33245 # On St. Venant flexure and torsion problem for symmetrical airfoil sections. K.-F. Wang (Fudan University, Shanghai, Communist China). Acta Mechanica Solida Sinica, Nov. 1980, p. 218-233. In Chinese, with abstract in English.

The St. Venant torsion and flexure problem of a cantilever beam comprising a series of symmetrical airfoil cross sections and loaded at the free end perpendicular to the plane of symmetry is treated. A mathematical form assigned to the cross sectional shape is derived through the inversion of a hyperbola. The form contains a single parameter k for adjusting the thickness of the airfoil. It is noted that an exact solution was obtained by Stevenson (1938) for the case of k = 1 and that Lin and Whitehead (1951) obtained a torsion function for the case where k = 2. An exact solution was obtained by Lin (1956) for the case in which k is a positive integer. Here, an exact solution is obtained for the case where k is a positive rational number. C.R.

A81-33281 # Experimental study of the separation at the trailing edge of an axisymmetrical contoured after-body. J.-L.

Solignac (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). (La Recherche Aérospatiale, May-June 1980, p. 205-211.) La Recherche Aérospatiale (English Edition), May-June 1980, p. 65-71. Translation.

External flow separation upstream of the trailing edge of a profiled body has been experimentally analyzed on an axisymmetric afterbody. The aerodynamic field has been investigated with various measuring means: pressure probes, hot wires, laser velocimeter. These measurements were supplemented by visualizations. The overall results have made it possible to define the structure of the mean flow and characterize turbulence properties in the separation and the adjacent mixing zones. Furthermore, a special study has been devoted to the low frequency unsteady aspects which are seemingly associated with the generation of large turbulent structures in the mixing zone of the internal flow. (Author)

A81-33285 # O.N.E.R.A. ramjet test facilities. P. Berton and D. Regard (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). (La Recherche Aérospatiale, July-Aug. 1980, p. 241-258.) La Recherche Aérospatiale (English Edition), Aug.-Sept. 1980, p. 25-44. Translation.

Complementary ramjet test facilities have been built at Palaiseau near Paris (basic tests and component development) and at Modane in the Alps (industrial and synthesis tests). At Palaiseau, five benches are devoted to tests ranging from new configurations to technical assistance to industry in developing an operational missile. At Modane, the S4 supersonic wind tunnel has been modified to allow the testing of an actual ramjet missile scale model with its solid propellant booster. B.J.

A81-33288 # Contribution to the study of non stationary signals emitted by moving jet engine - Application to special analysis and imaging, I. J. Hay and M. Ernoult (Electricité de France, Clamart, Hauts-de-Seine, France). (La Recherche Aérospatiale, July-Aug. 1980, p. 283-296.) La Recherche Aérospatiale (English Edition), Aug. Sept. 1980, p. 69-82. 32 refs. Translation.

In order to install microphones closer to the trajectory of a swiftly moving noise source and deduce the directivities comparable to those measured in the far field but less sensitive to propagation conditions, a special class of nonstationary random processes has been studied. Conventional short time spectral analysis is discussed (periodogram smoothing and autoregressive model evaluation), and a time frequency spectrum is defined which is shown capable of giving back the correct results of the stationary case (far field). Knowing the motion of the source helps in improving the spectral resolution and particularly the spatial resolution of a synthetic antenna. The so-called 'de-Dopplerization' signal processing provides resolutions similar to those obtained in static tests. Some results of experiments on a point source and a jet are given to illustrate these reflections.

(Author)

A81-33291 # Pressure distribution computation on a nonlifting symmetrical helicopter blade in forward flight. J.-J. Chattot and J.-J. Philippe (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). La Recherche Aérospatiale (English Edition), no. 5, 1980, p. 19-33. 15 refs. Research supported by the Direction des Recherches, Etudes et Techniques.

Three dimensional unsteady transonic flows past helicopter rotor blades are analyzed. A computer program solving the threedimensional unsteady transonic small disturbance equation is described in detail. It can be applied to a blade of almost arbitrary geometry in the case of a non-lifting rotor. The numerical results are compared with experimental data as well as computations made at RAE and NASA. Finally, another example of application of the code is presented concerning a new blade tip which results in weaker transonic phenomena on the advancing blade. (Author)

A81-33293 # A new method for modal identification. G. Coupry (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). La Recherche Aérospatiale (English Edition), no. 5, 1980, p. 51-56.

Modal identification of a structure has always been based on the phase criterion technique, which imposes the choice of an excitation

configuration for which no phase shift appears between the different responses at resonance. The method proposed here is completely new - it defines an iterative process that determines an excitation configuration that 'blocks' all the modes, except one which is then isolated. The generalized mass and damping are measured by smoothing the response to this excitation by a least squares technique based on a one-degree-of-freedom model. The method was evaluated on the occasion of the ground vibration testing of two airplanes. The quality of the results has been proved by calculating, with the help of these generalized parameters, the response to a one point excitation, and by comparing this with actual results. (Author)

A81-33294 # Contribution to the study of non-stationary signals emitted by moving jet engines - Application to spectral analysis and imaging. II. J. Hay (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) and M. Ernoult (Electricité de France, Centre de Recherche, Clamart, Hauts-de-Seine, France). La Recherche Aérospatiale (English Edition), no. 5, 1980, p. 57-73. 32 refs.

An examination of the nonstationary noise spectrum for the class of quasi-stationary and quasi-white processes has made it possible to deal with more strongly nonstationary signals than usually possible in the study of flyover noises, thereby making it possible to bring the microphone closer to the trajectory of the noise source. A time frequency spectrum is defined, which can give the correct results of the stationary case (far field). Spectral resolution, particularly the spatial resolution of a synthetic antenna, can be improved by information on the motion of the source. Dedopplerization static tests. Results of experiments on a point source and a jet are presented. K.S.

A81-33673Study of a propulsive system (Etude d'un<br/>système propulsif). G. Couchet. Journal de Mécanique, vol. 20, no. 1,<br/>1981, ρ. 169-178. 5 refs. In French.

Adaptable planar systems have been defined as mechanical systems comprising a wing profile moving in a perfect incompressible fluid which are capable of functioning in irrotational flow. The present paper discusses the conditions under which such systems may lead to propulsive systems. The existence of adaptable systems with time-dependent connections is demonstrated, and examples of adaptable systems with null circulation around the profile are presented. The formation of a turbulent wake is then considered, and it is shown that if circulation around the profile is positive but at rest at infinity, the wake will exert force on the profile and propulsion will result.

A81-33687 # Dynamic errors of the Kalman filtering of trajectory parameters (Dinamicheskie pogreshnosti Kalmanovskoi fil'tratsii parametrov traektorii). N. F. Vollerner and V. M. Lavrinchuk. *Radioelektronika*, vol. 24, Apr. 1981, p. 75-80. 7 refs. In Bussian.

An analysis is presented of dynamic errors arising during the discrete Kalman filter tracking of nonlinearly varying parameters. Errors arising in the filtering of the coordinates and trajectories of radar-tracked objects are evaluated. It is shown that dynamic errors can be commensurate with statistical errors in the case of the uniform rectilinear motion and maneuvering of the tracked objects.

A81-33696 # Propeller and wing (Vint i krylo). M. Arlazorov. Moscow, Izdatel'stvo Znanie, 1980. 192 p. In Russian.

The evolution of ideas, concepts, and designs in the field of aviation is traced through five centuries, starting from the 15th century to the present times. Attention is given to the history of the helicopter which dates back to the designs by Leonardo da Vinci. Emphasis is placed on the history of aircraft construction in the USSR, including the development of the IL line and MIG fighter aircraft. V.L.

A81-33700 # Bonded laminated structures in aircraft manufacture (Sloistye kleenye konstruktsii v samoletostroenii). V. N. Krysin. Moscow, Izdatel'stvo Mashinostroenie, 1980. 232 p. 19 refs. In Russian.

The book deals with the design, fabrication and applications of bonded laminated structures in aircraft industry. The topics discussed include: classification of bonded laminated structures, their cost, theory of adhesion, adhesives used, bonding technology, honeycomb structures and their mechanical properties, and methods of quality assurance. V.L.

A81-33717 \* # Vortex-flow aerodynamics - An emerging design capability. J. F. Campbell (NASA, Langley Research Center, Subsonic-Transonic Aerodynamics Div., Hampton, Va.). Astronautics and Aeronautics, vol. 19, May 1981, p. 54, 56, 58.

Promising current theoretical and simulational developments in the field of leading edge vortex-generating delta, arrow ogival wings are reported, along with the history of theory and experiment leading to them. The effects of wing slenderness, leading edge nose radius, Mach number and incidence variations, and planform on the onset of vortex generation and redistribution of aerodynamic loads are considered. The range of design possibilities in this field are consequential for the future development of strategic aircraft, supersonic transports and commercial cargo aircraft which will possess low-speed, high-lift capability by virtue of leading edge vortex generation and control without recourse to heavy and expensive leading edge high-lift devices and compound airfoils. Attention is given to interactive graphics simulation devices recently developed. O.C.

A81-33718 # The rise of air and space. R. P. Hallion. Astronautics and Aeronautics, vol. 19, May 1981, p. 64-77, 87.

An historical account is given of the development of aeronautical and astronautical engineering, with emphasis on the economic, political, and military influences on creative contributors and the preeminent role played by U.S. researchers and constructors. The current economic importance of aerospace industries and the transformation of the energy climate are in conclusion stressed as the focus of national attention and effort. O.C.

A81-33736 # Finite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane. Z. Dzygadlo and J. Blaszczyk. *Journal of Technical Physics*, vol. 21, no. 3, 1980, p. 349-366. 11 refs.

The dynamic model of an aircraft considered by Dzygadlo and Blaszczyk (1977) is generalized. Deformable parts of the aircraft are made discrete by introducing one-dimensional finite elements. It is assumed that the aircraft is composed of rigid parts and deformable units. Attention is given to the formulation of the problem, equations for the deformable units, equations of motion for the rigid parts of the aircraft, dynamic and kinematic coupling conditions, frequency equation, natural modes, and numerical analysis. The computational method used for the numerical analysis was implemented with the aid of an Algol program. The correctness of algorithm and program were tested by performing a number of computations for a hypothetical aircraft with uniform mass and rigidity distribution along the deformable assemblies. G.R.

A81-33789 Is it safe - The safety assessment of aircraft systems. IV - Methods, techniques, and organisation. W. Tye and T. Lloyd. Aircraft Engineering, vol. 53, Apr. 1981, p. 2-4.

Essential aspects of satisfactory safety assessment methods are discussed with the formulation of a complete definition of the system to be analyzed seen as a preliminary step. It is noted that the identification of possible hazards arising from failure conditions determine the extent of necessary test programs. Revealed hazards are then compared to the permissible risk levels quoted in the safety requirements for instruments and equipment of the aircraft. Numerical calculations, using probability methods, are suggested when doubt exists whether a given system will comply with the 'Catastrophic Effect' requirements. The two most frequently used methods in failure analysis, 'top-down' and 'bottom-up', are mentioned, and the dependence diagram, converted engineering drawings, and the Fault Tree are recommended as aids in determining the consequences of combined failures. A technique called Zonal Analysis, helpful in organizing the search for potential risks, is discussed in detail. The formation of a separate safety assessment group to advise the main design groups is suggested as an important aspect in the coordination of the work of safety assessment. E.B.

A81-33790 Maintenance tomorrow and the day after. E. A. Green and A. W. Turner (Lockheed-California Co., Burbank, Calif.). (International Aircraft Maintenance Engineering Exhibition and Conference, Zurich, Switzerland, Feb. 11-13, 1981.) Aircraft Engineering, vol. 53, Apr. 1981, p. 5-15. 12 refs.

The impact of an accelerated introduction of alternate fuels, such as synthetic hydrocarbon and cryogenic fuels, is discussed and possible effects on airline fleets, design modification plans, and maintenance are analyzed. Global availability, environmental suitability, and technical and economical feasibility are mentioned as criteria determining the choices of future alternate fuels. The characteristics of two of the most promising cryogenic fuels, liquid methane (from coal or oil shale) and liquid hydrogen (from coal and water), are compared and the latter reviewed in terms of fuel system design, maintenance, service, facilities, and equipment. The analysis suggests that from the environmental pollution and safety points of view, liquid hydrogen is seen as the more promising choice as a long-term fuel for transportation, while liquid methane is considered a better choice for industrial purposes. Current long-range aircraft will continue to serve until replaced by aircraft using cryogenic fuel while the shorter-range aircraft will be replaced with more advanced types using new propulsion systems, new materials, and greatly simplified subsystems, but still running on syniet fuel. In the interim, avionic system changes and airframe modification programs are seen to dominate the field. F.B.

A81-33844 # A new method of airfoil flutter control (Nowa metoda syntezy ukladu sterowania flatterem profilu). J. Pietrucha and Z. Szewczyk. *Mechanika Teoretyczna i Stosowana*, vol. 18, no. 4, 1980, p. 577-586. 13 refs. In Polish.

The theory of modal control was applied to the synthesis of an active flutter suppressor under the assumption of linear unsteady aerodynamics. The linearity and stability of the flutter control system were demonstrated by Jones' approximation of Wagner's function.

A81-33868 Bearing wear detection using radioactive iron-55 tagging, J. A. Alcorta, J. H. Mohn (United Technologies Corp., Pratt and Whitney Aircraft Group, West Palm Beach, Fla.), and L. L. Packer (United Technologies Research Center, East Hartford, Conn.). American Society of Lubrication Engineers, Annual Meeting, 36th, Pittsburgh, Pa., May 11-14, 1981, Preprint 81-AM-6A-3. 8 p. 13 refs. Contract No. F33615-78-C-2008.

A tagging technique, using the iron-55 radioisotope (chosen for its low-energy X-ray emissions, long half-life, and the isotope homogeneity), for the detection and simultaneous locating of initial wear of oil-wetted turbine engine mainshaft bearings, has been developed and tested in a simulated gas turbine engine bearing environment. Two state-of-the-art high-speed bearing rollers were modified prior to irradiation to ensure the desired distress mode of the rig, and two levels of wear were introduced. A description and analysis of the test are presented, including oil analysis, wear metal debris recovery, and nuclear measurements of the metal debris. No neutron irradiation effects on the metallurgical properties, such as grain size and hardness, were observed. It was concluded that the tagging method allows identification of tagged rollers experiencing abnormal wear at the plus or minus 0.5 part per million iron level.

A81-33876 # Future U.S. jet fuels - A refiner's viewpoint. K. H. Strauss (Texaco, Inc., Beacon, N.Y.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0770. 7 p. 6 refs.

Future trends in jet fuel quality are examined in terms of available refinery charge stocks and competition with other products. The processing requirements of differing alternative crude sources are reviewed, highlighting the problem of hydrogen availability for anticipated processing. The role and impact of alternatives to petroleum crudes are reviewed and the resultant effect on jet fuel quality is presented. Increasing competition for middle distillates and decreasing competition for lighter naphtha fractions is pointed out as is the importance of balancing jet fuel quality against aircraft and engine development and operating costs. Continuing research to develop information for such studies is recommended. (Author)

A81-33877 # Airliner maintenance for fuel efficiency. D. J. Goldsmith (Eastern Airlines, Inc., Miami, Fla.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0787. 8 p. 10 refs.

A review is presented of the measures, related to the maintenance of aircraft hardware rather than the modification of operational habits, which airlines may use to lower fuel consumption. The program presented covers four main areas: (1) the accurate calibration of flight instruments, especially the airspeed indicator/ Machmeter and altimeter; (2) reductions of empty weight, through the use of lighter cabin materials and cargo containers, and by dispensing with exterior paint; (3) reduction of airframe drag, by means of careful control surface rigging and greater skin smoothness; and (4) the minimization of engine specific fuel consumption (SFC) deterioration, through the increase of clearances in turbine sections and aerodynamic degradation of compressor sections. O.C.

A81-33878 # Prop-Fan technical progress leading to technology readiness. B. S. Gatzen and W. M. Adamson (United Technologies Corp., Hamilton Standard Div., Windsor Locks, Conn.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0810. 18 p. 74 refs.

It is noted that a potential exists for saving six billion gallons of commercial aviation fuel in the 1990's provided the remaining technology readiness programs are accelerated to permit timely industry development of new Prop-Fan propulsion and aircraft systems starting in the mid-1980's. The basis of the fuel savings potential is presented, as is the status of the technology readiness. A summary is given of the remaining unresolved issues and the programs required for Prop-Fan technology readiness. It is pointed out that installation aerodynamics and source noise can be adequately resolved with the small-scale programs already in progress. A large-scale rotor program is considered necessary to make the Prop-Fan industrially viable. C.R.

A81-33879 # Federal policies affecting airport noise compatibility programs. J. E. Wesler (FAA, Washington, D.C.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0829.5 p. 5 refs.

Airport noise compatibility programs as affected by federal policies are discussed, and local planning and control to mitigate residual noise impacts are investigated. Three concepts proposed by the Federal Aviation Administration (FAA) as part of the federal plan to combat airport noise, are analyzed. They stipulate control of noise at its source - the aircraft, local controls over the use of aircraft at each airport, and the use of land around airports which is left to local authorities. Source-noise control and limitations through a series of regulations are reviewed. New regulations, describing the procedures, standards, and methodology for the development, submission and review of airport noise exposure maps and airport noise compatibility programs are metioned. E.B.

A81-33882 \* # Designing for aircraft structural crashworthiness. R. G. Thomson (NASA, Langley Research Center, Hampton, Va.) and C. Caiafa (FAA Technical Center, Atlantic City, N.J.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0803. 10 p. 32 refs. This report describes structural aviation crash dynamics research activities being conducted on general aviation aircraft and transport aircraft. The report includes experimental and analytical correlations of load-limiting subfloor and seat configurations tested dynamically in vertical drop tests and in a horizontal sled deceleration facility. Computer predictions using a finite-element nonlinear computer program, DYCAST, of the acceleration time-histories of these innovative seat and subfloor structures are presented. Proposed application of these computer techniques, and the nonlinear lumped mass computer program KRASH, to transport aircraft crash dynamics is discussed. A proposed FAA full-scale crash test of a fully instrumented radio controlled transport airplane is also described.

(Author)

A81-33883 # Energy modeling for aviation fuel efficiency. B. P. Collins (Mitre Corp., McLean, Va.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0789. 11 p. 10 refs. U.S. Department of Transportation Contract No. RS57-80C-00103.

The use of the energy balance concept in the analysis and determination of energy-efficient flight path profiles is treated as a classical optimal control problem. An optimal energy path is initially planned, based on anticipated flight path conditions. Once the journey along the planned path is started, feedback information indicative of both progress and encountered flight conditions allows the updating of a dynamic future optimal plan and, in some cases, a modification of the optimal policy. This concept is embodied in a set of equations that can be used to analyze the energy efficiency of propeller and turbojet aircraft during various operating conditions. The set of equations, and turbojet fuel flow equations for idle throttle setting and maximum thrust. O.C.

A81-33884 # Fuel conservation integrated into airline economics. D. R. Ferguson (Eastern Airlines, Inc., Miami, Fla.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0831, 7 p. 7 refs.

A method is proposed for determining the value of time to input into the least cost method of computer flight planning that will optimize the fuel-time trade-offs available over the planning time horizon. It provides a consistent yardstick for achieving consistency in all regimes of flight, between different aircraft types, and across a wide range of wind, temperature and weight conditions. K.S.

A81-33885 # Some design and procedural aspects of inflight collision avoidance. T. K. Vickers. AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0805. 8 p.

This paper presents an overview of the requirements for an in-flight collision avoidance system, and some of the basic problems relating to its implementation. The evolution of the FAA's ground-based approach to collision avoidance, leading to the development of DABS/ATARS and the airborne beacon collision avoidance system (BCAS) is described. The possible roles of BCAS are discussed, with emphasis on the procedural aspects. (Author)

A81-33886 # Rolls-Royce RB 211-535 power plant. D. J. Pickerell (Rolls-Royce, Ltd., Derby, England). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0807. 10 p.

This paper describes the derivation of the RB 211-535 power plant as a fuel efficient intermediate thrust size engine for short haul twin-engined aircraft. It traces the basic -535C from its conception giving a low risk engine with 25% better fuel burn than existing engines in this category, through to engine certification this year and service in 1983. The paper then describes the later version of the engine, the -535E4, generated in response to the increasing importance of fuel burn as oil prices and scarcity increase. This engine

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maintains the proven background of the RB 211 family but incorporates further advanced technology giving rise to additional fuel burn improvements and thrust growth potential. By using some of this thrust growth it is shown that this engine is capable of powering existing medium haul wide body trijets to produce fuel burn savings of 10%. (Author)

A81-33887 # An aircraft manufacturer's view of airport R&D needs. B. R. Hoy and M. L. Schoen (Douglas Aircraft Co., Long Beach, Calif.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0793. 5 p.

In view of escalating aircraft delay costs at airports, the fact that many U.S. airports are nearing their saturation capacity, and the possibility of reducing environmental impact and increasing passenger service and safety, a series of recommendations is made regarding research and development of advanced airport designs. Among the measures called for are: (1) a better understanding of the relationship between the physical and operational characteristics of aircraft and airport airside geometrics; (2) a better understanding of the economic impacts caused by airport environmental and weather constraints and future aircraft design requirements; (3) more efficient airport planning; (4) the elimination of duplicate research efforts; (5) improved determination of aircraft design criteria taking increased safety for aircraft and passengers as a focus of research.

0.C.

A81-33889 # CFM56-3 high by-pass technology for single aisle twins. N. Epstein (CFM International, Evendale, Ohio). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0808.8 p.

Key design details and the program to develop and certificate (in 1983) the CFM56-3 engine, recently selected by airlines to power the new Boeing 737-300, are presented. A historical overview, beginning with the CFM56-2 engine, is given, key milestones prior to the certification are projected, and current and potential applications of the CFM56-3 engine are shown. Key design features include 20,000 lb thrust, 60 in. diameter, 5.1 bypass ratio, 4,278 lb weight, 93.0 in. length, cruise performance at 25,000 ft and 0.72 Mach, low noise characteristics, and fuel burn improvement. At the time the CFM56-3 engine enters service, the CFM56 engines will have completed 18,000 hours of factory testing, 36,000 extra severity endurance cycles, 30,000 hours of core testing, and extensive abusive tests. K.S.

A81-33890 # Increasing capacity at Paris airports. A. L. Haines and R. M. Harris (Mitre Corp., McLean, Va.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0802. 6 p. 5 refs.

Mitre conducted a study of instrument approaches to Charlesde-Gaulle and Le Bourget Airports. The solution to the existing conflicting approach patterns was to design triple parallel approaches jointly to the two airports. The analysis of these approaches considered factors of surveillance, navigation, communication, airspace design, and control procedures. The recommended solutions illustrate application of several new concepts for parallel approaches. These include use of triple approaches, coordination between airports, use of other than Instrument Landing System (ILS) guidance, slightly converging flight paths, and a final turn to runway aligned course. (Author)

A81-33891 # Airport capacity enhancement by innovative use of runway geometry. A. L. Haines and A. N. Sinha (Mitre Corp., McLean, Va.). AIAA, SAE, ASCE, ATRIF, and TRB, International Air Transportation Conference, Atlantic City, N.J., May 26-28, 1981, AIAA Paper 81-0801. 6 p. 21 refs. U.S. Department of Transportation Contract No. FA01-81-C-0001.

Enhancement of airport capacity by new approaches in the use of runway geometry are explored, and requirements for varying concepts, such as dependent alternating parallel arrivals, triple parallel and converging approaches, are analyzed. Estimates of expected capacity benefits in the application of new approaches at 30 air carrier airports are presented. It is noted that annual airline delay costs, caused by airport congestion, exceed 1 billion dollars. A long term relief plan, provided by technology and high capital options, should include all phases of aircraft flow to the airport, with regard to integrated flow management, configuration management systems, reductions in instrument flight rules final approach spacing, specialized microwave landing system application, and multiple instrument flight rules operations. Criteria are discussed for multiple arrival streams to counteract the critical capacity problems during arrival processes at major U.S. airports, and specifications in the use of multiple arrival runway geometry are schematically presented.

E.B.

A81-33923 # The optimal lift-drag ratio of a civil aircraft (Finesse optimale d'un avion civil). Ch. Saulas (Avions Marcel Dassault-Breguet Aviation, Vaucresson, Hauts-de-Seine, France). Association Aéronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-35. 37 p. In French.

The optimization of civil aircraft lift-drag ratios is considered in terms of the polar curve relating the lift coefficient to the drag coefficient. Various experimental and comparative methods for obtaining the polar are discussed, and a model for polar calculation is presented which is based on analyses of the contributions of aircraft form, friction, interactions, roughness, equilibrium, elliptical, nonelliptical, separation and wave drag to the total drag, and the variation of these contributions as a function of lift. Means for optimizing the lift-drag ratios for each particular component of the aircraft are then examined, with attention given to the lifting surfaces, fuselage, pylonnacelle assembly and aircraft as a whole. It is concluded that although gains in lift-drag ratio for current aircraft may be slight, they would be advantageous. A.L.W.

A81-33927 # Study of the characteristics of a base-vented wing in nonlinear theory (Etude des caractéristiques d'une aile à base ventilée en théorie non linéaire). C. Pellone and A. Rowe (Grenoble, Institut de Mécanique, Grenoble, France). Association Aéronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-40. 27 p. 20 refs. In French. Direction des Recherches, Etudes et Techniques Contract No. 78-490.

A numerical method is developed for the nonlinear problem of two-dimensional supercavitating flow past a base-vented wing of simple geometry. The nonlinearity made it necessary to use an iterative procedure; good convergence was achieved. The extension of the method to the three-dimensional case is considered. B.J.

A81-33928 # Generalized active control - Its potential and directions of research (Contrôle actif généralisé: Potentialités - Axes d'efforts). Y. Negre. Association Aéronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-29. 21 p. In French.

The concept of generalized active control is defined, and the technical and economic possibilities of this technique are considered with particular reference to applications in transport aircraft and in such short-term areas as instability control, load control, and wing camber control. The research undertaken by Aérospatiale in these various areas is considered. B.J.

A81-33931 # Investigation of instantaneous distortions in air intakes at high angles of attack (Etude des distorsions instationnaires dans les prises d'air à forte incidence). G. Laruelle (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). Association Aéronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-38. 36 p. In French. Research supported by the Direction des Recherches, Etudes et Techniques.

Instantaneous distortions arising in compressor inlet sections play an important role in the characterization of internal flow in air intakes because of their effect on engine performance; engine compressor stall is generally related to the onset of strong distortions. This paper describes flow visualizations and wind tunnel tests conducted by ONERA to investigate instantaneous distortion in air intakes. Particular attention was given to the characterization of the flow in a cylindrical air intake at angle of attack, and the simulation of instantaneous distortion in static conditions. B.J.

A81-33933 # Improvement of the energy efficiency of helicopters (Amélioration du bilan propulsif d'un hélicoptère). J. Gallot (Société Nationale Industrielle Aérospatiale, Marignane, Bouches-du-Rhône, France). Association Aeronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-33. 19 p. 15 refs. In French.

Ways in which aerodynamic design can improve the energy efficiency of present-day helicopters are examined. Methods discussed include minimization of helicopter drag, improvement of engine air-intake operation, and optimization of the aerodynamic design of the main rotor. These aerodynamic improvements have been applied to the new generation of helicopters, with the SA 365N considered as an example. These improvements make it possible to increase helicopter energy efficiency by 30 percent at the present time, with an additional increase of 20 percent expected in the next decade.

B.J.

A81-33936 # Propellers for economic flight at high speeds (Hélices pour vol économique à grandes vitesses). J.-M. Bousquet (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). Association Aéronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-34. 28 p. 23 refs. In French. Research supported by the Direction des Recherches, Etudes et Techniques and Direction Générale de l'Aviation Civile.

Results of studies by the NASA-ATP (from 1976 on) and the ONERA-Aérospatiale programs for design and performance of transonic propeller blades are presented. Efficiencies of turboprops, turboreactors, and prop-fans are compared, and NASA studies are shown to indicate 80 percent efficiency for a Mach 0.8 prop-fan, with a 10-15 percent improvement in fuel efficiency over turboprops, using a thin profile, reinforced composite, multibladed configuration. ONERA is examining prop-fans to improve aerodynamic and acoustic codes for the purpose of testing a 1:5.4 scale model in the Modane S1 wind tunnel, where six different composites, drag forces through pressure measurements, wakes in stable and unstable modes, and fuselage panel behavior will be tested. D.H.K.

A81-33937 # Global optimization of a glider (Optimisation globale d'un planeur). M. Collard. Association Aéronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-36. 23 p. In French.

Improvements to the design of gliders which have resulted in remarkable performances in the areas of distance, velocity, and power efficiencies obtained are discussed. Attention is given to developments in the fields of wing profiles, induced drag, fuselage configurations, empenages and ballasting for unfavorable weather conditions, with particular emphasis on aerodynamic properties. It is concluded that present-day technology has arrived at a level of perfection difficult to surpass, and the advent of motorized gliders, which would represent a significant savings in the fuel required to reach altitude, is noted. A.L.W.

A81-33943 # Aerodynamic trials with the linear motordriven platform at the Toulouse Aeronautic Testing Center (Essais aérodynamiques avec la plate-forme à moteur linéaire du Centre d'Essais Aéronautique de Toulouse). J.-P. Vaunois (Toulouse, Centre d'Essais Aéronautique, Toulouse, France) and Mr. Januel. Association Aéronautique et Astronautique de France, Colloque d'Aérodynamique Appliquée, 17th, Grenoble, France, Nov. 12-14, 1980, Paper NT 80-41. 35 p. In French. A streamlined, linear induction motor-powered underground rail platform, equipped with a central, rectangular, gradually cambered planform, an electronic trailing edge damper, and longitudinal guides is described. Uses for hydrodynamics, shell and antenna tests at high speeds, for research complementary to wind tunnel and catapult experiments, and for fighter arrest barrier studies are listed. The reversible synchronous motor has a maximum power of 6,000 daN, consumes 2 MW from 0 to 100 Hz at 0 to 5,000 V, and uses 10 kWh for a trial run of 40 m/s, one-half that of the S5 wind tunnel. Its use for take-off and landing acceleration and deceleration studies are expressed and the addition of an arm to support models plus the installation of a gust generator will allow tests of inclination angles at various battlefield conditions. D.H.K.

A81-33948 Analysis of axial fan noise with the help of the Lowson formalism (Analyse du bruit des ventilateurs axiaux à l'aide du formalisme de Lowson). J. P. Bridelance. Association Aéronautique et Astronautique de France, Colloque d'Acoustique Aéronautique, 7th, Lyons, France, Nov. 4, 5, 1980, Paper NT 80-54. 28 p. 7 refs. In French. Research supported by the Délégation Générale à la Recherche Scientifique et Technique.

Slow rotation velocity, high lift profile blades are studied as a means of reducing specific acoustic power, shown in empirical studies of axial fans and helicopter blades to be highly correlated with rotational speed. Results for a new blade design are compared with classic axial fans for flow, pressure, efficiency, and noise. The Lowson method is used to extend Lighthill's (1952) work on acoustic fields generated by constant speed rotors, to rotors under acceleration. The source is considered as a point on the blades undergoing periodic fluctuations due to upstream turbulence, definable by a Fourier series, and the acoustic emissions result from unstable changes whose amplitude depends on the order of the Bessel function. D.H.K.

A81-33949 Broadband helicopter rotor noise (Bruit largebande des rotors d'hélicoptères). A. Damongeot (Société Nationale Industrielle Aérospatiale, Division Hélicoptères, Marignane, Bouchesdu-Rhône, France). Association Aéronautique et Astronautique de France, Colloque d'Acoustique Aéronautique, 7th, Lyons, France, Nov. 4, 5, 1980, Paper NT 80-58. 16 p. 14 refs. In French.

A method is proposed for the calculation of the broadband noise emitted from a helicopter rotor on the basis of the investigation and modeling of the source region. The method involves the measurement of the intensity of the pressure fluctuations induced at the wall of the wing profile by the turbulent boundary layer, which was performed for two NACA 0012 profiles with large chords in a low-velocity subsonic wind tunnel in the incompressible regime, and in the compressible regime at higher velocities. The measured wall pressure spectra are then reduced with respect to the local boundary layer displacement, allowing the representation of wall pressure spectra for profiles with arbitrary chords, Mach numbers, operating Reynolds numbers and angles of attack by a single curve. Convection rates and correlation lengths are also obtained. The Lowson formulation is then used to calculate the noise emitted by the fluctuating load distributions, and results are shown to be in good agreement with experimental noise measurements made for the metal-bladed SA 330 rotor. A.L.W.

A81-33950 Analysis of total and static pressure fluctuations in an air intake at high incidence (Analyse des fluctuations de pression totale et statique dans une entrée d'air à grande incidence). J. Delville and M. Bouriot (Poitiers, Université, Poitiers, France). Association Aéronautique et Astronautique de France, Colloque d'Acoustique Aéronautique, 7th, Lyons, France, Nov. 4, 5, 1980, Paper NT 80-61. 36 p. 15 refs. In French. Direction des Recherches, Etudes et Techniques Contract No. 79-515.

The paper presents studies of pressure fluctuations in turbulent flow at low speed gathered by microphones placed in the flow at incidence angles of 20, 30, and 40 deg. Results are given for the 30 deg readings and dynamic pressure fluctuation measurements are compared with those taken by hot wire techniques. Graphs of the rms fluctuations are given for dynamic and static pressure and the probability density functions of the dynamic pressure are compared with the probabilities of velocity fluctuations. It was found that the zone of maximum fluctuation is characterized by intermittent forces translated by a flatness coefficient of 18, and near the end of the test channel the PDF approached a normal distribution. D.H.K.

A81-33952 \* # Acoustic performance evaluation of an advanced UH-1 helicopter main rotor system. D. R. Hoad and D. A. Conner (NASA, Langley Research Center, Structures Laboratory, Hampton, Va.). American Helicopter Society, Annual Forum, 37th, New Orleans, La., May 17-19, 1981, Paper 81-58. 10 p. 14 refs.

An experimental investigation of the high-speed impulsive noise characteristics of an advanced main rotor system for the UH-1 helicopter has been conducted. Models of both the advanced main rotor system and the UH-1 main rotor system were tested at one-quarter scale in the Langley 4- by 7-meter (V/STOL) Tunnel using the General Rotor Model System (GRMS). Tests were conducted over a range of simulated flight and descent velocities. The tunnel was operated in the open-throat configuration with acoustic treatment to improve the acoustic characteristics of the test chamber. In-plane acoustic measurements of the high-speed impulsive noise demonstrated a 7 to 8 dB reduction in noise generation is available by using the advanced rotor system on the UH-1 helicopter. (Author)

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# STAR ENTRIES

N81-22000\*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.

#### **INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY** AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 1980

Robert W. Simpson In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 3-4

Avail: NTIS HC A07/MF A01 CSCL 01B

Several technological aspects governing air transportation at maior airports were investigated. Three major areas were emphasized: (1) development of automated decision making for dynamic scheduling of runway operations at a major airport; (2) flight evaluation of the performance of low cost Loran C receivers; and (3) design of microcomputer based electronic flight displays for general aviation aircraft. R.C.T.

N81-22001\*# Massachusetts Inst. of Tech., Cambridge. MIT ANNOTATED BIBLIOGRAPHY

In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 5-11

Avail: NTIS HC A07/MF A01 CSCL 01B

A bibliography is presented which covers a wide variety of navigation, guidance, control, and display research. Fifteen citations are included. R.C.T.

N81-22002\*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.

### USE OF LORAN-C FOR GENERAL AVIATION AIRCRAFT NAVIGATION

Krishnan Natarajan In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 13-18 refs (Grant NGL-22-009-640)

Avail: NTIS HC A07/MF A01 CSCL 17G

Quantitative and qualitative observations were made on the Loran-C in general aviation aircraft. The evaluation of Loran-C for both cross country flights and nonprecision approaches was conducted under simulated instrument flight rules conditions. Particular emphasis was placed on the reliability and failure of Loran-C equipment as well as its susceptibility to atmospheric effects such as P static. Efforts were made to quantify the long term stability of the Loran-C time difference grid. Several E field antenna configurations were also evaluated in terms of performance. Significant results are reported. R.C.T.

N81-22003\*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.

### AN ANALYSIS OF THE ADAPTABILITY OF LORAN-C TO AIR NAVIGATION

James A. Littlefield In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 19-42

(Grant NGR-36-009-017)

Avail: NTIS HC A07/MF A01 CSCL 17G

The sources of position errors characteristics of the Loran-C navigation system were identified. Particular emphasis was given to their point on entry as well as their elimination. It is shown that the ratio of realized accuracy to theoretical accuracy of the Loran-C is highly receiver dependent. R.C.T.

N81-22004\*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab:

THE P/POD PROJECT: PROGRAMMABLE/PILOT ORIENT. ED DISPLAY

James A. Littlefield In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 43-50

Avail: NTIS HC A07/MF A01 CSCL 09B

A pilot orientated display system was developed for general aviation aircraft in order to reduce cockpit workloads. Emphasis was placed on the optimization of flight procedural aspects (i.e., interpretation of Loran data). Low cost hardware/software were utilized in the system to reduce developmental costs. Parallel development, and testing were conducted on the ground (simulator) and in the air using the same hardware. R.C.T.

N81-22005\* Ohio Univ., Athens. Avionics Engineering Center

### INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT OHIO UNIVERSITY, 1980

Richard H. McFarland In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 53-73 refs

Avail: NTIS HC A07/MF A01 CSCL01C

Specific configurations of first and second order all digital phase locked loops were analyzed for both ideal and additive Gaussian noise inputs. In addition, a design for a hardware digital. phase locked loop capable of either first or second order operation was evaluated along with appropriate experimental data obtained from testing of the hardware loop. All parameters chosen for the analysis and the design of the digital phase locked loop were consistent with an application to an Omega navigation receiver although neither the analysis nor the design are limited to this application. For all cases tested, the experimental data showed close agreement with the analytical results indicating that the Markov chain model for first and second order digital R.C.T. phase locked loops are valid.

N81-22006\*# Ohio Univ., Athens. Avionics Engineering Center

### RESULTS OF A LORAN-C FLIGHT TEST USING AN ABSOLUTE DATA REFERENCE

Joseph P. Fischer In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 75-90 refs

Avail: NTIS HC A07/MF A01 CSCL 17G

A closed circuit flight test was conducted using VORs and NDBs as reference points. The Loran-C data collected during the flight was then compared against a reference provided by a discrete address beacon system facility. Information on the equipment configuration in the aircraft, the flight procedure, and the results obtained are presented. R.C.T.

N81-22007\*# Ohio Univ., Athens. Avionics Engineering Center

### **MICROCOMPUTER PROCESSING FOR LORAN-C**

Robert W. Lilley, Daryl L. McCall, and Stanley M. Novacki, III In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 97-100

### Avail: NTIS HC A07/MF A01 CSCL 17G

Schematic diagrams are presented for the microcomputer processing for Loran-C. Diagrams are included for the following: microcomputer Loran-C loop improvements; Loran-C receiver commutated AGC; and dc-dc power supply R.C.T.

N81-22008\*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

### INVESTIGATION OF AIR TRANSPORTATION TECHNOLOGY AT PRINCETON UNIVERSITY, 1980

Robert F. Stengel In NASA, Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 107-113 refs

Avail: NTIS HC A07/MF A01 CSCL 01C

Several aspects of air transportation technology are discussed. The following are included: evaluation of an OMEGA-dead reckoning hybrid navigation system; implementation of a microprocessor controlled flight research ground station: investigation of fuel use characteristics of general aviation aircraft; investigation of a dead reckoning concept incorporating a fluidic
rate sensor; experimentation related to ultrasonic altimetry; and concept development for a laser based collision avoidance system. RCT

N81-22009\*# Princeton Univ., N. J.

LASER BEACON COLLISION AVOIDANCE SYSTEMS L, M. Sweet, R. B. Miles, E. Wong, and M. Tomeh In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 115-122

#### Avail: NTIS HC A07/MF A01 CSCL 17G

The development objectives for a laser beacon collision avoidance system are outlined. A system suitable to general aviation aircraft is briefly described. MG.

## N81-22010\*# Princeton Univ., N. J.

DEAD RECKONER NAVIGATION PROJECT R. Ellis and L. Sweet In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res. 1980 Mar. 1981 p 123-130

Avail: NTIS HC A07/MF A01 CSCL 17G

A previous dead reckoner involved a classical gyrocompass. a Hewlett-Packard minicomputer, and a true airspeed sensor. In an effort to bring the cost of this system more in line with the realities of general aviation, recent work was done on replacing the minicomputer with a microcomputer and implementing a fluidic rate sensor in the compass system in place of the directional E.D.K. gyro.

#### N81-22011\*# Princeton Univ., N. J.

#### GENERAL AVIATION AIRPLANE FUEL ECONOMY SYSTEM MODEL

L. Sweet and H. Curtis In NASA. Langley Research Center Joint Univ. Program for Air Transportation Res., 1980 Mar. 1981 p 133-142

Avail: NTIS HC A07/MF A01 CSCL 01C

The aerodynamic characteristics which affect the fuel consumption of general aviation aircraft are outlined. All data are presented in the form of graphs. R.C.T.

#### N81-22015\*# Mississippi State Univ., Mississippi State AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAM-ICS AND COOLING OF A HORIZONTALLY OPPOSED AIR-COOLED AIRCRAFT ENGINE INSTALLATION Final Report

Stan J. Miley (Texas A and M Univ., College Station), Ernest J. Cross, Jr. (Texas A and M Univ., College Station), John K. Owens, and David L. Lawrence (Turbo West Corporate Aircraft Center, Broomfield, Colo.) Washington NASA Mar. 1981 152 p refs

#### (Grant NsG-1083)

e.

(NASA-CR-3405) Avail: NTIS HC A08/MF A01 CSCL 01A A flight-test based research program was performed to investigate the aerodynamics and cooling of a horizontally-opposed engine installation. Specific areas investigated were the internal aerodynamics and cooling mechanics of the installation, inlet aerodynamics, and exit aerodynamics. The applicable theory and current state of the art are discussed for each area. Flight-test and ground-test techniques for the development of the cooling installation and the solution of cooling problems are presented. The results show that much of the internal aerodynamics and cooling technology developed for radial engines are applicable to horizontally opposed engines. Correlation is established between engine manufacturer's cooling design data and flight measurements of the particular installation. Also, a flight-test method for the development of cooling requirements in terms of easily measurable parameters is presented. The impact of inlet and exit design on cooling and cooling drag is shown to be of major significance. Author

N81-22016\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PRESSURE AND FORCE DATA FOR A FLAT WING AND A WARPED CONICAL WING HAVING A SHOCKLESS RECOMPRESSION AT MACH 1.62

David S. Miller, Emma Jean Landrum, James C. Townsend, and William H. Mason, (Grumman Aerospace Corp, Bethpage, N.Y.) Apr. 1981 333 p refs

(NASA-TP-1759: L-13856) Avail: NTIS HC A15/MF A01 CSCL 10A

A conical nonlinear flow computer code was used to design a warped (cambered) wing which would produce a supercritical expansion and shockless recompression of the crossflow at a lift coefficient of 0.457, an angle of attack of 10 deg, and a Mach number of 1.62. This cambered wing and a flat wing the same thickness distribution were tested over a range of Mach numbers from 1.6 to 2.0. For both models the forward 60 percent is purely conical geometry. Results obtained with the cambered wing demonstrated the design features of a supercritical expansion and a shockless recompression, whereas results obtained with the flat wing indicated the presence of crossflow shocks. Tables of experimental pressure, force, and moment data are included, as well as selected oil flow photographs. E.D.K.

#### N81-22023# ILC Industries, Inc., Frederica, Del.

AIR FORCE GEOPHYSICS LABORATORY AERODYNAMIC-ALLY TETHERED BALLOON, 45,000 CUBIC FEET Final Report, Feb. 1973 - Jun. 1979

G. P. Durney and R. W. Lawrence Hanscom, AFB., Mass. AFGL Dec. 1980 103 p refs (Contract F19628-73-C-0155; AF Proj. 6665)

(AD-A096758; AFGL-TR-80-0367) NTIS Avail: HC A06/MF A01 CSCL 04/1

An empennage ripstop fabric of combined Kevlar and pre-heat set Dacron yarns, and a hull fabric which is a biaxially woven fabric stabilized with an oriented non-woven polyester fabric, were developed. A 45,000 cu. ft. balloon was designed, fabricated and tested. The new material is suitable for construction of balloons in the 100,000 cu. ft. range. The hull fabric developed on this program was later scaled-up and is currently used in USAF 250,000 cu. ft. Seek Skyhook Aerostats. GRA

N81-22029# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Entwurfsaerodynamik.

COMPUTATION OF PRESSURE DISTRIBUTION ON THE DFVLR WING-BODY MODEL BY THE PANEL METHOD

Romesh Kumar Jain (National Aeronautical Lab.), Guenter Redeker, and Syed Rafeeq Ahmed Nov. 1979 36 p refs Sponsored in part by DAAD, Bonn

(DFVLR-FB-80-02) Avail: NTIS HC A03/MF A01

The panel method is based on a discrete singularity distribution. The complete surface of a given configuration is divided into a large number of plane quadrilateral or triangular panels and the singularity strength on each of these panels is obtained as a solution of an integral equation. A control point is selected on each panel in order to satisfy the boundary condition. Viscous effects are shown very important for supercritical wings having a large amount of rear loading, and the need to modify the panel method to include boundary layer calculations is highlight-Author (ESA) ed.

N81-22031\*# Battelle Columbus Labs., Mountain View, Calif. A REVIEW OF IN-FLIGHT EMERGENCIES IN THE ASRS **DATA BASE** Final Report

Richard F. Porter 3 Apr. 1981 25 p

(Contract NAS2-10060)

(NASA-CR-166166) Avail: NTIS HC A02/MF A01 CSCL 01C

A series of 154 in-flight emergencies as reported to the Aviation Safety Reporting System are described. The various types of emergencies are examined and an attempt is made to determine the human errors and other factors associated with each incident, as well as the measures taken to resolve the emergency. It is concluded that nearly one half of those emergencies reported were related to failure or malfunction of aircraft subsystems. Of all the emergencies, nearly one quarter were essociated with power plant failure. Other frequently encountered emergency types are associated with operation in instrument meteorological conditions without appropriate clearance or qualification, and with low fuel state situations. Human error is prominently featured in many of the incidents, appearing in the actions of pilots and air traffic controllers.

N81-22032<sup>●</sup># Systems Control, Inc., West Palm Beach, Fla. Technology Industries Div.

CANDIDATE CDTI PROCEDURES STUDY Final Report R. E. Aca Hampton, Va. NASA. Langley Research Center

Jan. 1981 80 p refs

(Contract NAS1-16247)

(NASA-CR-165673) Avail: NTIS HC A05/MF A01 CSCL 01C

A concept with potential for increasing airspace capacity by involving the pilot in the separation control loop is discussed. Some candidate options are presented. Both enroute and terminal area procedures are considered and, in many cases, a technologically advanced Air Traffic Control structure is assumed. Minimum display characteristics recommended for each of the described procedures are presented. Recommended sequencing of the operational testing of each of the candidate procedures is presented. S.F.

N81-22033# Boeing Military Airplane Development, Seattle, Wash.

ANALYSIS OF EJECTION SEAT STABILITY USING EASY PROGRAM, VOLUME 1 Final Report, May 1979 - Sep. 1980

Christopher L. West, Brian R. Ummel, and Roger F. Yurczyk Wright-Patterson AFB, Ohio AFWAL Sep. 1980 691 p refs (Contract F33615-79-C-3407; AF Proj. 2402) (AD-A096597; AFWAL-TR-80-3014-Vol-1) Avail: NTIS

(AD-A096597) AFWAL-1R-80-3014-Vol-1) AVail: NTIS HC A99/MF A01 CSCL 01/3

High performance combat aircraft have extended the maneuvering/operating range into regimes that exceed the capabilities of current ejection seat systems. One of the problems encountered involves the unstable rotational characteristics of the typical ejection seat, resulting in a decreased probability of survival due to the reorientation of the ejecting crewmember into an attitude less tolerant to acceleration. Furthermore, an unstable election seat may neither clear the airframe, nor provide adequate ground clearance. The capability to simulate the trajectory of an escape system, and to determine its stability characteristics using classical stability and control methods, is required to enhance the development of both active and passive stability augmentation systems. The objective of this development effort was to develop an ejection seat classical stability analysis capability by incorporating SAFEST computerized simulation subroutines into the EASY program standard component library. The resultant computer program described in this User Manual/ document is EASY and SAFEST Integration for the Evaluation of Stability and Trajectory (EASIEST). Volume 1 is a 'stand-alone' user manual describing the EASIEST program characteristics and complete information on the use of the program and how to apply it to ejection seat dynamics and control analysis. It contains listings of the procedure files, models, analysis, standard components, and subroutines. Volume 2 is Boeing proprietary and contains only the source code listings of EASY 5. GRA

N81-22034# Air Force Academy, Colo. Dept. of Mathematical Sciences.

#### AN INVESTIGATION OF TWO SAFE ESCAPE FROM BASE FLIGHT PROFILES Final Report

Robert A. Rappold Jan. 1981 24 p refs (AD-A096571; USAFA-TR-81-3) Avail: NTIS HC A02/MF A01 CSCL 01/2

This research establishes two base case scenarios for 'safe escape' profiles for large conventional aircraft. The profiles considered were: (1) a constant altitude dash, and (2) a constant airspeed climb. The flight profile modeling assumed the aircraft had first reached a safe maneuvering airspeed and altitude. Other assumptions were consistent with aerodynamic and pilot limitations and operational considerations. The governing differential equations of motion are derived and the Runge-Kutta numerical solution technique applied. GRA

N81-22035# Air Force Armament Lab., Eglin AFB, Fla.

VELOCITY TOLERANCE OF ESCAPE SYSTEMS Final Report, 1977 - 1979

C. D. Gragg 1 Dec. 1980 28 p refs

(AF Proj. 9993)

(AD-A096881; AD-E800237: AD-TR-80-59) Avail: NTIS HC A03/MF A01 CSCL 01/3

Eighty-four (84) Air Force escape system tests were analyzed for velocity tolerance. The target velocity should not be stated in terms of per cent. This practice has led to some serious under testing of maximum velocities. The velocity tolerance is essentially independent of the magnitude of the velocity. A velocity tolerence of plus/minus 23.5 KEAS (Knots Equivalent Air Speed) will prevent excessive over or under testing. GRA

**N81-22036\*#** National Aeronautics and Space Administration. Pasadena Office, Calif.

LOW-FREQUENCY RADIO NAVIGATION SYSTEM Patent Application

David E. Wallis, inventor (to NASA) (JPL) Filed 6 Mar. 1981 26 p

(Contract NAS7-100)

(NASA-Case-NPO-15264-1; US-Patent-Appl-SN-241154) Avail: NTIS HC A03/MF A01 CSCL 17G

A method of continuous wave navigation using four transmitters operating at sufficiently low frequencies to assure essentially pure groundwave operation is described. The transmitters are keyed to transmit constant bursts (1/4 sec) in a time-multiplexed pattern with phase modulation of at least one transmitter for identification of the transmitters and with the ability to identify the absolute phase of the modulated transmitter and the ability to modulate low rate data for transmission. The transmitters are optimally positioned to provide groundwave coverage over a service region of about 50 by 50 km for the frequencies selected in the range of 200 to 500 kHz, but their locations are not critical because of the beneficial effect of overdetermination of position of a receiver made possible by the fourth transmitter. Four frequencies are used, at least two of which are selected to provide optimal resolution. All transmitters are synchronized to an average phase as received by a monitor receiver. NASA

#### N81-22037\*# Battelle Columbus Labs., Mountain View, Calif. POTENTIAL EFFECTS OF THE INTRODUCTION OF THE DISCRETE ADDRESS BEACON SYSTEM DATA LINK ON AIR/GROUND INFORMATION TRANSFER PROBLEMS Ralph L. Grayson 30 Mar. 1981 47 p ref

(Contract NAS2-10060)

(NASA-CR-166165) Avail: NTIS HC A03/MF A01 CSCL 17G

This study of Aviation Safety Reporting System reports suggests that benefits should accure from implementation of discrete address beacon system data link. The phase enhanced terminal information system service is expected to provide better terminal information than present systems by improving currency and accuracy. In the exchange of air traffic control messages, discrete address insures that only the intended recipient receives and acts on a specific message. Visual displays and printer copy of messages should mitigate many of the reported problems associated with voice communications. The problems that remain unaffected include error in addressing the intended recipient and messages whose content is wrong but are otherwise correct as to format and reasonableness.

N81-22038# European Space Agency, Paris (France). FUNCTIONAL ANALYSIS AND OPERATIONAL ASSESS-MENT OF AN ONBOARD GLIDE PATH GUIDANCE SYSTEM FOR VISUAL APPROACHES (VISUAL APPROACH MONI-TOR VAM)

Josef Thomas and Helmut Stein Dec. 1980 103 p refs Transl. into ENGLISH of 'Funktionanal. u. Operationelle Bewertung eines Bordgestuetzten Gleitpfadfuehrungssystems fuer Sichtanfluege (Visual Approach Monitor VAM)'', Rept. DFVLR-FB-79-38 DFVLR, Brunswick, Oct. 1979 Original report in GERMAN previously announced as N81-10043

(ESA-TT-655; DFVLR-FB-79-38) Avail: NTIS HC A06/MF A01

A function and error analysis was carried out on the visual approach monitor (VAM), a head-up display system for manual

visual approaches. Its operational characteristics as regards guidance performance and stability were investigated in simulation and flight tests. Flight tests show that under the chosen test conditions the VAM system produces no detectable increase in accuracy compared to visual approaches. However, it leads to significantly reduced scatter and extreme values in almost all flight guidance parameters. The VAM system is approximately comparable to instrument landing systems in its overall guidance nerformance. Author (ESA)

N81-22039\*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

#### KINEMATIC PROPERTIES OF THE HELICOPTER IN COORDINATED TURNS

Robert T. N. Chen and James A. Jeske Apr. 1981 41 p refs (NASA-TP-1773; A-8399) Avail: NTIS HC A03/MF A01 CSCL 01C

A study on the kinematic relationship of the variables of helicopter motion in steady, coordinated turns involving inherent sideslip is described. A set of exact kinematic equations which govern a steady coordinated helical turn about an Earth referenced vertical axis is developed. A precise definition for the load factor parameter that best characterizes a coordinated turn is proposed. Formulas are developed which relate the aircraft angular rates and pitch and roll attitudes to the turn parameters, angle of attack, and inherent sideslip. A steep, coordinated helical turn at extreme angles of attack with inherent sideslip is of primary interest. The bank angle of the aircraft can differ markedly from the tilt angle of the normal load factor. The normal load factor can also differ substantially from the accelerometer reading along the vertical body axis of the aircraft. Sideslip has a strong influence on the pitch attitude and roll rate of the helicopter. Pitch rate is independent of angle of attack in a coordinated turn and in the absence of sideslip, angular rates about the stability axes are independent of the aerodynamic characteristics of the aircraft. SE

N81-22040\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ANALYTICAL STUDY OF THE CRUISE PERFORMANCE OF CLASS OF REMOTELY PILOTED, MICROWAVE-POWERED, HIGH-ALTITUDE AIRPLANE PLATFORMS Charles E. K. Morris, Jr. Apr. 1981 78 p refs (NASA-TM-81969) Avail: NTIS HC A05/MF A01 CSCL

01C Each cycle of the flight profile consists of climb while the vehicle is tracked and powered by a microwave beam, followed by gliding flight back to a minimum altitude. Parameter variations were used to define the effects of changes in the characteristics of the airplane aerodynamics, the power transmission systems, the propulsion system, and winds. Results show that wind effects limit the reduction of wing loading and increase the lift coefficient, two effective ways to obtain longer range and endurance for each flight cycle. Calculated climb performance showed strong sensitivity to some power and propulsion parameters. A simplified method of computing gliding endurance was developed. T.M.

# N81-22041# Boeing Vertol Co., Philadelphia, Pa. CRASHWORTHINESS DESIGN PARAMETER SENSITIVITY ANALYSIS Final Report, Sep. 1979 - Aug. 1980 Anthony E. Tanner Feb. 1981 281 p refs

(Contract DAAK51-79-C-0042; DA Proj. 1L1-62209-AH-76) (AD-A096550; D210-11676-1; USAAVRADCOM-TR-80-D-31) Avail: NTIS HC A13/MF A01 CSCL 01/2

This program investigated the relationships between aircraft weight, the level of crashworthiness in the design, and the cost and weight associated with crashworthiness elements of the design. Accident and research data were reviewed and actual aircraft designs were analyzed with respect to their levels of crashworthiness and potential improvements. Processing of the data yielded cost and weight curves for use in preliminary design. The curves provide the relationships between gross weight, mean empty weight, levels of crashworthiness, and selected design elements that contribute to crashworthiness for designs employing metallic or composite materials and having gross weights up to

50,000 pounds. Comparisons were made with the current ACAP analyses and results showed good agreement for the weight values and level of crashworthiness. The intent of the curves is to allow the designer to rapidly optimize the weights of a preliminary design with respect to performance and utility, and to assess the impact on crashworthiness of reducing the weight of the structure or other crashworthiness contributions. When weight values are resolved, cost curves are then used. A 'Scout' helicopter was defined for both a metallic and composite structure and comparisons were made using the curves generated in this report. GRA

N81-22042# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

CALIBRATION OF AN AXIAL FAN AT VARIOUS POWER SETTINGS FOR USE ON A QUARTER SCALE XC-8A AIR CUSHION MODEL Final Report, 1 Oct. 1977 - 1 May 1979

David L. Fischer Nov. 1980 49 p refs

(AF Proj. 2402) NTIS (AD-A097043: AFWAL-TR-80-3094) Avail: HC A03/MF A01 CSCL 01/3

A method was developed to measure volume flow from electrically powered fans during model testing of a dynamically scaled, quarter-scale XC-8A air cushion model. To measure the volume flow during model operation, the static pressure at a point along the fan inlet duct was correlated with volume flow. Correlation of the fan inlet static pressure with volume flow was performed using one of the two fans used on the model and a fan calibration rig. The fan calibration rig is independent of the model and used the orifice plate method to measure volume flow. Correlation was performed at five different input voltage settings to the fan from 100 volts/200 cycles to the normal rated voltage input of 200 volts/400 cycles. Reduction of the normal rated voltage was investigated so that the volume flow could be controlled during model operation to more accurately simulate the XC-8A fan performance maps. The results of this work are five sets of graphical data illustrating the fan output static pressure and inlet static pressure versus volume flow. This data will be a key to future research using the quarter-scale XC-8A air cushion model for development of air cushion technology. GRA

#### N81-22043# Aeronautical Research Labs., Melbourne (Australia). SEA KING MATHEMATICAL MODEL VALIDATION TRIALS. FLIGHT DATA CHANNEL CALIBRATION

D. T. Hourigan Sep. 1980 44 p refs

(AD-A096587; ARL/AERO TM-325) Avail: NTIS HC A03/MF A01 CSCL 14/2

Thirty-two channels of flight data were recorded to validate a mathematical model of an R.A.N. Sea King Mk. 50 helicopter. Described is the calibration procedure used for each channel.

GRA

# N81-22044# Dayton Univ., Ohio.

STRUCTURAL FLIGHT LOADS SIMULATION CAPABILITY, VOLUME 1 Final Report, Jun. 1977 - Sep. 1980

Fred K. Bogner Wright-Patterson AFB, Ohio AFWAL Nov. 1980 190 p refs 2 Vol.

(Contract F33615-76-C-3135; AF Proj. 2402)

(AD-A096572: UDR-TR-80-73-Vol-1;

AFWAL-TR-80-3118-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 01/3

An experimental test facility has been developed for performing realistic simulation of flight loads on sections of aircraft wing structures. Concurrently, an analytical technique was developed for predicting the internal load distributions of ballistically damaged, multiple load path aircraft wing structures. In all, six replica wing structures and one T-38 wing structure were tested in the loads facility. The analytically predicted stresses were satisfactory, especially when the response was in the linear range. However, with a substantial amount of damage present and/or when the response was nonlinear, the experimental and analytical results differed substantially. This is thought to be caused by oversimplified finite element models. Further testing is forthcoming. GRA

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#### N81-22045# Dayton Univ., Ohio. Aerospace Mechanics Div. STRUCTURAL FLIGHT LOADS SIMULATION CAPABILITY. VOLUME 2: STRUCTURAL ANALYSIS COMPUTER PROGRAM USER'S MANUAL Final Report, Aug. 1977 -Sep. 1980

Sep. 1980 T. S. Bruner, M. P. Bouchard, J. G. Gebara, M. J. Hecht, and Fred K. Bogner Wright-Patterson AFB, Ohio AFWAL Nov. 1980 358 p refs 2 Vol.

(Contract F33615-76-C-3135)

(AD-A096594: UDR-TR-80-73-Vol-2;

AFWAL-TR-80-3118-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 01/3

A complete system for the modeling, analysis and postanalysis of wing structures utilizing finite elements in simulated flight loads testing has been developed. The preprocessor incorporated the MAGNA element types 3, 4 and 5 (2-D membrane, truss and thin shells) into three predefined wing class models and allows for the conversion of existing wing models to be analyzed by MAGNA. MAGNA is a very powerful and flexible material and geometrical nonlinear analysis program capable of solving a wide variety of finite element problems. Two postprocessors are coupled to the modeling and analysis of the wing structures to provide model geometry, stress or strain contour or relief displacement plots of the model and analysis results. GRA

N81-22046# Bristol Univ. (England). Dept. of Aeronautical Engineering.

THE DEVELOPMENT OF THE SECONDARY WING STRUC-TURE FOR A RIGID WING HANG GLIDER B.S. Thesis C. P. Blackman and I. Grant Jun. 1980 39 p refs (BU-251) Avail: NTIS HC A03/MF A01

The design, construction and testing of a secondary wing structure using foam and glass fiber sandwich construction are described. Materials and construction techniques used were those readily available to the amateur. The wing section, an FX 72-MS-150B, was modified to simplify construction. Load tests were conducted on the iron on plastic film covering material. Static loading tests and an aerodynamic loading test in a wind tunnel were carried out, the latter on a 1.52 m span, section of the full scale wing. The structure proves to be more than adequately strong, although its weight would be only 4.14 kg. Author (ESA)

#### N81-22047\*# Sperry Flight Systems, Phoenix, Ariz. V/STOLAND DIGITAL AVIONICS SYSTEM FOR XV-15 TILT ROTOR Final Report

Sam P. Liden Jan. 1980 381 p (Contract NAS2-10326)

(NASA-CR-152320) Avail: NTIS HC A17/MF A01 CSCL 01D

A digital flight control system for the tilt rotor research aircraft provides sophisticated navigation, guidance, control, display and data acquisition capabilities for performing terminal area navigation, guidance and control research. All functions of the XV-15 V/STOLAND system were demonstrated on the NASA-ARC S-19 simulation facility under a comprehensive dynamic acceptance test. The most noteworthy accomplishments of the system are: (1) automatic configuration control of a tilt-rotor aircraft over the total operating range; (2) total hands-off landing to touchdown on various selectable straight-in glide slopes and on a flight path that includes a two-revolution helix; (3) automatic guidance along a programmed three-dimensional reference flight path; (4) navigation data for the automatic guidance computed on board, based on VOR/DME, TACAN, or MLS navid data; and (5) integration of a large set of functions in a single computer, utilizing 16k words of storage for programs and data. A.R.H.

N81-22048\*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif. AIRCRAFT BODY-AXIS ROTATION MEASUREMENT

SYSTEM Patent Application Kenneth T. Cowdin, inventor (to NASA) Filed 11 Mar. 1981

Kenneth T. Cowdin, inventor (to NASA) Filed 11 Mar. 1981 22 p (NASA-Case-FRC-11043-1; US-Patent-Appl-SN-242790) Avail: NTIS HC A02/MF A01 CSCL 01D

A two-gyro four-gimbal attitude sensing system providing continuous aximuth information as the aircraft turns on its roll axis while the near vertical flight, and for preventing tumble of platforms in gyro systems upon departure from near vertical flight, is described. The provision of continuous azimuth information allows recovery from vertical on a desired heading. The system is comprised of means for stabilizing an outer roll gimbal that is common to a vertical gyro and a directional gyro with respect to the aircraft platform which is being angularly displaced about an axis substantially parallel to the outer roll gyro axis, and means for producing a signal indicative of the magnitude of such displacement as an indication of aircraft heading. Means are provided to cause stabilization of the outer roll gimbal prior to entering vertical flight and destabilization of the outer roll J.D.H. gimbal when departing vertical flight.

#### NB1-22049∯ Bolt, Beranek, and Newman, Inc., Cambridge, Mass. LASER DOPPLER AIRSPEED AND ALTITUDE SENSOR Final Report, 15 Oct. 1977 - 15 Nov. 1980

M. J. Rudd Feb. 1981 72 p refs (Contract F49620-78-C-0023; AF Proj. 2305) (AD-A096980; AFOSR-81-0309TR) Avail: NTIS HC A04/MF A01 CSCL 17/8

The feasibility of an air data system based on the measurement of the resonant fluorescence of carbon dioxide in the atmosphere is discussed. The Doppler shift of the fluorescence gives the air velocity and the linewidth gives the pressure altitude. A system using a tunable diode laser has been set-up and characterized. Attempts to measure back-scattered fluorescence were unsuccessful, but inelastic scattering in the forward direction was observed. Mechanisms for this are discussed but no firm conclusion is reached. A correlation technique for processing the data is discussed and its accuracy computed. GRA

N81-22050# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

FLIGHT EVALUATION OF THE CONCEPT OF THE STAGE A PERIPHERAL VISION HORIZON DEVICE (PVHD) USING THE CH 135 AIRCRAFT OF 403 SQUADRON - CEB GAGETOWN

R. C. Rud and R. D. Michas 8 Dec. 1980 9 p refs (AD-A096870; DCIEM-TC-80-C-66) Avail: NTIS HC A02/MF A01 CSCL 01/4

The PVHD is an aircraft flight attitude instrument which uses the principle that visual sensory orientation information reaches the brain via the peripheral visual pathways. The instrument is currently in a developmental stage but six workable models have been manufactured under contract for the Development of National Defence (DND) by Varian Canada Incorporated (VCI). In order to evaluate the concept under operational conditions, it was necessary to install the system in an aircraft and fly it under variable weather conditions in various types of missions. The CH 135 (Huey) helicopter was chosen for the conceptual flight trials and 403 Squadron (CFB Gagetown) was tasked to fly the system. The system was flown for approximately 35 hours by several different pilots under visual meteorological conditions, (VMC), instrument meteorological conditions (IMC), simulated instrument flying (SIF), in many missions both day and night. Daily and weekly utilization logs and reports were recorded by the pilots. At the end of the flight trial, each pilot reported his impressions on a questionnaire. Flying times under various conditions are reported along with the impressions of the pilots who flew the system. Recommendations for further operational studies are made. GRA

 NB1-22051\*#
 General Electric Co., Cincinnati, Ohio.

 ENERGY EFFICIENT ENGINE FLIGHT PROPULSION

 SYSTEM:
 AIRCRAFT/ENGINE INTEGRATION EVALUA 

 TION
 Status Report, Jan. 1978 - Nov. 1978

 R. F. Patt Jun. 1980
 328 p refs

 (Contract NAS3-20643)
 (NASA-CR-159584: R79AEG274)

 NC A15/MF A01
 CSCL 21E

Results of aircraft/engine integration studies conducted on an advanced flight propulsion system are reported. Economic evaluations of the preliminary design are included and indicate that program goals will be met, installed sfc, DOC, noise, and emissions were evaluated. Aircraft installation considerations and growth were reviewed. JM.S.

#### N81-22052\*# General Electric Co., Lynn, Mass. QUIET CLEAN GENERAL AVIATION TURBOFAN (QCGAT) TECHNOLOGY STUDY, VOLUME 1 Final Report Dec. 1975 193 p refs

(Contract NAS3-19429)

(NASA-CR-164222; R75AEG026-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 21E

The preliminary design of an engine which satisfies the requirements of a quiet, clean, general aviation turbofan (QCGAT) engine is described. Also an experimental program to demonstrate performance is suggested. The T700 QCGAT engine preliminary design indicates that it will radiate noise at the same level as an aircraft without engine noise, have exhaust emissions within the EPA 1981 Standards, have lower fuel consumption than is available in comparable size engines, and have sufficient life for five years between overhauls. M.G.

#### N81-22053\*# General Electric Co., Evendale, Ohio. DESIGN CONCEPTS FOR LOW-COST COMPOSITE TUR-BOFAN ENGINE FRAME Final Report

S. C. Mitchell and L. J. Stoffer Oct. 1980 70 p refs (Contract NAS3-22160)

(NASA-CR-165217; R81AEG311) NTIS Avail: HC A04/MF A01 CSCL 21E

Design concepts for low cost, lightweight composite engine frames were applied to the design requirements for the frame of a commercial, high bypass engine. Four alternative composite frame design concepts identified which consisted of generic type components and subcomponents that could be adapted to use in different locations in the engine and the different engine sizes. A variety of materials and manufacturing methods were projected with a goal for the lowest number of parts at the lowest possible cost. After a preliminary evaluation of all four frame concepts, two designs were selected for an extended design and evaluation which narrowed the final selection down to one frame that was significantly lower in cost and slighty lighter than the other frame. An implementation plan for this lowest cost frame is projected for future development and includes prospects for reducing its weight with proposed unproven. innovative fabrication techniques. Author

N81-22054\*# National Aeronautics and Space Administration, Washington, D. C.

#### PROCEDURE FOR PRESSURE CONTACT ON HIGH-POWER SEMICONDUCTOR DEVICES FREE OF THERMAL FATIGUE **Final Report**

Joachim Knobloch Dec. 1979 20 p refs Transl. into ENGLISH of "Verfahren zur lastwechselfesten Druckkon-taktie-rung an Leistungs-Halbleiter-Bauelementen" BMFT-FB-T-78-02 Bundesministerium fuer Forschung und Technologie, Bonn, Nov. 1978 p 1-29 Translation was announced as N79-27418 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Brown, Boveri and Cie, A.G., Lampertheim (Contract NASw-3199)

(NASA-TM-75733; BMFT-FB-T-78-02) Avail: NTIS HC A02/MF A01 CSCL 21E

To eliminate thermal fatigue, a procedure for manufacturing semiconductor power devices with pure pressure contact without solid binding was developed. Pressure contact without the use of a solid binding to avoid a limitation of the maximum surface in the contact was examined. A silicon wafer covered with a relatively thick metal layer is imbedded with the aid of a soft silver foil between two identically sized hard contact discs (molybdenum or tungsten) which are rotationally symmetrical. The advantages of this concept are shown for large diameters. The pressure contact was tested successfully in many devices in a large variety of applications. E.A.K.

N81-22055\*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. COMPONENT RESEARCH FOR FUTURE PROPULSION SYSTEMS

C. L. Walker, G. J. Weden, and J. Zuk 1981 16 p refs Presented at Fifty-seventh Specialists' Meeting, Toulouse, 11-14 May 1981; sponsored by AGARD Prepared in cooperation with NASA. Ames Research Center and Army Aviation Research and Development Command, Cleveland, Ohio

(NASA-TM-82613; AVRADCOM-TR-81-C-12) Avail: NTIS HC A02/MF A01 CSCL 21E

Factors affecting the helicopter market are reviewed. The trade-offs involving acquisition cost, mission reliability, and life cycle cost are reviewed, including civil and military aspects. The potential for advanced vehicle configurations with substantial improvements in energy efficiency, operating economics, and characteristics to satisfy the demands of the future market are identified. Advanced propulsion systems required to support these vehicle configurations are discussed, as well as the component technology for the engine systems. Considerations for selection of components in areas of economics and efficiency S.F. are presented.

N81-22056\*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

#### THERMAL AND FLOW ANALYSIS OF A CONVECTION AIR-COOLED CERAMIC COATED POROUS METAL CONCEPT FOR TURBINE VANES

Francis S. Stepka 1981 12 p refs Presented at the 20th Natl. Heat Transfer Conf., Milwaukee, 2-5 Aug. 1981; sponsored by the ASME and the American Inst. of Chemical Engineers (NASA-TM-81749; E-815) Avail: NTIS HC A02/MF A01 CSCL 21E

The heat transfer and pressure drop through turbine vanes made of a sintered, porous metal coated with a thin layer of ceramic and convection cooled by spanwise flow of cooling air were analyzed. The analysis was made to determine the feasibility of using this concept for cooling very small turbines, primarily for short duration applications such as in missile engines. The analysis was made for gas conditions of approximately 10 and 40 atm and 1644 K and with turbine vanes made of felt type porous metals with relative densities from 0.2 to 0.6 and ceramic coating thicknesses of 0.076 to 0.254 mm. J.M.S.

# N81-22057 Dayton Univ., Ohio. MAXIMUM LIKELIHOOD IDENTIFICATION OF AIRCRAFT LATERAL PARAMETERS WITH UNSTEADY AERODYNAMIC MODELLING Ph.D. Thesis

Siva Subrahmanyam Banda 1980 198 p

Avail: Univ. Microfilms Order No. 8107428

A simplified aerodynamic force and moment model for unsteadiness in the sideslipping flight was developed via an indicial sidewash function and an indicial sideforce function. The presence of convolution integrals in the equations of motion led to the Fourier transformation of these equations into the frequency domain. A parameter extraction algorithm based on the maximum likelihood estimation technique was developed in the frequency domain. This algorithm was applied to pseudo data as well as real flight data. The results indicated that, for the cases considered, inclusion of unsteady aerodynamics showed significant difference in some of the parameters, in various flights. The parameters extracted whowed less variation for different control inputs when unsteady aerodynamic modelling was included in the extraction algorithm. Dissert. Abstr.

N81-22058 Princeton Univ., N. J.

#### THE DEVELOPMENT OF A THEORETICAL AND EXPERI-MENTAL MODEL FOR THE STUDY OF ACTIVE SUPPRES-SION OF WING FLUTTER Ph.D. Thesis David Eric Dashcund 1981 432 p

Avail: Univ. Microfilms Order No. 8108087

A wind tunnel model was used to study active suppression of classical bending torsion wing flutter using feedback control. Modeling the unsteady aerodynamics in the Laplace domain in terms of an irrational, exact representation of the generalized Theodorsen's function shows the presence of additional stability roots of the system which are not associated with the structural

modes of the system nor with the feedback compensation or control surface actuator dynamics. A set of open loop system equations can be formulated from the derived closed loop system equations. Use of a rational, Pade approximation of the unsteady aerodynamics then permits the application of either classical control theory or state vector methods to feedback flutter control system synthesis and optimization. The model is applicable to a study of the effect of various active control system parameters such as control surface size and location, wing motion sensor and its location, feedback control law, feedback compensation, and actuator dynamics. Dissert, Abstr.

N81-22059\*# Honeywell Systems and Research Center. Minneapolis, Minn.

#### F-8C ADAPTIVE CONTROL LAW REFINEMENT AND SOFTWARE DEVELOPMENT Final Report, Jun. 1976 - Jun. 1977

Gary L. Hartmann and Gunter Stein Apr. 1981 184 p refs (Contract NAS4-2344)

(NASA-CR-163093; HONEYWELL-77SRC53) Avail: NTIS HC A09/MF A01 CSCL 01C

An explicit adaptive control algorithm based on maximum likelihood estimation of parameters was designed. To avoid iterative calculations, the algorithm uses parallel channels of Kalman filters operating at fixed locations in parameter space. This algorithm was implemented in NASA/DFRC's Remotely Augmented Vehicle (RAV) facility. Real-time sensor outputs (rate gyro, accelerometer, surface position) are telemetered to a ground computer which sends new gain values to an on-board system. Ground test data and flight records were used to establish design values of noise statistics and to verify the ground-based adaptive TM. software.

N81-22060\*# National Aeronautics and Space Administration, Washington, D. C.

#### A DIGITAL-ANALOG HYBRID SYSTEM AND ITS APPLICA-TION TO THE AUTOMATIC FLIGHT CONTROL SYSTEM SIMULATION RESEARCH

Jan. 1981 23 p. refs. Transl. into ENGLISH of "Shu-mo hun-he xi-tong ji chi jai zi-dong feishin kong-zhi xi-tong fang-jan yen-jiu jun de ying-yung" Rept. HK-80072 Communist China, Aug. 1980 9 p Transl. by Scientific Translation Service, Santa Barbara. Calif. Original doc. prep. by Chinese Academy of Aeronautics, **Communist China** 

(Contract NASw-3198)

HK-80072) NTIS (NASA-TM-76457; Avail: HC A02/MF A01 CSCL 01C

The characteristics of a digital-analog hybrid system composed of a DJS-8 digital computer and a HMJ-200 analog computer are described as well as its applications to simulation research for an automatic flight control system. A hybrid computational Å R.H example is included to illustrate the application.

N81-22061\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DESCRIPTION OF 0.186 SCALE MODEL OF HIGH-SPEED DUCT OF NATIONAL TRANSONIC FACILITY

Carl L. Gentry, Jr., William B. Igoe, and Dennis E. Fuller May 1981 49 p refs

(NASA-TM-81949; L-13523) Avail: NTIS HC A03/MF A01 CSCL 14B

The National Transonic Facility (NTF) is a pressurized cryogenic wind tunnel with a 2.5 m square test section. A 0.186-scale model of the NTF was used to simulate the aerodynamic performance of the components of the high-speed duct of the NTF. These components consist of a wide-angle diffuser, settling chamber, contraction section, test section, model support section. and high-speed diffuser. The geometry of the model tunnel, referred to as the diffuser flow apparatus is described, and some of its Author operating characteristics are presented.

N81-22063# Aeronautical Research Labs., Melbourne (Australia). APPLICATION OF COMPUTER COLOUR RASTER DISPLAYS IN THE COCKPIT IN RESEARCH FLIGHT SIMULATION H. A. Thelander Mar. 1980 40 p refs

(AD-A096542; ARL/SYS-71; AR-001-798) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes an experimental investigation of the factors influencing the use of computer driven color raster displays for the provision of cockpit displays and instrumentation in manned flight simulation research. Cockpit information presentation requirements and raster display methods are discussed. The findings of the study are that the method has applicability to research simulaton, with economic advantages over the conventional approach. The main factors affecting its use are quantified GŔA

# N81-22095 Georgia Inst. of Tech., Atlanta. BEHAVIOR OF CONTINUOUS FILAMENT ADVANCED COMPOSITE ISOGRID STRUCTURE Ph.D. Thesis Ambur Damodara Reddy 1980 110 p Avail: Univ. Microfilms Order No. 8107287

To realize the full potential of continuous filament advanced composite isogrid (CPACI), basic data on the load bearing structure must be acquired and evaluated in conjunction with current theoretical models and analysis methods. The data base established through such an effort is of great importance in order to inspire confidence in the use of the concept. Both strength and stiffness controlled behavior was studied. Three large panels were tested previously as wide columns in uniaxial compression with fixed loaded ends. A variety of element tests including assessment of fiber content are performed to determine a maximum of information from the three original panels. The experimental data obtained are self consistent and show good agreement with theoretical predictions. The pronounced effect of transverse shear flexibility is evident in the bend tests and in the correlation of buckling data. The scaling law suggested is useful as buckling tests of complex structures may sometimes be avoided. Manufacturing inconsistencies are clearly identified as the primary reason for the scatter in test data. Dissert. Abstr.

N81-22098\*# National Aeronautics and Space Administration, Washington, D. C.

#### EROSION RESISTANT COATINGS

Leonello Falco and Alessandro Cushini Jan. 1981 14 p refs Transl. into ENGLISH from Proc. Assoc. Ital. di Aeron. Astronautics (Turin), v. 1, 1979 p 335-344 Presented at the 3rd Natl. Congr. Assoc. Ital. di Aeron. e Astronautics, Turin, 30 Sep. - 3 Oct. 1975 Original language document was announced as A78-19056 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Univ. Levrotto e Bella, Italy

(Contract NASw-3198)

(NASA-TM-75870) Avail: NTIS HC A02/MF A01 CSCL 11D

Apparatus for measuring the resistance of materials to erosion is examined and a scheme for standardization of the test parameters is described. Current materials being used for protecting aircraft parts from erosion are surveyed, their chief characteristics being given. The superior properties of urethane coatings are pointed out. The complete cycle for painting areas subject to erosion is described. Author

N81-22106# Boeing Co., Seattle, Wash. Boeing Military Airplane Development Dept.

ADVANCED FIBER REINFORCED THERMOPLASTIC STRUCTURES Final Report, 1 Aug. 1976 - 1 Aug. 1979 J. T. Hoggatt, S. Oken, and E. E. House Apr. 1980 289 p (Contract F33615-76-C-3048; AF Proj. 2401)

AFWAL-TR-80-3023) NTIS (AD-A096759; Avail: HC A13/MF A01 CSCL 11/4

The objective of the program was to demonstrate the performance and cost savings of graphite/polysulfone. This objective was attained through a thirteen task program which cultimated in the design, fabrication and test of a full scale elevator torque box. The P-1700 polysulfone resin was selected and used with A-S unidirectional graphite fibers (Hercules 3004/A-S/P1700 prepreg) and with T-300 woven graphite fibers (Hexcel T-3004/23x24, 811 Satin Prepreg). Tooling concepts, consolidation and post forming processes, and field repair

procedures were developed. The graphite/thermoplastic elevator had a 27% weight savings as compared to the aluminum elevator, and a cost saving of 20%, by the tenth elevator shipset. A limited study of a Union Carbide proprietary thermoplastic, known as PKXA, which has much improved solvent resistance as compared to P-1700 polysulfone, was conducted. This limited study showed that PKXA appeared to be a viable substitute for P-1700 polysulfone. It is recommended that a further study of PKXA be made in order to further optimize the manufacturing procedures for it. GRA

N81-22129\*# Boeing Co., Seattle, Wash.

SERVICE EVALUATION OF ALUMINUM BRAZED TITAN-IUM (ABTI)

S. D. Elrod Washington NASA May 1981 43 p refs (Contract NAS1-13681)

(NASA-CR-3418; D6-48609) Avail: NTIS HC A03/MF A01 CSCL 11F

Long term creep-rupture, flight service and jet engine exhaust tests on aluminum-brazed titanium (ABTi), originally initiated under the DOT/SST follow-on program, were completed. These tests included exposure to natural airline service environments for up to 6 years. The results showed that ABTi has adequate corrosion resistance for long time commercial airplane structural applications. Special precautions are required for those sandwich structures designed for sound attenuation that utilize perforated skins. ABTi was also shown to have usable creep-rupture strength and to be metallurgically stable at temperatures up to 425 C (800 F). A.R.H.

N81-22130\*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

#### INVESTIGATION OF AIR SOLUBILITY IN JET A FUEL AT HIGH PRESSURES Final Report

S. D. Rupprecht and G. M. Faeth Washington NASA May 1981 111 p refs

(Grant NsG-3306)

(NASA-CR-3422) Avail: NTIS HC A06/MF A01 CSCL 07D The solubility and density properties of saturated mixtures of fuels and gases were measured. The fuels consisted of Jet A and dodecane, the gases were air and nitrogen. The test range included pressures of 1.03 to 10.34 MPa and temperatures of 298 to 373 K. The results were correlated successfully, using the Soave equation of state. Over this test range, dissolved gas

concentrations were roughly proportional to pressure and increased slightly with increasing temperature. Mixture density was relatively

independent of dissolved gas concentration.

N81-22282\*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.

ANTENNA DESIGN AND DEVELOPMENT FOR THE MICROWAVE SUBSYSTEM EXPERIMENTS FOR THE TERMINAL CONFIGURED VEHICLE PROJECT Final Report, 1 Aug. 1976 - 31 Dec. 1979

Jacob Becher, Norman Cohen, and Jim Rublee Mar. 1981 158 p refs

(Grant NsG-1331)

(NASA-CR-164220; PTR-81-7) Avail: NTIS HC A08/MF A01 CSCL 09C

The feasibility of classifying an airport terminal area for multipath effects, i.e., fadeout potentials or limits of video resolution, is examined. Established transmission links in terminal areas were modeled for landing approaches and overflight patterns. A computer program to obtain signal strength based on a described flight path was written. The application of this model to evaluate the signal transmission obtained in an actual flight equipped with additional signal strength monitoring equipment is described. The actual and computer received signal are compared, and the feasibility of the computer simulation for predicting signal amplitude fluctuation is evaluated. J.D.H.

N81-22358\*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPARATUS FOR AND METHOD OF COMPENSATING DYNAMIC UNBALANCE Patent Application John A. Hrastar, Sr., inventor (to NASA) Filed 27 Feb. 1981 29 p

(NASA-Case-GSC-12550-1; US-Patent-Appl-SN-238888) Avail: NTIS HC A03/MF A01 CSCL 13I

An apparatus to stabilize a fine platform that carries a parabolic reflecting dish, utilized in connection with the large aperture, multichannel microwave radiometer, is discussed. It provides compensation for dynamic unbalance imparted to a fixed body by a shaft about which the rotating body rotates. Force components exerted on the fixed body by the rotating body in a plane at right angles to the axis are determined. In response to the determined force components, the rotational speed and effective direction of mass means mounted on the rotating body are controlled. The mass means has an effective axis of rotation in a plane at right angles to the longitudinal axis. NASA

#### N81-22400\*# Lockheed-Georgia Co., Marietta. HIGH FREQUENCY DRIVE MECHANISM FOR AN ACTIVE CONTROLS SYSTEMS AIRCRAFT CONTROL SURFACE

Hugh E. Smith In NASA. Marshall Space Flight Center The 15th Aerospace Mech. Symp. May 1981 p 173-188

Avail: NTIS HC A19/MF A01 CSCL 01C

The mechanism was successfully utilized on a wind tunnel model tested in the transonic blow down tunnel. The mechanism is also applicable to a flying aircraft. Several interrelated mechanical subsystems were utilized, including a low inertia antibacklash drive mechanism for high frequency oscillation and a compact antibacklash drive mechanism for conversion of rotary motion to linear motion. E.D.K.

#### N81-22419\*# Lockheed-California Co., Burbank. DESIGN CONSIDERATIONS FOR COMPOSITE FUSELAGE STRUCTURE OF COMMERCIAL TRANSPORT AIRCRAFT G. W. Devis and I. F. Sakata Hampton, Va. NASA. Langley Research Center Mar. 1981 51 p refs

 (Contract NAS1-15949)
 Avail:
 NTIS

 (NASA-CR-159296:
 LR-29540)
 Avail:
 NTIS

 HC A04/MF A01
 CSCL 20K
 Statement
 Statement

The structural, manufacturing, and service and environmental considerations that could impact the design of composite fuselage structure for commercial transport aircraft application were explored. The severity of these considerations was assessed and the principal design drivers delineated. Technical issues and potential problem areas which must be resolved before sufficient confidence is established to commit to composite materials were defined. The key issues considered are: definition of composite fuselage design specifications, damage tolerance, and crashworthiness. E.A.K.

**N81-22420#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

## STRUCTURES AND MATERIALS PANEL

1980 97 p Presented at the 50th Meeting of the Struct. and Mater. Panel, Athens, Greece, Spring 1980

(AD-A089019) Avail: NTIS HC A05/MF A01 CSCL 20/11 Partial Group and Committee contents: Reports. (1) Aeroelasticity, (2) Impact Damage Tolerance, (3) Fracture Mechanics Design Methodology, (4) Composite Materials, (5) Critically Loaded Hole Technology, (6) Corrosion Fatigue, (7) Factors of Safety, (8) Corrosion, (9) R and D Cooperation, (10) Standard Aeroelastic Configurations, (11) Helicopter Fatigue, (12) Dynamic Environmental Qualification Techniques, (13) Dimensionally Stable Structures for Space, (14) Dynamic Response to Damaged Runways, (15) Advanced Casting Technology, (16) Maintenance in Service of High Temperature Parts, and (17) Fatigue Rated Fastener Systems. Proposals for New Activities; (1) Effects of Short Cracks, (2) NDT of Ceramic Materials, (3) CAD/CAM. GRA

N81-22437# Lockheed-California Co., Burbank.

#### AIRCRAFT CRASH DYNAMICS: SOME MAJOR CONSIDER-ATIONS

In The Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 13, No. 3 Mar. 1981 p 3-6 refs

Author

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D. C. \$15.00/set CSCL 01/9

The considerations are aircraft crash environments, available analytical methods, and occupant protection. The aircraft crash environment varies depending on aircraft size, configuration, and usage. Current crash design requirements for military and civil helicopters, small airplanes, and large airplanes are presented. Analytical modeling of crash behavior requires three levels of capability: simple, intermediate, and detailed. Brief descriptions of methods and reference simulations are provided. Occupant protection, which is the goal of the crash design effort, is related to a design in which the load capability of the various systems is compatible with the crash environment. T.M.

N81-22589\*# National Aeronautics and Space Administration, Washington, D. C.

#### ANNOYANCE CAUSED BY LIGHT AIRCRAFT NOISE

Mar. 1981 134 p refs Transl. into ENGLISH of "Stoerwirkungen Durch den Laerm der Kleinaviatik" Switzerland, Jun. 1980 p 1-132 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. fur Prazisorientierte Sozialforschung, Zurich, Switzerland and Mitwirkung der Eidg. Materialpurefungsanstalt, Dueden dorf, Switzerland

(Contract NASw-3198)

(NASA-TM-76533) Avail: NTIS HC A07/MF A01 CSCL 13B

The correlation between objective and noise stresses and subjectively perceived disturbance from general aviation aircraft was studied at 6 Swiss airports. Noise levels calculated for these airports are given. Survey results are analyzed. A.R.H.

N81-22590\*# National Aeronautics and Space Administration, Washington, D. C.

#### THE ANNOYANCE CAUSED BY AIRPLANE NOISE IN THE VICINITY OF ORLY AIRPORT AND THE REACTION OF NEIGHBORING RESIDENTS

J. Francois Apr. 1981 16 p Transl. into ENGLISH of "La Gene Causee par le Bruit des Avions au Voisinage de l'Aeroport d'Orly et les Reactions des Riverains" Paris, Aug. 1972 15 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. Francais d'Opinion Publique, Paris (Contract NASw-3199)

(NASA-TM-76575) Avail: NTIS HC A02/MF A01 CSCL 13B

General conclusions and the technical appendix of a report on the attitudes of people living near Orly Airport (Paris) toward airplane noise are presented. The noise was found to be very disruptive of residents' lifestyle and well being, although differences in perceived nuisance were noted. The factors inducing people to protest and who they blame for the present situation are discussed. It was found that the public image of protest or generally positive and that people who did not protest were viewed as passive, uncaring, or else connected to aviation.

A.R.H.

N81-22593\*# National Aeronautics and Space Administration, Washington, D. C.

#### THE EFFECT OF AIRPLANE NOISE ON THE INHABITANTS OF AREAS NEAR OKECIE AIRPORT IN WARSAW

Zbigniew Koszarny, Stefan Maziarka, and Wanda Szata May 1981 17 p refs Transl. into ENGLISH from Rocznik Panstwowego Zakladu Hygieny (Poland), v. 27, no. 2, 1976 p 113-121 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by National Inst of Hygiene, Warsaw (Contract NASw-3198)

(NA SA-TM-75879) Avail: NTIS HC A02/MF A01 CSCL 138

The state of health and noise annoyance among persons living in areas near Okecie airport exposed to various intensities of noise was evaluated. Very high annoyance effects of airplane noise of intensities over 100 dB (A) were established. A connection between the airplane noise and certain ailments complained about by the inhabitants was demonstrated. A.R.H.

N81-22594\*# National Aeronautics and Space Administration, Washington, D. C.

# THE RELATIONSHIP BETWEEN NOISE AND ANNOYANCE AROUND ORLY

J. Francois and J. P. Roche May 1981 90 p Transl. into ENGLISH of 'Liaison dentre le bruit et la gene autour d'Orly" Paris, Jan. 1973 p 76 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. Francois d'Opinion Publique, Paris

(Contract NASw-3198)

(NASA-TM-76573) Avail: NTIS HC A05/MF A01 CSCL 13B

The extent to which annoyance estimated by an isopsophic index is a good forecaster for annoyance perceived near airport approaches was investigated. An index of sensed annoyance is constructed, and the relationship between the annoyance index and the isopsophic index is studied. A.R.H.

N81-22666# Deutscher Wetterdienst, Offenbach am Main (West Germany).

INVESTIGATIVE TECHNICAL MEASUREMENTS OF THE PLANETARY BOUNDARY LAYER MADE ONBOARD AN INSTRUMENTED MOTORIZED GLIDER [MES-STECHNISCHE UNTERSUCHUNG DER PLANETARISCHEN GRENZCHICHT MIT HILFE EINES INSTRUMENTIERTEN MOTORSEGLERS]

Heinz Fortak (Freie Univ., West Germany) 1980 167 p In GERMAN; ENGLISH summary Sponsored by Deutsche Forschungsgemeinschaft (DFG)

(Rept-149; ISBN-3-88149-174-5; ISSN-0072-4130) Avail: NTIS HC A08/MF A01

Research into the planetary boundary layer is described. An instrumented motorized glider was used in making observations. The most important task of the experiment was the investigation of convective processes and their interactions with neighboring scales. Results show the strong variability of the vertical structure of the atmosphere caused by convection, the life cycle of individual convective cells, the two dimensional distribution of those cells, and their dependence on surface properties as well as the interactions between convection and lee waves, including cloud streets. Author (ESA)

#### N81-22722\*# Systems Control. Inc., Palo Alto, Calif. DEKFIS USER'S GUIDE: DISCRETE EXTENDED KALMAN FILTER/SMOOTHER PROGRAM FOR AIRCRAFT AND ROTORCRAFT DATA CONSISTENCY Nov. 1979 69 p

(Contract NAS1-14549)

(NASA-CR-159081) Avail: NTIS HC A04/MF A01 CSCL 09B

The computer program DEKFIS (discrete extended Kalman filter/smoother), formulated for aircraft and helicopter state estimation and data consistency, is described. DEKFIS is set up to pre-process raw test data by removing biases, correcting scale factor errors and providing consistency with the aircraft inertial kinematic equations. The program implements an extended Kalman filter/smoother using the Friedland-Duffy formulation. M.G.

NB1-22723\*# Systems Control, Inc., Palo Alto, Calif.

SCI IDENTIFICATION (SCIDNT) PROGRAM USER'S GUIDE

Nov. 1979 50 p

(Contract NAS1-14549)

(NASA-CR-159082) Avail: NTIS HC A03/MF A01 CSCL 098

The computer program Linear SCIDNT which evaluates rotorcraft stability and control coefficients from flight or wind tunnel test data is described. It implements the maximum likelihood method to maximize the likelihood function of the parameters based on measured input/output time histories. Linear SCIDNT may be applied to systems modeled by linear constant-coefficient differential equations. This restriction in scope allows the application of several analytical results which simplify the computation and improve its efficiency over the general nonlinear case. M.G.

#### N81-22724\*# Systems Control, Inc., Palo Alto, Calif. NLSCIDNT USER'S GUIDE MAXIMUM LIKEHOOD PARAM-ETER IDENTIFICATION COMPUTER PROGRAM WITH NONLINEAR ROTORCRAFT MODEL

Nov. 1979 121 p refs (Contract NAS1-14549)

(NASA-CR-159083) Avail: NTIS HC A06/MF A01 CSCL 09B

A nonlinear, maximum likelihood, parameter identification computer program (NLSCIDNT) is described which evaluates rotorcraft stability and control coefficients from flight test data. The optimal estimates of the parameters (stability and control coefficients) are determined (identified) by minimizing the negative log likelihood cost function. The minimization technique is the Levenberg-Marquardt method, which behaves like the steepest descent method when it is far from the minimum and behaves like the modified Newton-Raphson method when it is nearer the minimum. Twenty-one states and 40 measurement variables are modeled, and any subset may be selected. States which are not integrated may be fixed at an input value, or time history data may be substituted for the state in the equations of motion. Any aerodynamic coefficient may be expressed as a nonlinear polynomial function of selected 'expansion variables'. MG

#### N81-22725\*# Systems Control, Inc., Palo Alto, Calif. SCI MODEL STRUCTURE DETERMINATION PROGRAM (OSR) USER'S GUIDE Nov. 1979 29 p

(Contract NAS1-14549)

(NASA-CR-159084) Avail: NTIS HC A03/MF A01 CSCL 09B

The computer program, OSR (Optimal Subset Regression) which estimates models for rotorcraft body and rotor force and moment coefficients is described. The technique used is based on the subset regression algorithm. Given time histories of aerodynamic coefficients, aerodynamic variables, and control inputs, the program computes correlation between various time histories. The model structure determination is based on these correlations. Inputs and outputs of the program are given. M.G.

#### N81-22726\*# Systems Control, Inc., Palo Alto, Calif. INDES USER'S GUIDE MULTISTEP INPUT DESIGN WITH NONLINEAR ROTORCRAFT MODELING

Nov. 1979 54 p ref Sponsored in part by Army (Contract NAS1-14549)

(NASA-CR-159085) Avail: NTIS HC A04/MF A01 CSCL 09B

The INDES computer program, a multistep input design program used as part of a data processing technique for rotorcraft systems identification, is described. Flight test inputs base on INDES improve the accuracy of parameter estimates. The input design algorithm, program input, and program output are MG presented.

N81-22727\*# North Carolina State Univ., Raleigh. Dept. of **Electrical Engineering** 

A STUDY OF REAL-TIME COMPUTER GRAPHIC DISPLAY TECHNOLOGY FOR AERONAUTICAL APPLICATIONS Progress Report, 1 Oct. 1980 - 31 Mar. 1981 S. A. Rajala 30 Apr. 1981 67 p refs

(Grant NsG-1355)

(NASA-CR-164221) Avail: NTIS HC A04/MF A01 CSCL 09B

The development, simulation, and testing of an algorithm for anti-aliasing vector drawings is discussed. The pseudo anti-aliasing line drawing algorithm is an extension to Bresenham's algorithm for computer control of a digital plotter. The algorithm produces a series of overlapping line segments where the display intensity shifts from one segment to the other in this overlap (transition region). In this algorithm the length of the overlap and the intensity shift are essentially constants because the transition region is an aid to the eye in integrating the segments into a single smooth line. EAK.

N81-22832\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AIRFRAME NOISE OF A SMALL MODEL TRANSPORT AIRCRAFT AND SCALING EFFECTS

John G. Shearin May 1981 27 p refs (NASA-TP-1858: L-14257) Avail: NTIS HC A03/MF A01 CSCL 20A

Airframe noise of a 0.01 scale model Boeing 747 wide-body transport was measured in the Langley Anechoic Noise Facility. The model geometry simulated the landing and cruise configurations. The model noise was found to be similar in noise characteristics to that possessed by a 0.03 scale model 747. The 0.01 scale model noise data scaled to within 3 dB of full scale data using the same scaling relationships as that used to scale the 0.03 scale model noise data. The model noise data are compared with full scale noise data, where the full scale data are calculated using the NASA aircraft noise prediction Author program.

N81-22833\*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.

THE ROLE OF COHERENT STRUCTURES IN THE GENERA-TION OF NOISE FOR SUBSONIC JETS Semiannual Report

G. L. Morrison 1 May 1981 24 p refs Original contains color illustrations

(Grant NAG1-112)

(NASA-CR-164214) Avail: NTIS HC A02/MF A01 CSCL 20A

Results from mean flow field surveys are reported. Flow fluctuation amplitude measurements and acoustic measurements are presented. The organized structure was characterized in terms of axial flow and radial flow. T.M

N81-22836\*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN EVALUATION OF A SIMPLIFIED NEAR FIELD NOISE MODEL FOR SUPERSONIC HELICAL TIP SPEED PROPEL-LERS

James H. Dittmar Mar. 1981 24 p refs

(NASA-TM-81727; E-768) Avail: NTIS HC A02/MF A01 CSCL 20A

Existing propeller noise models are versatile and complex but require large computational times, therefore a simplified noise model that could be used to obtain quick noise estimates for these propellers was evaluated. This simplified poise model compared favorably with a complex model for a straight blade propeller and for swept propeller blades when the propeller sweep was properly considered. The simplified model can thus be used as an approximation to the complex model. Comparisons of either the complex or simplified noise models with the available noise data are not good for supersonic propeller helical tip speeds. By adjusting various constants in the simplified model, the noise estimates can be brought into the same range as the data at the propeller design point but the variation of the model with helical tip Mach number remains different than the data. A.R.H.

N81-22838\*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

#### THE PROPELLER TIP VORTEX. A POSSIBLE CONTRIBUTOR TO AIRCRAFT CABIN NOISE

Brent A. Miller, James H. Dittmar, and Robert J. Jeracki Apr. 1981 11 p refs

(NASA-TM-81768; E-821) Avail: NTIS HC A02/MF A01 CSCL 20A

Although the assumption is generally made that cabin noise levels are governed by the transmission of propeller generated noise through the fuselage sidewall, it was postulated that the propeller wake striking the wing, in particular pressure disturbances generated downstream of the propeller by the action of the propeller tip vortex, could be strong enough to excite the aircraft structure and contribute to the cabin noise level. Tests conducted to measure the strength of the propeller tip vortex support this hypothesis. It was found that the propeller tip vortex can produce a fluctuation pressure on a simulated wing surface in the wake of a propeller that exceeds by more than 15 dB the maximum direct noise that would strike the fuselage. Wing surface response to propeller tip vortex induced excitations, and the effectiveness of this response in radiating noise to the cabin interior, must be established to assess the full significance of these results. A.R.H.

N81-22839\*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

#### COMPARISON OF PREDICTED ENGINE CORE NOISE WITH PROPOSED FAA HELICOPTER NOISE CERTIFICATION REQUIREMENTS

U. vonGlahn and D. Groesbeck 1981 19 p refs Presented at the 101st Meeting of the ASA, Ottawa, Ontario, 18-22 May 1981

(NASA-TM-81739; E-791) Avail: NTIS HC A02/MF A01 CSCL 20A

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

N81-22969\*# National Academy of Sciences - National Research Council, Washington, D. C.

#### NASA'S AERONAUTICS RESEARCH AND TECHNOLOGY BASE Final Report

Apr. 1979 52 p (Contract NASw-2342)

(NASA-CR-164195: PB81-134686) Avail: NTIS HC A04/MF A01 CSCL 05A

NASA's research technology base in aeronautics is assessed in terms of: (1) US aeronautical technology needs and requirements in the future: (2) objectives of the aeronautics program: (3) magnitude and scope of the program: and (4) research and technology performed by NASA and other research organizations. S.F.

N81-22971# Boeing Co., Seattle, Wash. Product Support/ Experience Analysis Center.

DEVELOPMENT OF MAINTENANCE METRICS TO FORE-CAST RESOURCE DEMANDS OF WEAPON SYSTEMS. ANALYSIS AND EVALUATION, REVISION A Interim Report, 1 Mar. 1978 - 15 Oct. 1979

Donald K. Hindes, Gary A. Walker, David H. Wilson, and Frank Maher (AF Human Resources Lab., Wright-Patterson AFB, Ohio) Feb. 1980 156 p refs Revised

(Contract F33615-77-C-0075)

(AD-A096688; D194-10089-1) Avail: NTIS HC A08/MF A01 CSCL 05/1

This report describes the results of the first four tasks of an eight task study. The total effort is intended to develop more accurate metrics and weightings to be incorporated into the Air Force method (Logistics Composite Model (LCOM)) for determining manpower and other resource requirements for operational and developing weapon systems. The approach taken for this portion of the study effort was to identify, obtain, review and catalog related research and/or descriptive studies; select a representative cross section of aircraft and subsystems/equipments; identify and select applicable study parameters/variables; and acquire field experience data from various maintenance management information systems and on-site visits to operational units. The data base thus accumulated was computer processed via LCOM or follow-on analysis.

N81-22972# Boeing Co., Seattle, Wash. Product Support/ Experience Analysis Center.

DEVELOPMENT OF MAINTENANCE METRICS TO FORE-CAST RESOURCE DEMANDS OF WEAPON SYSTEM. MAINTENANCE METRICS AND WEIGHTINGS, REVI-SION A Interim Report, 1 Nov. 1978 - 1 Oct. 1979

Donald K. Hindes, Gary A. Walker, David H. Wilson, and Frank Maher (AF Human Resources Lab., Wright-Patterson AFB) Oct. 1980 383 p. refs. Revised

(Contract F33615-77-C-0075)

(AD-A096689; D194-10089-3) Avail: NTIS HC A17/MF A01 CSCL 05/1

The approach taken for this portion of the study effort was to utilize the source data identified in Task V as inputs to develop statistical models for the estimation and prediction of the maintenance action demands of the equipment items selected for study. The data case values acquired for the lists of hardware, operational parameters which were found in Task V (Analyzing and Prioritizing Parameters) to be directly and strongly related to the maintenance demand rates of the selected equipment items were reconstituted into input data sets for the modeling process. This process resulted in one hardware, one operational, and one environmental data set being associated with each aircraft subsystem studied. Step-wise regression analysis was then applied to each data set for each subsystem's equipment to obtain best fit multiple regression equations explaining maintenance action demand as a function of equipment characteristic parameters, as a function of operational characteristic parameters, and as a function of environmental characteristic parameters. These separate equations for each type of parameter consitute 'generic' Maintenance Metrics and Weightings Models which facilitate the estimation of expected maintenance action demand for any aircraft subsystem when only equipment characteristics, only operational characteristics, or only environmental characteristics are known. GRA

N81-22973# Boeing Co., Seattle, Wash. Product Support/ Experience Analysis Center.

DEVELOPMENT OF MAINTENANCE METRICS TO FORE-CAST RESOURCE DEMANDS OF WEAPON SYSTEMS. ANALYSIS AND RESULTS OF METRICS AND WEIGHTINGS, REVISION A Interim Report, 1 Nov. 1978 - 1 Oct. 1979 Donald K. Hindes, Gary A. Walker, David H. Wilson, and Frank Maher (AF Human Resources Lab., Wright-Patterson, AFB, Ohio) Nov. 1980 164 p refs Revised

(Contract F33615-77-C-0075)

(AD-A096690: D194-10089-4) Avail: NTIS HC A08/MF A01 CSCL 05/1

This report describes the method and results of the eighth task to Develop Maintenance Metrics to Forecast Resource Demands of Weapon Systems. The purpose of this task was to perform simulation experiments with existing LCOM aircraft simulators using the newly developed maintenance metrics and weightings in order to validate the techniques and data developed during the course of this study. The findings indicate that the new maintenance metrics predictor equations can provide acceptable estimations of overall aircraft maintenance demand rates under a wide variety of equipment, operational, and environmental characteristics. These general models could be used for predicting equipment failure rates in many user situations such as LCOM analyses and new aircraft concept definition.

GRA

#### N81-22974# Arinc Research Corp., Annapolis, Md. AIRCRAFT MODIFICATION MANAGEMENT EVALUATION Final Report

S. Baily Dec. 1980 115 p refs (Contract F33615-80-C-5102)

(AD-A096458) Avail: NTIS HC A06/MF A01 CSCL 05/1 Because of the long lead times and large budgetary outlays associated with major weapon system acquisitions, it is planned that most of the current inventory of US Air Force aircraft types will remain in service through the 1990s. As a result of this continued use of existing aircraft, the Air Force must pursue an aggressive modernization program to maintain the force structure at a high level of operational readiness. Rapidly expanding technology is being exploited to maintain a high degree of capability in an aging force. These factors are expected to result in an extensive aircraft retrofit program at least through the year 2000. To ensure the smooth implementation of this modification effort for aircraft weapon systems, the Air Force must continue to improve modification management techniques. Fundamental problem areas exist in current Air Force management techniques for aircraft modification. Therefore, this analysis was undertaken (1) to identify, define, and validate the most significant problem areas in aircraft modification management; (2) to examine the cause-and-effect relationship of identified problems and develop a structured approach to their resolution; and (3) to identify topics requiring research and initiatives leading to improvement in aircraft modification management. GRA

#### N81-23008# European Space Agency, Paris (France). CONTRIBUTIONS TO THE 9TH SYMPOSIUM ON AIRCRAFT INTEGRATED DATA SYSTEMS

Feb. 1981 370 p refs Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" DFVLR, Brunswick Report DFVLR-Mitt-79-03, Feb. 1978 p 7-362 Proceedings held at Friedrichshafen, West Germany, 26-27 Sep. 1978 Original report in GERMAN previously announced as N80-25275

(ESA-TT-532; DFVLR-Mitt-79-03) Avail: NTIS HC A16/MF A01

Aircraft subsystems which are required for the detection, description, and recording of the aircraft operating conditions as well as the flight events are addressed. These systems supply the crew with flight information necessary for an effective execution of the flight mission. Safety and economics are among the factors considered. For individual titles, see N81-23009 through N81-23023.

#### N81-23009# European Space Agency, Paris (France), EXPERIENCES WITH A FLIGHT DATA RECORDING System (FDRS) in a german airforce fighter Bomber Wing After field trials

H. Harsch (Jagdbombergeschwader 34 Memmingen) In its Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 10-24 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintegrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 11-26

#### Avail: NTIS HC A16/MF A01

A one year test of the LEADS-200 digital flight data recording and processing system was carried out. Both hardware and software aspects of the system are described. The test data are given and discussed in detail. Accident and maintenance aspects, flight safety, and operational management are emphasized. Author (ESA)

#### N81-23010# European Space Agency, Paris (France). ENGINE PARAMETER TREND ANALYSIS WITH LEADS 200: POSSIBILITIES AND LIMITATIONS

W. Koschel (Lehrstuhl und Inst. fuer Strahlantriebe und turboarbeitsmaschinen der Technischen Hochschule Aachen) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 25-52 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintegrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 27-52

#### Avail: NTIS HC A16/MF A01

Causes of fighter aircraft engine damage were analyzed in order to identify engine components that should be monitored over the long term so as to ensure aircraft safety. The possibility of recognizing deterioration of these components using data from the LEADS 200 flight recorder system is discussed and illustrated using performance data from the J79-MTU-K1K engine system. Author (ESA)

#### N81-23011# European Space Agency, Paris (France). INVESTIGATIONS INTO LOCAL FAULT DETECTION ON TURBOJET ENGINES

H. Toenskoetter (Inst. fuer Strahlantriebe und Turboarbeitsmaschinen Rheinish-Westfaelische Technische Hochschule Aachen) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 53-79 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintegrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 57-83

## Avail: NTIS HC A16/MF A01

Results of the experimental investigations carried out with simulated faults in a single spool turbojet engine are presented. The effect of small disturbances, such as low compressor air bleed, a single removed turbine guide vane, or one plugged fuel nozzle on local and circumferentially averaged aerothermodynamic parameters are described. The location of the investigated faults by an engine condition monitoring system is studied and the possibility of including an analysis of circumferential flow nonuniformities at turbine exit for fault detection in the hot section of an engine is discussed. Author (ESA)

#### N81-23012# European Space Agency, Paris (France). LOCATION OF FAULTS IN JET ENGINES BY CALCULATION OF COMPONENT CHARACTERISTICS

G. Dahl (Brunswick Univ.) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 80-106 Transt. into ENGLISH of "Beitrage zum 9 Symp. Bordintegrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03. Feb. 1979 p 85-112

#### Avail: NTIS HC A16/MF A01

A method to calculate the component characteristics of single spool jet engines was developed using measured engine data. The method was tested by simulating many different faults on a J-65 engine, recording measured engine data, and performing a fault diagnosis on the basis of the measured data. The method is capable of locating single and multiple faults of arbitrary nature and magnitude. Author (ESA)

#### N81-23013# European Space Agency, Paris (France).

#### THE ENGINE USAGE MONITORING SYSTEM: AN HEURISTIC APPROACH TO COST EFFECTIVE DATA MONITORING AND ANALYSIS

F. Robinson (Rolls Royce, Ltd., Bristol) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems ESA-TT-532) Feb. 1981 p 107-134 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 113-138

#### Avail: NTIS HC A16/MF A01

An engine monitoring system is described that is capable of accurately measuring low cycle fatigue during service operations. Up to 16 parameters relating to engine reliability can be recorded at intervals 0.5 sec. Data are recorded on cassettes for ground processing. Author (ESA)

#### N81-23014# European Space Agency, Paris (France). RELATIONSHIPS FOR A FLIGHT PERFORMANCE COMPUT-ER

M. Kloster *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 135-146 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 139-150

#### Avail: NTIS HC A16/MF A01

Formulas which approximate drag, thrust, and fuel consumption as functions of altitude and Mach number are discussed. Flight performance in the case of steepest climb and greatest acceleration is derived. It is shown that the resulting equations can be numerically solved by a small onboard computer. The formulas are simplified in order to obtain analytic relations.

Author (ESA)

#### N81-23015# European Space Agency, Paris (France). CLASSIFICATION OF OPERATING CONDITIONS OF TURBOMACHINES FROM SOLID BORNE SOUND

D. Barschdorf (Karlsruhe Univ.), B. Stuehlen (Karlsruhe Univ.), and W. Mach (Karlsruhe Univ.) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 147-164 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 151-168

#### Avail: NTIS HC A16/MF A01

A method for continuously monitoring turbine engine conditions using acoustic signature procedures is presented. Rotor synchronous measurement of accelerometer values and formal pattern recognition methods are used. Correlation between measured data and certain working or fault machine conditions is accomplished by data collection during a learning phase. Only small computers are needed to implement the method.

Author (ESA)

#### N81-23016# European Space Agency, Paris (France). REDUCTION OF MEASURED DATA AND POSSIBILITIES FOR EARLY DETECTION OF SENSOR BREAK-DOWN

G. Dahl (Technische Univ., Brunswick) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 165-181 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 169-185

#### Avail: NTIS HC A16/MF A01

Procedures were developed that prepare and reduce automatically recorded data in order to assess the reliability of sensors. The data were divided into blocks of constant levels and statistical methods were used to determine their mean value, standard deviation, and regression line. A strong increase in the variation coefficient is found to indicate sensor faults. Author (ESA)

## N81-23017# European Space Agency, Paris (France). DESCRIPTION OF THE BRITISH CIVIL AVIATION AIR-

#### DESCRIPTION OF THE BRITISH CIVIL AVIATION AIR-WORTHINESS DATA RECORDING PROGRAMME (CAADRP)

H. D. Ruben (Civil Aviation Authority, Redhill, England) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 182-209 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 187-214

#### Avail: NTIS HC A16/MF A01

The application of routine operational flight recorder data to airworthiness problems and the maintenance of safety standards are described. The various ways in which the data are analyzed, are illustrated with examples. A brief history of airworthiness data recording is presented as well. Author (ESA)

#### N81-23018# European Space Agency, Paris (France). THE SYDAS FLIGHT DATA PROCESSING SYSTEM

C. Dupuy (Enertec Schlumberger, Paris) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 210-229 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 215-235

#### Avail: NTIS HC A16/MF A01

The use of the SYDAS system for the maintenance and safety of aircraft is shown. Data from a variety of aircraft types are processed automatically and completely. The system checks syncword and aircraft data system calibration, verifies time sequencing, displays documentary data, converts parameters into engineering units, identifies flight modes, checks limit exceedances, and records condensed data as well as flight anomalies separately. Data may be presented as lists, or graphs and plots of flight paths while statistical calculations are possible. Unique features of the system include both bit and frame synchronizers. The functions of the system during the data acquisition and reduction phase are also described. Author (ESA)

# N81-23019# European Space Agency, Paris (France). THE USE OF AIRCRAFT INTEGRATED DATA SYSTEM AT KLM

R. A. Hartman (KLM Royal Dutch Airlines, Schiphol Airport) In its Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 230-262 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 237-268

#### Avail: NTIS HC A16/MF A01

An aircraft integrated data system that is able to interrogate up to 350 parameters of some 40 aircraft systems is described. Sampled flight data are recorded and subsequently analyzed by special ground based computer programs. The use of the output of these programs by engineering and operational departments to investigate incidents, aircraft, and flight crew performance, and flight safety is described. Author (ESA)

#### N81-23020# European Space Agency, Paris (France).

#### NAVAIDS CALIBRATION EVALUATION WITH A COMPUT-ER-CONTROLLED AVIONICS DATA ACQUISITION SYS-TEM

F. J. Abbink (Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam) and R. Krijn (Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam) *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 263-324 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 269-311

#### Avail: NTIS HC A16/MF A01

A computer system is described that allows the acquisition of aircraft data and their use to evaluate the applicability and accuracy of multidistance measuring equipment positioning. The system was also used as a reference for the calibration of both Doppler and standard VOR stations in the Netherlands and for the calibration of an inertial sensor system. The system is also used for the measurement of air traffic control radar signals. The power density of the pulses of the primary and secondary radar are presented as time histories, antenna patterns, and vertical coverage diagrams. Author (ESA)

#### N81-23021# European Space Agency, Paris (France). THE RECONSTRUCTION OF FLIGHT PATHS FROM AIDS DATA WITH THE AID OF MODERN FILTERING METHODS

W. Benecke and K. Hurrass *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 325-337 refs Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 313-326

#### Avail: NTIS HC A16/MF A01

A method is described that allows the reconstruction of the flight path of an aircraft in cases when a modern, airborne, autonomous navigation system is unavailable. The method uses the true airspeed, the VOR bearing, and the DME distance and applies optimum smoothing techniques. The smoothing operation consists of two steps: (1) forward filtering (the Kalman filter equations are solved for the point in time considered, estimated values and the corresponding co-variance matrices are obtained as results), and (2) backward smoothing (the equations and the backward filter are solved backward in terms of time, the estimated values of the forward filter being used and improved). Data from a test flight are used to illustrate the method. Author (ESA)

N81-23022# European Space Agency, Paris (France). DETECTION AND LOCATION OF FAULTS IN ONBOARD AIRCRAFT SYSTEMS WITH THE AID OF THE AUTOMATIC FAULT IDENTIFICATION SYSTEM (AFIS)

H. Kalbe (MBB, Hamburg) and F. Hildebrandt (MBB, Hamburg) In its Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-352) Feb. 1981 p 338-354 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 327-344

#### Avail: NTIS HC A16/MF A01

A device to monitor aircraft systems performance is described. Operation modes include the continuous monitoring of aircraft systems, automatic fault identification, trend data sampling, and single signal interrogations. The microcomputer based system is operated onboard and results in improved maintenance activity, reduces the crew workload, and leads to increased dispatch reliability. Author (ESA)

N81-23023# European Space Agency, Paris (France).

PROCESSING OF AIDS FLIGHT RECORDER DATA FOR A QUICK LOOK WITH THE AID OF A HYBRID COMPUTER SYSTEM

H. Hoffman *In its* Contrib. to the 9th Symp. on Aircraft Integrated Data Systems (ESA-TT-532) Feb. 1981 p 355-370 Transl. into ENGLISH of "Beitrage zum 9 Symp. Bordintergrierte Flugdatensysteme" (Brunswick) DFVLR-Mitt-79-03, Feb. 1979 p 345-362

Avail: NTIS HC A16/MF A01

The translation of flight data recorder information into data which are stored in 12 bit words on computer compatible magnetic tape is described. The translation makes use of a hybrid computer and passes through the following steps: active filtering, use of a one bit analog to digital converter, and change from serial to parallel data. Author (ESA)

#### N81-23024# Aeronautical Research Labs., Melbourne (Australia). STRUCTURAL DESIGN OF BFRP PATCHES FOR MIRAGE WING REPAIR

R. Jones and R. J. Callinan Jul. 1980 21 p refs (AD-A097195: ARL/Struc-Note-461) Avail: NTIS HC A02/MF A01 CSCL 01/3

This paper is concerned with the design aspects of two repair schemes developed for application to the lower wing skin of Mirage aircraft. Both repairs involve bonding a boron fiber reinforced plastic (BFRP) patch to the wing skin. In one instance the skin is cracked and the patch is acting as a crack stopper, while in the other instance the patch covers a series of holes and its prime purpose is to lower the stress field. Author (GRA)

N81-23025# Missouri Univ. -Columbia. Dept. of Industrial Engineering.

AN ANALYSIS OF OPPORTUNISTIC MAINTENANCE POLICY FOR THE F100PW100 AIRCRAFT ENGINE Final Report, 1 Jan. - 31 Dec. 1980

Michael C. Smith 31 Dec. 1980 51 p refs

(Grant AF-AFOSR-0102-80; AF Proj. 2304)

(AD-A097548: AFOSR-81-0313TR) Avail: NTIS HC A04/MF A01 CSCL 01/3

An analytic model for computing optimal screening intervals for replacing life-limited parts in the F100PW100 aircraft engine is presented. The model involves determining the point in advance of a part life limit where the marginal cost of replacing a part equals the marginal expected cost of not replacing the part. The policy results in a set of Conditional Part Level (CPL) screens conditioned o<sup>-</sup> the status of the module and engine at the time of engine removal. The policy is evaluated through comparison with a base/depot screening approach. The evaluation is accomplished through a simulation of the 20-year life cycle of the F100 engine. The evaluation demonstrates the economic and performance advantages of the CPL screening policy. Model assumptions include independent part failures and exponential failure distributions for parts without life limits. Further investigation of the impact of the assumptions is suggested.

Author (GRA)

#### N81-23030\*# General Dynamics Corp., Fort Worth, Tex. ANALYSIS OF WIND TUNNEL TEST RESULTS FOR A 9.39-PER CENT SCALE MODEL OF A VSTOL FIGHTER/ ATTACK AIRCRAFT. VOLUME 1: STUDY OVERVIEW Final Report, 10 Sep. 1979 - 10 Feb. 1981

J. R. Lummus, G. T. Joyce, and C. D. OMalley Oct. 1980 97 p 4 Vol.

(Contract NAS2-10344)

(NASA-CR-152391-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01A

The ability of current methodologies to accurately predict the aerodynamic characteristics identified as uncertainties was evaluated for two aircraft configurations. The two wind tunnel models studied horizontal altitude takeoff and landing V/STOL fighter aircraft derivatives. R.C.T. N81-23031\*# General Dynamics Corp., Fort Worth, Tex. ANALYSIS OF WIND TUNNEL TEST RESULTS FOR A 9.39-PER CENT SCALE MODEL OF A VSTOL FIGHTER/ ATTACK AIRCRAFT. VOLUME 2: EVALUATION OF PREDICTION METHODOLOGIES Final Report, 10 Sep. 1979 - 10 Feb. 1981

J. R. Lummus, G. T. Joyce, and C. D. OMalley Oct. 1980 139 p. 4 Vol.

(Contract NAS2-10344)

(NASA-CR-152391-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 01A

An evaluation of current prediction methodologies to estimate the aerodynamic uncertainties identified for the E205 configuration is presented. This evaluation was accomplished by comparing predicted and wind tunnel test data in three major categories: untrim med longitudinal aerodynamics; trimmed longitudinal aerodynamics; and lateral-directional aerodynamic characteristics. R.C.T.

N81-23032\*# General Dynamics Corp., Fort Worth, Tex. ANALYSIS OF WIND TUNNEL TEST RESULTS FOR A 9.39-PER CENT SCALE MODEL OF A VSTOL FIGHTER/ ATTACK AIRCRAFT. VOLUME 3: EFFECTS OF CONFIGUR-ATION VARIATIONS FROM BASELINE Final Report, 10 Sep. 1970 - 11 Nov. 1980

J. R. Lummus, G. T. Joyce, and C. D. OMalley Oct. 1980. 373 p 4 Vol.

(Contract NAS2-10344)

(NASA-CR-152391-Vol-3) Avail: NTIS HC A16/MF A01 CSCL 01A

The aerodynamic characteristics of the components of the baseline E205 configuration is presented. Geometric variations from the baseline E205 configuration are also given including a matrix of conrad longitudinal locations and strake shapes. R.C.T.

N81-23033\*# General Dynamics Corp., Fort Worth, Tex. ANALYSIS OF WIND TUNNEL TEST RESULTS FOR A 9.39-PER CENT SCALE MODEL OF A VSTOL FIGHTER/ ATTACK AIRCRAFT. VOLUME 4: RALS R104 AERODY-NAMIC CHARACTERISTICS AND COMPARISONS WITH E205 CONFIGURATION AERODYNAMIC CHARACTERIS-TICS Final Report, 10 Sep. 1979 - 10 Feb. 1981

J. R. Lummus, G. T. Joyce, and C. D. OMalley Oct. 1980 136 p. 4 Vol.

(Contract NAS2-10344)

(NASA-CR-152391-Vol-4) Avail: NTIS HC A07/MF A01 CSCL 01A

The longitudinal and lateral-directional aerodynamic characteristics of the RALS R104 wind tunnel model are summarized. Configurations for the E205 are also presented for comparison. R.C.T.

N81-23034\*# Old Dominion Univ., Norfolk, Va. INVESTIGATION OF AERODYNAMIC CHARACTERISTICS OF WINGS HAVING VORTEX FLOW USING DIFFERENT NUMERICAL CODES Progress Report, 1 Sep. 1978 - 31 Aug. 1979

C. Subba Reddy and G. L. Goglia Apr. 1981 59 p refs (Grant NsG-1561)

(NASA-CR-165706) Avail: NTIS HC A04/MF A01 CSCL 01A

The aerodynamic characteristics of highly sweptback wings having separation-induced vortex flow were investigated by employing different numerical codes with a view to determining some of the capabilities and limitations of these codes. Flat wings of various configurations-strake wing models, cropped, diamond, arrow and double delta wings, were studied. Cambered and cranked planforms have also been tested. The theoretical results predicted by the codes were compared with the experimental data, wherever possible, and found to agree favorably for most of the configurations investigated. However, large cambered wings could not be successfully modeled by the codes. It appears that the final solution in the free vortex sheet method is affected by the selection of the initial solution. Accumulated span loadings estimated for delta and diamond wings were found to be unusual in comparison with attached flow results in that the slopes of these load curves near the leading edge do not tend to infinity as they do in the case of attached flow. Author

N81-23035\*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

AN ASYMPTOTIC UNSTEADY LIFTING-LINE THEORY WITH ENERGETICS AND OPTIMUM MOTION OF THRUST-PRODUCING LIFTING SURFACES Thesis

Ali Reza Ahmadi Apr. 1981 345 p refs (Grant NGR-22-009-818)

(NASA-CR-165679) Avail: NTIS HC A15/MF A01 CSCL 01A

A low frequency unsteady lifting-line theory is developed for a harmonically oscillating wing of large aspect ratio. The wing is assumed to be chordwise rigid but completely flexible in the span direction. The theory is developed by use of the method of matched asymptotic expansions which reduces the problem from a singular integral equation to quadrature. The wing displacements are prescribed and the pressure field, airloads, and unsteady induced downwash are obtained in closed form. The influence of reduced frequency, aspect ratio, planform shape, and mode of oscillation on wing aerodynamics is demonstrated through numerical examples. Compared with lifting-surface theory, computation time is reduced significantly. Using the present theory, the energetic quantities associated with the propulsive performance of a finite wing oscillating in combined pitch and heave are obtained in closed form. Numerical examples are presented for an elliptic wing. M.G

N81-23036\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

TWO DIMENSIONAL AERODYNAMIC CHARACTERISTICS OF THE NACA 0012 AIRFOIL IN THE LANGLEY 8 FOOT TRANSONIC PRESSURE TUNNEL

Charles D. Harris Apr. 1981 139 p refs (NASA-TM-81927) Avail: NTIS HC A07/MF A01 CSCL 01A

Data are presented for lift coefficients from near zero through maximum values at Mach numbers from 0.30 to 0.86 and Reynolds numbers of  $3.0 \times 10$  to the sixth power with transition fixed. A limited amount of data is presented near zero and maximum lift for a Reynolds number of  $6.0 \times 10$  to the sixth power with transition fixed. In addition, transition free data is presented through the Mach number range from 0.30 to 0.86 for near zero lift and a Reynolds number of  $3.0 \times 10$  to the sixth power. T.M.

N81-23037\*∦ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

# TOPOLOGY OF THREE-DIMENSIONAL SEPARATED FLOWS

Murray Tobak and David J. Peake Apr. 1981 46 p refs (NASA-TM-81294; A-8554) Avail: NTIS HC A03/MF A01 CSCL 01A

Based on the hypothesis that patterns of skin-friction lines and external streamlines reflect the properties of continuous vector fields, topology rules define a small number of singular points (nodes, saddle points, and foci) that characterize the patterns on the surface and on particular projections of the flow (e.g., the crossflow plane). The restricted number of singular points and the rules that they obey are considered as an organizing principle whose finite number of elements can be combined in various ways to connect together the properties common to all steady three dimensional viscous flows. Introduction of a distinction between local and global properties of the flow resolves an ambiguity in the proper definition of a three dimensional separated flow. Adoption of the notions of topological structure, structural stability, and bifurcation provides a framework to describe how three dimensional separated flows originate and succeed each other as the relevant parameters of the problem are varied. Author

N81-23039\*# National Aeronautics and Space Administration. Arres Research Center, Moffett Field, Calif.

FULL SCALE AERODYNAMIC CHARACTERISTICS OF A PROPELLAR INSTALLED ON A SMALL TWIN ENGINE

#### AIRCRAFT WING PANEL

Philip R. Barlow, Victor R. Corsiglia, and Joseph Katz May 1981 22 p refs

(NASA-TM-81285: A-8478) Avail: NTIS HC A02/MF A01 CSCL 01A

Full-scale measurements of shaft thrust and torque were made. Wind-tunnel speeds and blade angles were set for full-scale flight conditions. Excellent quality measurements were obtained of the thrust coefficient, the power coefficient, and the propeller efficiency for various values of the advance ratio and the blade incidence angle at 3/4-blade radius. A conventional propeller theory found in the literature was applied to the present results. Although thrust, power, and efficiency were somewhat overpredicted, the advance ratio for maximum efficiency was predicted quite accurately. It was found that, for some conditions, spinner drag could be significant. A simple correction that was based on the spinner base pressure substantially accounted for the changes in efficiency that resulted from this cause.

N81-23043# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate. METHOD FOR PREDICTING THE JET-INDUCED AERODY-

NAMICS OF V/STOL CONFIGURATIONS IN TRANSITION Interim Report

Marvin M. Walters and Robert E. Palmer 30 Jan. 1981 41 p refs

(WF41400000)

(AD-A097356: NADC-80205-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

A method for predicting the propulsive induced aerodynamics of a VSTOL aircraft in the transition flight regime is presented. This method is applicable to low wing, circular jet subsonic VSTOL configurations with normally exhausting jets. Validation results for various VSTOL configurations are also presented.

Author (GRA)

N81-23052# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

EXPERIMENTAL FLUTTER AT HIGH SUBSONIC SPEEDS AND ITS THEORETICAL PREDICTION, TAKING INTO ACCOUNT WING THICKNESS AND REYNOLDS NUMBER H. C. Garner and B. W. Payne (British Aerospace Aircraft Group,

Weybridge, England) /n AGARD Boundary Layer Effects on Unsteady Airloads Feb. 1981 21 p refs

#### Avail: NTIS HC A08/MF A01

Half model flutter tests of a symmetrical high aspect ratio wing at stream Mach numbers M sub infinity between 0.75 and 0.90 are described. Equivalent air speeds at flutter, calculated with aerodynamics from subsonic lifting surface theory, are in fairly good agreement with the measured values up to M sub infinity = 0.86 In the range 0.86 < M sub infinity 0.89 the measured flutter speed increases rapidly until the flow is stable, contrary to the predictions with the linear theoretical aerodynamics. However, the use of approximate theories compatible with steady and quasi-steady aerodynamics flow transonic small perturbation (TSP) theory leads to the correct qualitative behavior of flutter speed with inviscid TSP aerodynamics the rapid rise in flutter speed is anticipated by about 0.02 in M sub infinity, but allowance for the boundary layers is shown to halve this discrepancy. T.M.

N81-23053\*# Scientific Research Associates, Inc., Glastonbury, Conn.

#### ANALYSIS OF TURBULENT FLOW ABOUT AN ISOLATED AIRFOIL USING A TIME DEPENDENT NAVIER-STOKES PROCEDURE

S. J. Shamroth and H. J. Gibeling *In* AGARD Boundary Layer Effects on Unsteady Airfoils Feb. 1981 14 p refs Sponsored in cooperation with Army Research and Technology Lab.

#### (Contract NAS1-15214)

Avail: NTIS HC A08/MF A01 CSCL 01A

The procedure solves the Navier-Stokes equations by the consistently split linearized block implicit method of Briley and McDonald in a body fitted coordinate system. The procedure is described and results are presented for flow about an airfoil

whose incidence changes from 6 degrees to 19 degrees at a Reynolds number of one million and Mach number of 0.2. In addition, the unsteady flow about an airfoil held at a constant 19 degree incidence is examined and compared to data. T.M.

N81-23054\*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL STUDIES OF SCALE EFFECTS ON OSCILLATING AIRFOILS AT TRANSONIC SPEEDS

Sanford S. Davis In AGARD Boundary Layer Effects on Unsteady Airfoils Feb. 1981 13 p refs

N81-23044 14-02)

Avail: NTIS HC A08/MF A01 CSCL 01A

Scale effects are discussed with reference to a conventional airfoil (NACA 64A010) and a supercritical airfoil (NLR 7301) at mean flow conditions that support both weak and strong shock waves. During the experiment the Reynolds number was varied from 3 x 10 to the sixth power at time history data are presented over the range of reduced frequencies that are important in aeroelastic applications. The experimental data show that viscous effects are important in the case of the supercritical airfoil at all flow conditions and in the case of the conventional airfoil under strong shock wave conditions. Some frequency dependent viscous effects were also observed. тм

N81-23055# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

#### SOME REMARKS ON THE UNSTEADY AIRLOADS ON OSCILLATING CONTROL SURFACES IN SUBSONIC FLOW

H. Foersching In AGARD Boundary Layer Effects on Unsteady Airloads Feb. 1981 8 p refs

#### Avail: NTIS HC A08/MF A01

Parameters which are neglected within the framework of linearized potential flow theory, but which are highly influential in the development of unsteady airloads on oscillating control surfaces in subsonic flow are discussed. Based on theoretical and experimental results the effects of gap width and slot geometry, finite thickness, flow viscosity, and incidence of both wing and control surface are explained. Some topics for further research work with regard to active control applications are indicated. Author

N81-23056# Royal Aircraft Establishment, Bedford (England). Structures Dept.

#### OSCILLATORY FLOWS FROM SHOCK INDUCED SEPARA-TIONS ON BICONVEX AEROFOILS OF VARYING THICK-NESS IN VENTILATED WIND TUNNELS

D. G. Mabey In AGARD Boundary Layer Effects on Unsteady Feb. 1981 Airfoils 14 p refs

#### Avail: NTIS HC A08/MF A01

The flow instability boundaries on a series of biconvex airfoils with thickness/chord ratios varying from 10 to 20%, set at zero incidence, were measured in a small transonic tunnel. The region of flow instability with laminar boundary layer/shock wave interactions was a little wider than the corresponding region with turbulent boundary layer/shock wave interactions. A criterion for the occurrence of the instability was developed from the measurements. Some interesting examples of dynamic wall interference effects were observed in the slotted working sections with hard slats, which were greatly reduced in the alternative slotted working sections with slats made from sound absorbing laminates. Interesting examples of dynamic interference were also observed in special comparative tests in closed working sections formed by hard or laminate walls. тм

#### N81-23058\*# Douglas Aircraft Co., Inc., Long Beach, Calif. STUDY TO DEVELOP IMPROVED FIRE RESISTANT AIRCRAFT PASSENGER SEAT MATERIALS Final Report, 4 Dec. 1979 - 30 Sep. 1980

Fred E. Duskin, Kenneth J. Schutter, Howard H. Sieth, and Edward L. Trabold Aug. 1980 128 p refs (Contract NAS2-9337)

(NASA-CR-152408; MDC-J4665) NTIS Avail: HC A07/MF A01 CSCL 01C

The Phase 3 study of the NASA 'Improved Fire Resistant Aircraft Seat Materials' involved fire tests of improved materials in multilayered combinations representative of cushion configurations. Tests were conducted to determine their thermal, smoke, and fire resistance characteristics. Additionally, a 'Design Guideline' for Fire Resistant Passenger Seats was written outlining general seat design considerations. Finally, a three-abreast 'Tourist Class' passenger seat assemmbly fabricated from the most advanced fire-resistant materials was delivered. Author

N81-23059\*# Boeing Commercial Airplane Co., Seattle, Wash. MLS: AIRPLANE SYSTEM MODELING

A. D. Thompson, B. P. Stapleton, D. B. Walen, P. F. Rieder, and D. G. Moss Apr. 1981 133 p refs (Contract NAS1-14880)

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(NASA-CR-165700;	D6-48724)	Avail:	NTIS
HC A07/MF A01	CSCL 17G		

Analysis, modeling, and simulations were conducted as part of a multiyear investigation of the more important airplane-systemrelated items of the microwave landing system (MLS). Particular emphasis was placed upon the airplane RF system, including the antenna radiation distribution, the cabling options from the antenna to the receiver, and the overall impact of the airborne system gains and losses upon the direct-path signal structure. In addition, effort was expended toward determining the impact of the MLS upon the airplane flight management system and developing the initial stages of a fast-time MLS automatic control system simulation model. Results ot these studies are pre-A.R.H. sented.

N81-23060# Federal Aviation Administration, Atlantic City, N.J. A MICROCOMPUTER-BASED SIGNAL DATA CONVERTER FOR RUNWAY VISUAL RANGE MEASUREMENTS Final Report, Oct. 1979 - Apr. 1980

David M. Wainland, Glenn J. Horton, and Howard J. Meeks Feb. 1981 43 p refs

(FAA	Proj.	219-	151	-200)
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(AD-A097568; FAA-CT-80-43) Avail: NTIS HC A03/MF A01 CSCL 09/2

A laboratory model microcomputer-based Runway Visual Range (RVR) System was designed and built at the Federal Aviation Administration (FAA) Technical Center. The system includes a Microcomputer Signal Data Converter (SDC), a Remote Display, a local maintenance terminal, a cassette storage unit, a Transmissivity Display, and a Transmissometer Simulator. The Microcomputer SDC computes RVR values for up to 12 transmissometers: previous SDC designs can calculate RVR values for only 1 transmissometer. Furthermore, the microcomputer-based RVR System provides alarm checking, data storage. and RS-232 compatible data outputs that are not available in other RVR systems. Based on the improved capabilities and the microcomputer's low cost, it is concluded that Microcomputer SDC's would be cost effective at airports using more than three transmissometers. Author (GRA)

#### N81-23061# Federal Aviation Administration, Atlantic City, N.J. SUMMARY OF TRANSPONDER DATA, MAY 1979 -**NOVEMBER 1979**

Max Greenberg Feb. 1981 29 p refs (AD-A097569; FAA-CT-81-5) Avail: NTIS HC A03/MF A01 CSCL 17/7

The purpose of this effort was to determine the performance characteristics of air traffic control radar beacon transponders in an operational environment in general aviation aircraft. A transponder performance analyzer (TPA) was developed at the Federal Aviation Administration Technical Center to measure performance parameters of transponders installed in aircraft. The TPA was installed in a bus for mobility and simulates an air traffic control beacon interrogator (ATCBI) to facilitate measurement of 15 transponder parameters in approximately 30 seconds. A standard gain horn antenna is utilized to couple the signals between the TPA bus and the aircraft. Transponder data were collected at six different geographic locations resulting in more than 690 samples of general aviation transponders. Results show that 42 percent of the transponders met all measured parameters. This is a slight improvement over the 1977/1978 data and is attributed to inclusion of data collected at general aviation airports in the Atlanta area. It is recommended that a study be conducted to determine the effects of transponder performance on the air traffic control systems (Automated Radar Terminal System (ARTS) and National Airspace System (NAS)) by individually varying each of the 15 parameters outside of Author (GRA) their specification limits.

N81-23062# Army Aviation Development Test Activity, Fort Rucker, Ala.

#### FUNCTIONAL TESTING AIRBORNE NAVIGATION EQUIP-**MENT** Final Report

3 Mar. 1981 35 p refs

(AD-A097115; TOP-6-3-205; DARCOM-R-310-6;

DRSTE-RP-702-105) Avail: NTIS HC A03/MF A01 CSCL 17/7

This document provides guidance and procedures for performance testing airborne navigation equipment. The document addresses the following: Flight Planning, Range Test, Rotor Modulation, Accuracy, and Influence of Weather. It provides the test officer with general information and guidance in test preparation, test controls, test conduct, and data reduction.

Author (GRA)

#### N81-23063# Lincoln Lab., Mass. Inst. of Tech., Lexington. ELECTRONIC FLIGHT RULES: AN ALTERNATIVE SEPARA-TION ASSURANCE CONCEPT

John W. Andrews and Walter M. Hollister 31 Dec. 1980 99 p refs

(Contracts F19628-80-C-0002; DOT-FA72WAI-261)

(AD-A097570; ATC-93; FAA-RD-80-2) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report presents results of a study of alternative concepts for tactically separating aircraft in low altitude en route airspace. It describes a concept designated Electronic Flight Rules (EFR) which allows aircraft to fly under instrument meteorological conditions in a manner that retains most of the freedom and flexibility of VFR flight. Feasibility considerations, potential benefits, applicable technologies, and alternative system configurations are evaluated. Author (GRA)

N81-23064\*# Boeing Vertol Co., Philadelphia, Pa

PRELIMINARY DESIGN STUDY OF ADVANCED COM-POSITE BLADE AND HUB AND NONMECHANICAL CONTROL SYSTEM FOR THE TILT-ROTOR AIRCRAFT. VOLUME 1: ENGINEERING STUDIES Final Report

H. R. Alexander, K. E. Smith, M. A. McVeigh, P. G. Dixon, and B. L. McManus Nov. 1979 263 p refs 2 Vol.

(Contract NAS2-10160)

(NASA-CR-152336-1; D210-11569-1-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 01C

Composite structures technology is applied in a preliminary design study of advanced technology blades and hubs for the XV-15 tilt rotor research demonstrator aircraft. Significant improvements in XV-15 hover and cruise performance are available using blades designed for compatibility with the existing aircraft, i.e., blade installation would not require modification of the airframe, hub or upper controls. Provision of a low risk nonmechanical control system was also studied, and a development specification is given. Author

## N81-23065\*# Boeing Vertol Co., Philadelphia, Pa. PRELIMINARY DESIGN STUDY OF ADVANCED COM-POSITE BLADE AND HUB AND NONMECHANICAL CONTROL SYSTEM FOR THE TILT-ROTOR AIRCRAFT. VOLUME 2: PROJECT PLANNING DATA Feb. 1980 65 p refs 2 Vol.

(Contract NAS2-10160)

(NASA-CR-152336-2; D210-11569-2-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 01C

Project planning data for a rotor and control system procurement and testing program for modifications to the XV-15 tilt-rotor research demonstrator aircraft is presented. The design, fabrication, and installation of advanced composite blades compatible with the existing hub, an advanced composite hub, and a nonmechanical control system are required. J.D.H.

N81-23066\*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif. COMPARISON OF THEORETICAL PREDICTIONS OF ORBITER AIRLOADS WITH WIND TUNNEL AND FLIGHT TEST RESULTS FOR A MACH NUMBER OF 0.52

Alan L. Carter and Robert L. Sims May 1981 33 p refs (NASA-TM-81358) Avail: NTIS HC A03/MF A01 ( CSCL 01C

The measurement and prediction of wing airloads for space shuttle orbiter 101 during approach and landing tests is discussed. Strain gage instrumentation, calibration, and flight data processing are covered along with wind tunnel and simulator results. The generation of theoretical predictions using the FLEXSTAB computer program is described, and the results are compared to experimental measurements. ARH.

N81-23067\*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

A COMPARISON OF LABORATORY MEASURED TEMPERA-TURES WITH PREDICTIONS FOR A SPAR/SKIN TYPE AIRCRAFT STRUCTURE

Jerald M. Jenkins May 1981 23 p refs (NASA-TM-81359) Avail: NTIS HC A02/MF A01 CSCL 010

A typical spar/skin aircraft structure was heated nonuniformly in a laboratory and the resulting temperatures were measured. The heat transfer NASTRAN computer program was used to provide predictions. Calculated temperatures based on a thermal model with conduction, radiation, and convection features compared closely to measured spar temperatures. Results were obtained without the thermal conductivity, specific heat, or emissivity with temperature. All modes of heat transfer (conduction, radiation, and convection) show to affect the magnitude and distribution of structural temperatures. E.A.K.

#### N81-23068\*# Grumman Aerospace Corp., Bethpage, N.Y. AIRCRAFT WING WEIGHT BUILD-UP METHODOLOGY WITH MODIFICATION FOR MATERIALS AND CONSTRUC-**TION TECHNIQUES** Final Report

Peter York and Raymond W. Labell Sep. 1980 120 p refs (Contract NAS2-9805)

(NASA-CR-166173) Avail: NTIS HC A06/MF A01 CSCL 01C

An aircraft wing weight estimating method based on a component buildup technique is described. A simplified analytically derived beam model, modified by a regression analysis, is used to estimate the wing box weight, utilizing a data base of 50 actual airplane wing weights. Factors representing materials and methods of construction were derived and incorporated into the basic wing box equations. Weight penalties to the wing box for fuel, engines, landing gear, stores and fold or pivot are also included. Methods for estimating the weight of additional items (secondary structure, control surfaces) have the option of using details available at the design stage (i.e., wing box area, flap area) or default values based on actual aircraft from the data base.

Author

N81-23069\*# Douglas Aircraft Co., Inc., Long Beach, Calif. COMMERCIAL AVIATION ICING RESEARCH REQUIRE-MENTS

L. P. Koegeboehn Apr. 1981 59 p refs

(Contract NAS3-22361)

(NASA-CR-165336) Avail: NTIS HC A04/MF A01 CSCL 010

A short range and long range icing research program was proposed. A survey was made to various industry and goverment agencies to obtain their views of needs for commercial aviation ice protection. Through these responsed, other additional data, and Douglas Aircraft icing expertise; an assessment of the state-of-the-art of aircraft icing data and ice protection systems was made. The information was then used to formulate the icing research programs. S.F.

N81-23070\*# Boeing Vertol Co., Philadelphia, Pa. ROTORCRAFT AVIATION ICING RESEARCH REQUIRE-MENTS: RESEARCH REVIEW AND RECOMMENDATIONS **Final Report** 

A. A. Peterson, L. Dadone, and A. Bevan May 1981 116 p

refs (Contract NAS3-22384) 20155344: D210-11662-1) NTIS Avail: HC A06/MF A01 CSCL 01C

The status of rotorcraft icing evaluation techniques and ice protection technology was assessed. Recommendations are made for near and long term icing programs that describe the needs of industry. These recommended programs are based on a consensus of the major U.S. helicopter companies. Specific activities currently planned or underway by NASA, FAA and DOD are reviewed to determine relevance to the overall research requirements. New programs, taking advantage of current activities, are recommended to meet the long term needs for rotorcraft icing certification. A.R.H.

N81-23071\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

#### TRANSONIC FLUTTER STUDY OF A WIND-TUNNEL MODEL OF AN ARROW-WING SUPERSONIC TRANSPORT

Charles L. Ruhlin and Charles R. Pratt-Barlow (Boeing Commercia Airplane Co., Seattle) Apr. 1981 16 p refs Presented at the AIAA Struct. Dyn. Spec. Meeting, Atlanta, 9-10 Apr. 1981 (NASA-TM-81962) Avail: NTIS HC A02/MF A01 CSCL 01C

A 1/20-size, low-speed flutter model of the SCAT-15F complete airplane was tested on cables to simulate a near free-flying condition. Only the model wing and fuselage were flexible. Flutter boundaries were measured for a nominal configuration and a configuration with wing fins removed at Mach numbers M from 0.76 to 1.2. For both configurations, the transonic dip in the wing flutter dynamic pressure q boundary was relatively small and the minimum flutter g occurred near M = 0.92. Removing the wing fins increased the flutter q about 14 percent and changed the flutter mode from symmetric to antisymmetric. Vibration and flutter analyses were made using a finite-element structural representation and subsonic kernelfunction aerodynamics. For the nominal configuration, the analysis (using calculated modal data) predicted the experimental flutter q levels within 10 percent but did not predict the correct flutter mode at the higher M. For the configuration without wing fins, the analysis predicted 16 to 36 percent unconservative (higher than experimental) flutter q levels and showed extreme sensitivity to mass representation details that affected wing tip mode shapes. For high subsonic M, empennage aerodynamics had a significant effect on the predicted flutter boundaries of several symmetric modes. A R H

N81-23072\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

#### TRANSONIC FLUTTER AND GUST-RESPONSE TESTS AND ANALYSES OF A WIND-TUNNEL MODEL OF A TORSION FREE WING AIRPLANE

Charles L. Ruhlin and Arthur C. Murphy (General Dynamics/Fort Worth, Tex.) Apr. 1981 17 p refs Presented at the AIAA Dyn. Spec. Conf., Atlanta, 9-10 Apr. 1981

(NASA-TM-81961) Avail: NTIS HC A02/MF A01 CSCL 010

An exploratory study of a 1/5.5 size, complete airplane version of a torsion free wing (TFW) fighter aircraft was conducted. The TFW consisted of a wing/boom/canard assembly on each fuselage side that was interconnected by a common pivot shaft so that the TFW could rotate freely in pitch. The effect of the TFW was evaluated by comparing data obtained with the TFW free and the TFW locked to the fuselage. With the model mounted on cables to simulate an airplane free flying condition, flutter boundaries were measured at Mach number (M) from 0.85 to 1.0 and gust responses at M = 0.65 and 0.90. The critical flutter mode for the TFW free configuration was found experimentally to occur at M = 0.95 and had the rigid TFW pitch mode as its apparent aerodynamic driver. RCT

#### N81-23073# Douglas Aircraft Co., Inc., Long Beach, Calif. FUEL/ENGINE/AIRFRAME TRADE OFF STUDY Final Report, 1 May 1978 - 1 Oct. 1980 A. T. Peacock, H. Hennig, N. C. Burmaster, E. R. Brown, R. M.

Matsuo, J. R. Herrin, S. A. Mosier, J. R. Grant, J. E. Drever, and J. J. Snider Sep. 1980 260 p refs Prepared in cooperation with Union Oil Co. of Calif., Los Angeles and Pratt and Whitney Aircraft Group, East Hartford

(Contract F33615-78-C-2001; AF Proj. 3048) (AD-A097391; AFWAL-TR-80-2038) NTIS Avail: HC A12/MF A01 CSCL 21/4

This report covers a study of the effects of broadening the specifications for JP-4 and JP-8, by increasing the freeze point, decreasing the smoke point, and extending the end point on minimizing costs and maximizing fuel availability. The study considered the impact on the engines and airframes. It was concluded that the specification maximum allowable freeze point of JP-4 or JP-8 could not be increased without degrading aircraft system performance and safety on the basis of criteria available to this study. Increases in availability were predicted for JP-4 of up to 9% and for JP-8 between 41% and 62%. A fuel price analysis was performed based on prices through 1978. Price changes subsequent to the analysis have been so rapid and so unbalanced between products that predictions cannot be made of price changes resulting from specification changes.

Author (GRA)

N81-23074# General Accounting Office, Washington, D. C. Mission Analysis and Acquisition Div.

DOD'S USE OF REMOTELY PILOTED VEHICLE TECHNOL-OGY OFFERS OPPORTUNITIES FOR SAVING LIVES AND DOLLARS

3 Apr. 1981 43 p

(AD-A097419; GAO/MASAD-81-20) Avail: NTIS HC A03/MF A01 CSCL 01/3

Contents: The Status of RPV Technology: Proven, Available, and Little Used; RPVs not Popular with the Military; and Civil Use of RPVs not Likely without Military Development. GRA

N81-23075# Rockwell International Corp., Columbus, Ohio. North American Aircraft Div.

DESIGN, DEVELOPMENT, AND EVALUATION OF LIGHT-WEIGHT HYDRAULIC SYSTEM, PHASE 1 Final Report, 16 Aug. 1978 - 30 Jan. 1981

Joseph N. Demarchi and Robert K. Haning Jan. 1981 273 p refs

(Contract N62269-78-C-0363)

(AD-A097505; NR81H-2; NADC-77108-30) Avail: NTIS HC A12/MF A01 CSCL 13/7

The Lightweight Hydraulic System (LHS) program assesses the advantages of using an 8000 psi operating pressure level in Navy aircraft instead of the conventional 3000 psi level. This report presents the results of Phase I of a program to design, fabricate, and test a full scale 8000 psi system in a ground simulator and A-7E flight test aircraft. Two independent lightweight hydraulic systems; powered by variable delivery 8000 psi pumps, utilize twenty 8000 psi actuators and fourteen types of LHS minor hardware items. A steel framework ground simulator was designed with LHS component installation and hydraulic distribution systems similar to the A-7E aircraft. Laboratory tests conducted on components fabricated Phase I include rod seal development, servo valve erosion, compatibility, pressure impulse, and endurance. A math model of the compatibility system was verified. Test results demonstrated that the Phase II simulator will function as designed. Weight and space analyses made on LHS components projected the 30% weight and 40% space saving goals can be achieved. Based on preliminary R M assessments of the development hardware, the MFHBF and MMH/FH improvements goal of 15% will be obtained. Author (GRA)

N81-23076# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautical Engineering.

ATTACK VS SCAN: A COMPARISON OF ENDGAME AIRCRAFT SURVIVABILITY COMPUTER PROGRAMS M.S. Thesis

James Earl Parr Dec. 1980 121 p refs

(AD-A097663) Avail: NTIS HC A06/MF A01 CSCL 09/2 This study compares two computer programs, ATTACK and SCAN, with respect to the utility and validity of each program. The comparison is made from two points of view; a model developer and a consumer. The utility considers six subject areas: (1) documentation, (2) geometric modeling, (3) P(K)/Vulnerable Area Modeling, (4) Missile, Warhead and Fuze Modeling, (5) Scenario Simulation and (6) Program Output, SCAN was determined to be superior in every area except for the missile, warhead and fuze modeling area. For the validity evaluation, equivalent models were developed for a show box target and a simple warhead for both programs. A separate plot technique was used to verify the program results. For the sample models used in the comparison, the results agreed qualitatively with those from the plot technique. Author (GRA)

#### N81-23077# Aeronautical Research Labs., Melbourne (Australia). AN ANALYSIS OF THERMAL BALANCE IN THE COOLED CABIN OF A SEA KING HELICOPTER

Brian Rebbechi Mar. 1980 28 p refs (AD-A097199; ARL/MECH-ENG-NOTE-378; AR-001-811) Avail: NTIS HC A03/MF A01 CSCL 01/3

This study arose from problems of excessive cabin temperatures encountered by the Royal Australian Navy during operation of Sea King Mk. 50 helicopters. These high temperatures were producing adverse effects on crew efficiency, particularly during flights of long duration experienced in anti-submarine missions. The Aeronautical Research Laboratories recorded cabin temperatures and humidities in one Sea King helicopter of the RAN fleet over an extended period; these measurements are reported by Rebbechi and Edwards (1979). A preliminary estimate of the cabin heat loads, together with suggestions for partially alleviating the problem, was made by Rebbechi (1977). The conclusions of this earlier work, however, were that an acceptable cabin environment could only be attained by the use of refrigeration to cool the cabin air. A vapor cycle cooling unit was subsequently built by ARL for feasibility studies of cabin cooling, and was flight tested in a Sea King helicopter. These flight trials were intended to establish the cooling capacity required in a permanently fitted installation and to evaluate the overall suitability of electrically powered vapor cycle systems. The results of these GRA trials are reported.

N81-23078# National Academy of Sciences - National Research Council, Washington, D. C. Aeronautics and Space Engineering Board.

#### AN EVALUATION OF NASA'S PROGRAM FOR ADVANCING **ROTORCRAFT TECHNOLOGY** Final Report 1978 19 p

(Contract NASw-2342)

(PB81-144180) Avail: NTIS HC A02/MF A01 CSCL 01C A survey is made of the technological needs and opportunities for improving various types of rotorcraft over the next two decades and the adequacy of NASA's proposed research effort to provide the necessary technology in that period. GRA

N81-23079# General Accounting Office, Washington, D. C. Logistics and Communications Div.

#### F-16 INTEGRATED LOGISTICS SUPPORT: STILL TIME TO **CONSIDER ECONOMICAL ALTERNATIVES**

20 Aug. 1980 56 p (PB81-137473; LCD-80-89) Avail: NTIS HC A04/MF A01 CSCI 01C

While the Air Force's integrated logistics support plan for the F-16 should ensure that the aircraft will be adequately maintained, there is still time and opportunity to improve its effectiveness and reduce support costs. Several alternative operational and support concepts which Department of Defense and Air Force logistics planners need to consider for the still developing F-16 program are recommended. GRA

N81-23080\*# Honeywell, Inc., Minneapolis, Minn. Avionics Div.

**DEMONSTRATION ADVANCED AVIONICS SYSTEM (DAAS)** FUNCTIONAL DESCRIPTION Interim Report

15 Oct. 1980 197 p Prepared jointly with King Radio Corp., Olathe, Kans.

(Contract NAS2-10021)

(NASA-CR-152405) Avail: NTIS HC A09/MF A01 CSCL 01D

A comprehensive set of general aviation avionics were defined for integration into an advanced hardware mechanization for demonstration in a Cessna 402B aircraft. Block diagrams are shown and system and computer architecture as well as significant hardware elements are described. The multifunction integrated data control center and electronic horizontal situation indicator are discussed. The functions that the DAAS will perform are examined. This function definition is the basis for the DAAS hardware and software design. A.R.H.

N81-23081# Transportation Systems Center, Cambridge, Mass. Statistical Design and Analysis Branch

#### GENERAL AVIATION ACTIVITY AND AVIONICS SURVEY Annual Summary Report, CY 1979

Judith C. Schwenk Jan. 1981 165 p refs Survey held in 1980; sponsored by FAA

(AD-A097604; TSC-FAA-81-1; FAA-MS-81-1) Avail: NTIS HC A08/MF A01 CSCL 01/2

This report presents the results and a description of the 1979 General Aviation Activity and Avionics Survey. The survey was conducted during 1980 by the FAA to obtain information on the activity and avionics of the United States registered general aviation aircraft fleet, the dominant component of civil aviation in the U.S. The survey was based on a statistically selected sample of about 14.2% of the general aviation fleet and obtained a response rate of 71%. Survey results are based upon responses but are expanded upward to represent the total population. Survey results revealed that during 1979 an estimated 43.3 million hours of flying time were logged by the 210,339 active general aviation aircraft in the U.S. fleet, yielding a mean annual flight time per aircraft of 203.5 hours. The active aircraft represented about 85% of the registered general aviation fleet. The report contains breakdowns of these and other statistics by manufacturer/model group, aircraft type, state and region of based aircraft, and primary use. Also included are fuel consumption, lifetime airframe hours, avionics, and engine hours esti-Author (GRA) mates.

N81-23082# Naval Air Systems Command, Washington, D. C. NAVAIR AVIONICS MASTER PLAN

26 Feb. 1981 243 p

(AD-A097522) Avail: NTIS HC A11/MF A01 CSCL 09/5 The purpose of the NAVAIR Avionics Master Plan (NAMP) is to: Disseminate Naval Air Systems Command (NAVAIR) policy and guidance in all aspects of the development of Naval avionic equipment; Provide a single comprehensive document highlighting all aspects of Naval avionics - its current status, its requirements, and its long range objectives; Establish a planning baseline to serve as a foundation for overall advanced planning; Focus attention on management issues and technological problems that require resolution in the near term and on those special issues that require immediate attention to solve critical problems that require resolution in the near term and on those special issues that required immediate attention to solve critical problems to ensure the orderly availability of needed avionic equipment.

Author (GRA)

# N81-23083# Dynamics Research Corp., Wilmington, Mass. DIGITAL AVIONICS INFORMATION SYSTEM (DAIS). VOLUME 1: IMPACT OF DAIS CONCEPT ON LIFE CYCLE COST Final Report

John C. Goclowski, John M. Glasier, Mariorie A. Bristol, Jonathan T. Frueh, and H. Anthony Baran (Logistics and Technical Training Div., Wright-Patterson AFB, Ohio) Brooks AFB, Tex. Air Force Human Resources Lab. Mar. 1981 72 p refs 2 Vol.

(Contract F33615-75-C-5218; AF Proj. 2051)

(AD-A097339: AFHRL-TR-81-4-(I)-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/3

The Digital Avionics Information System (DAIS) approach to avionics design is a total system concept rather than a functional subsystem or hardware-oriented system. DAIS uses common processing, information transfer, control and display, and support software elements to service all avionics functional areas on an integrated basis. Thus, the DAIS architecture and core elements are not dedicated to any one specific avionic function, but are used to perform the tasks of many avionic functions with the avionic sensors and subsystems. This systems approach provides flexibility to accommodate a wide variety of avionic configurations and missions, as well as redundancy to improve availability. Standardization and replication of the core elements can reduce the life cycle costs when major modifications/retrofits of an avionic configuration are considered, or when applied across the fleet by reducing unnecessary development proliferation and reducing maintenance costs. GRA

## N81-23084# Dynamics Research Corp., Wilmington, Mass. DIGITAL AVIONICS INFORMATION SYSTEM (DAIS). **VOLUME 2: IMPACT OF DAIS CONCEPT ON LIFE CYCLE COST. SUPPLEMENT Final Report**

John C. Goclowski, John M. Glasier, Marjorie A. Bristol, Jonathan T. Frueh, and H. Anthony Baran (Logistics and Technical Training Div., Wright-Patterson AFB, Ohio) Brooks AFB, Tex. Air Forces Human Resources Lab. Mar. 1981 136 p refs 2 Vol. (Contract F33615-75-C-5218; AF Proj. 2051)

(AD-A097438; AFHRL-TR-81-4-(II)-Vol-1) Avail NTIS HC A07/MF A01 CSCL 09/3

The Digital Avionics Information System (DAIS) approach to avionics design is a total system concept rather than a functional subsystem or hardware-oriented system. DAIS uses the common processing, information transfer, control and display, and support software elements to service all avionics functional areas on an integrated basis. Thus, the DAIS architecture and core elements are not dedicated to any one specific avionic function, but are used to perform the tasks of many avionic functions with the avionic sensors and subsystems. This system approach provides flexibility to accommodate a wide variety of avionic configurations and missions, as well as redundancy to improve availability. Standardization and replication of the core elements can reduce the life cycle costs when major modifications/retrofits of an avionic configuration are considered, or when applied across the fleet by reducing unnecessary decolopment proliferation and reducing maintenance costs. A limited assessment of the potential effects of the DAIS concept on avionics system life cycle cost is assessed in this report by a cost comparison of a hypothetical application of a conceptual mid-1980's DAIS suite versus a conventional avionics suite used in a close-air-support (CAS) aircraft both with one major modification/retrofit. The first volume of this two volume technical report describes the cost comparison and its results. This volume supplements the first by providing additional details of the comparison, appendices, model output reports of the Life Cycle Cost Impact Modeling System (LCCIM), and data used in the comparison. Author (GRA)

N81-23085\*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

#### A NONLINEAR PROPULSION SYSTEM SIMULATION TEHNIQUE FOR PILOTED SIMULATORS

James R. Mihaloew 1981 14 p refs Presented at the 12th Ann. Pittsburgh Conf. on Modelling and Simulation, 30 Apr. 1 May 1981; sponsored by IEEE, ISA, SCS, SMCS

(NASA-TM-82600; E-847) Avail: NTIS HC A02/MF A01 CSCL 21E

In the past, propulsion system simulations used in flight simulators have been extremely simple. This resulted in a loss of simulation realism since significant engine and aircraft interactions were neglected and important internal engine parameters were not computed. More detailed propulsion system simulators are needed to permit evaluations of modern aircraft propulsion systems in a simulated flight environment. A real time digital simulation technique has been developed which provides the capabilities needed to evaluate propulsion system performance and aircraft system interaction on manned flight simulators. A parameter correlation technique is used with real and pseudo dynamics in a stable integration convergence loop. The technique has been applied to a multivariable propulsion system for use in a piloted NASA flight simulator program. Cycle time is 2.0 ms on a Univac 1110 computer and 5.7 ms on the simulator computer, a Xerox Sigma 8. The model is stable and accurate with time steps up to 50 ms. The program evaluated the simulation technique and the propulsion system digital control. The simulation technique and model used in that program are described and results from the simulation are presented. Author

N81-23086\*# United Technologies Corp., East Hartford, Conn. Commercial Products Div.

#### PERFORMANCE DETERIORATION BASED ON SIMULATED AERODYNAMIC LOADS TEST, JT9D JET ENGINE DIAG-NOSTICS PROGRAM Final Report

W. J. Stromberg 9 Feb. 1981 301 p refs (Contract NAS3-20632)

PWA-5512-75) (NASA-CR-165297; Avail: NTIS HC A14/MF A01 CSCL 21E

An engine was specially prepared with extensive instrumentation to monitor performance, case temperatures, and clearance changes. A special loading device was used to apply known loads on the engine by the use of cables placed around the flight inlet. These loads simulated the estimated aerodynamic pressure distributions that occur on the inlet in various segments of a typical airplane flight. Test results indicate that the engine lost 1.3 percent in take-off thrust specific fuel consumption (TSFC) during the course of the test effort. Permanent clearance changes due to the loads accounted for 1.1 percent; increase in low pressure compressor airfoil roughness and thermal distortion in the high pressure turbine accounted for 0.2 percent. Pretest predicted performance loss due to clearance changes was 0.9 percent in TSFC. Therefore, the agreement between measurement and prediction is considered to be excellent. Author

N81-23087# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia). Research and Development Branch X RAY FLUORESCENCE SPECTROMETRIC ANALYSIS OF WEAR METALS IN USED LUBRICATING OILS

Dwight E. Veinot Dec. 1980 20 p refs (AD-A097552; NTIS DREA-TM-80/J) Avail: HC A02/MF A01 CSCL 07/4

An X-ray fluorescence spectrometric technique was developed for the direct determination of iron and copper wear metal concentrations in used lubricating oils from CH 124 'Sea King' helicopter engines. The X-ray fluorescence wear metal levels were compared to the atomic absorption wear metal levels determined on corresponding samples. In general, the X-ray fluorescence results indicated higher levels of wear metal contamination and also provided earlier indications of abnormal wear based on more pronounced changes in detected wear metal production than did the results obtained by atomic absorption analysis.

Author (GRA)

N81-23088# National Aeronautical Establishment, Ottawa (Ontario). Structures and Materials Lab.

THE REJUVENATION OF PROPERTIES IN TURBINE ENGINE HOT SECTION COMPONENTS BY HOT ISOSTATIC PRESSING

P. H. Floyd, W. Wallace, and J-P. A. Immarigeon Feb. 1981 26 p refs Presented at the NATO Defence Res. Board Seminar, Bremen, West Germany, 6-10 Apr. 1981

(AD-A097551: NAE-LR-605: NRC-19164) Avail: NTIS HC A03/MF A01 CSCL 21/5.

A significant factor in the cost of ownership of industrial, marine and aircraft gas turbine engines is the high price of replacement of parts that have reached the limit of their original design life. Many parts, particularly those operating in the hot sections of gas turbine engines, will be replaced on a routine basis, even though they may have many thousands of safe operating hours remaining. In order to reduce costs, and to conserve materials that are rapidly becoming scarce, a great deal of effort is being expended to develop treatments that allow used parts to be refurbished and their original properties restored by regenerative heat treatments. A significant development has occurred recently in this area with the introduction of hot isostatic pressing. With hot isostatic pressing it is possible to reheattreat service exposed parts under pressure so that precipitate structures are restored, and internal defects such as creep voids and cavities are eliminated. As a result, new metal properties

can be restored in many cases. However, during hot isostatic pressing there is a tendency for grain growth to occur, for changes in grain boundary structure to occur, and for irreversible changes in carbide morphology and distribution to occur. Consequently, the effective processing of materials requires that careful control of the time, temperature and pressure conditions used in the autoclave be achieved. The particular conditions used must be established for each individual alloy of interest in order to develop the appropriate microstructural features required and thereby obtain the desired improvements in mechanical properties. Author (GRA)

#### N81-23089# Naval Postgraduate School, Monterey, Calif. INVESTIGATION OF THE USE OF LIQUID CRYSTAL THERMOGRAPHY TO STUDY FLOW OVER TUR-BOMACHINERY BLADES M.S. Thesis

Roy L. Brennon Sep. 1980 68 p refs (AD-A097289) Avail: NTIS HC A04/MF A01 CSCL 14/2 The use of liquid crystal thermography was investigated as a technique for visualizing the flow over a NACA series 65 compressor blade. The demonstration of the feasibility of the technique was conducted in the low turbulence wind tunnel at the U.S. Naval Postgraduate School. Local heat transfer coefficients were obtained for Reynolds numbers varying from 100,000 to 600,000 with the angle of incidence of the blade varying from 0 degrees to 30 degrees. Author (GRA)

N81-23093\*# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

APPLICATION OF VARIABLE STRUCTURE SYSTEM THEORY TO AIRCRAFT FLIGHT CONTROL Interim Report Anthony J. Calise, Isaac Kadushin, and Fred Kramer May 1981 42 p refs

(Contract NAG2-8)

(NASA-CR-164321) Avail: NTIS HC A03/MF A01 CSCL 01C

The current status of research on the application of variable structure system (VSS) theory to design aircraft flight control systems is summarized. Two aircraft types are currently being investigated: the Augmentor Wing Jet STOL Research Aircraft (AWJSRA), and AV-8A Harrier. The AWJSRA design considers automatic control of longitudinal dynamics during the landing phase. The main task for the AWJSRA is to design an automatic landing system that captures and tracks a localizer beam. The control task for the AV-8A is to track velocity commands in a hovering flight configuration. Much effort was devoted to developing computer programs that are needed to carry out VSS design in a multivariable frame work, and in becoming familiar with the dynamics and control problems associated with the aircraft types under investigation. Numerous VSS design schemes were explored, particularly for the AWJSRA. The approaches that appear best suited for these aircraft types are presented. Examples are given of the numerical results currently being generated. A.R.H.

N&1-23095\*# Gjerding (B. K.) Simulation Electronics, Seattle, Wash.

USER'S MANUAL FOR FLIGHT SIMULATOR DISPLAY SYSTEM (FSDS)

Connie C. Egerdahl 18 Nov. 1979 14 p (Contract NAS2-9434)

(NASA-CR-164295) Avail: NTIS HC A02/MF A01 CSCL 14B

The capabilities of the flight simulator display system (FSDS) are described. FSDS is a color raster scan display generator designed to meet the special needs of Flight Simulation Laboratories. The FSDS can update (revise) the images it generates every 16.6 mS, with limited support from a host processor. This corresponds to the standard TV vertical rate of 60 Hertz, and allows the system to carry out display functions in a time critical environment. Rotation of a complex image in the television raster with minimal hardware is possible with the system. M.G.

N81-23096\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

#### DESCRIPTION OF RECENT CHANGES IN THE LANGLEY 6- BY 28-INCH TRANSONIC TUNNEL William G. Sewall May 1981 45 p refs

(NASA-TM-81947; L-13609) Avail: NTIS HC A03/MF A01 CSCL 14B

Calibrations were obtained in the Langley 6 by 28-inch transonic tunnel with newly installed controllable reentry flaps and test section floor and ceiling. Using available theory, the top and bottom slotted walls were redesigned for minimum wind tunnel interference errors of blockage and stream-line curvature. To minimize Mach number gradients along the tunnel axis downstream of the model, controllable flaps were installed to regulate the flow reentering the test section through the slotted walls. The flap setting is independent of stagnation pressure and varies only with Mach number. The freestream Mach number is determined from the pressrue measured at a station 66.04 cm upstream of the model station. The model has no significant influence on the vertical Mach number distribution at this station. This method of Mach number determination appears to be more accurate than one using the plenum pressure. RCT

#### N81-23097# Hickok (Eugene A.) and Associates, Wayzata, Minn. NATIONAL RUNWAY FRICTION MEASUREMENT PRO-GRAM Final Report, Sep. 1978 - Dec. 1980

John R. MacLennan, Norman C. Wenck, Paul D. Josephson, and John B. Erdmann Dec. 1980 121 p refs (Contract DOT-FA78WA-4242)

(AD-A097334; FAA-AAS-80-1) Avail: NTIS HC A06/MF A01 CSCL 01/5

Measurements of runway friction, pavement surface conditions and engineering data for 491 runways at 268 U.S. airports are used for statistical analysis to develop guidance materials to insure the design and maintenance of nonslippery surfaces at United States airports. Friction values are analyzed as they relate to pavement type, texture depth, grooving, and rubber accumulation. The basic concepts of Advisory Circular 150/5320-12 are supported by the data. Corrective maintenance action is recommended for runways with friction values less than the recommended value of 0.50. Author (GRA)

**NB1-23243\***# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

#### COMBUSTION SYSTEM PROCESSES LEADING TO COR-ROSIVE DEPOSITS

Carl A. Stearns, Fred J. Kohl, and Daniel E. Rosner (Yale Univ.,) 1981 25 p refs Presented at the NACE Intern. Conf. on High Temp. Corrosion, San Diego, Calif., 2-6 Mar. 1981 (Contract EF-77-A-01-2593)

(NASA-TM-81752; DOE/NASA/2593-27; E-744) Avail: NTIS HC A02/MF A01 CSCL 11F

Degradation of turbine engine hot gas path components by high temperature corrosion can usually be associated with deposits even though other factors may also play a significant role. The origins of the corrosive deposits are traceable to chemical reactions which take place during the combustion process. In the case of hot corrosion/sulfidation, sodium sulfate was established as the deposited corrosive agent even when none of this salt enters the engine directly. The sodium sulfate is formed during the combustion and deposition processes from compounds of sulfur contained in the fuel as low level impurities and sodium compounds, such as sodium chloride, ingested with intake air. In other turbine and power generation situations, corrosive and/or fouling deposits can result from such metals as potassium, iron, calcium, vanadium, magnesium, and silicon.

#### N81-23249# Aeronautical Research Labs., Melbourne (Australia). FATIGUE LIFE VARIABILITY IN ALUMINUM ALLOY AIRCRAFT STRUCTURES

G. S. Jost and S. P. Costolloe Jan. 1980 24 p refs (AD-A097198; ARL/STRUC-381) Avail: NTIS HC A02/MF A01 CSCL 11/6

A survey of variability in the fatigue lives of aluminium alloy aircraft structures tested under gust and maneuver loadings using programmed and random sequences has shown that scatter associated with gust loading is significantly higher than that for maneuver loading. By contrast, there appears to be no systematic effect of loading sequence. The data have been treated both as lognormal and Weibull distributed. Author (GRA)

N81-23269# Bureau of Mines, Albany, Oreg. Albany Research Center.

#### SILVER RECOVERY FROM AIRCRAFT SCRAP

D. Harry Chambers and B. W. Dunning, Jr. 1980 29 p refs (PB81-150021; BM-RI-8477) Avail: NTIS HC A03/MF A01 CSCL 11F

Silver was recovered by an electrolytic method from stainless steel honeycomb sections separated from aircraft scrap. These sections had been constructed by sandwiching a stainless steel honeycomb core between stainless steel sheets and then brazing the assembly with a silver alloy. Over 300 pounds of silver was used in the B-58 bomber, concentrated in certain honeycomb sections of the aircraft. Following stredding of the aircraft parts, an average of 95 percent (ranging 67 to 100 percent) of the silver was recovered in a single electrorefining step. After the electrorefined product was magnetically cleaned, purity of the recovered silver was greater than 99.3 percent. GRA

N81-23288# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate. DEVELOPMENT OF A WATER DISPLACING, TOUCH-UP

PAINT Final Report

Charles R. Hegedus 24 Feb. 1981 30 p refs

(WF61562001)

(AD-A097125; NADC-80207-60) Avail: NTIS HC A03/MF A01 CSCL 11/3

A water displacing paint has been developed for touch-up of existing paint which has cracked or chipped. Laboratory results illusirate that this coating has good adhesion, flexibility, and chemical, heat and weather resistance. The coating will displace water from a substrate upon application and will subsequently afford corrosion protection to the underlying metal. The developed coating can be applied by aerosol, conventional or airless spray techniques. GRA

N81-23325# Boeing Aerospace Co., Seattle, Wash. Experience Analysis Center.

DEVELOPMENT OF MAINTENANCE METRICS TO FORE-CAST RESOURCE DEMANDS OF WEAPON SYSTEMS (PARAMETER POLARIZATION), REVISION A Interim Report, 1 Aug. 1978 - 15 Oct. 1979

Donald K. Hindes, Gary A. Walker, David H. Wilson, and Frank Maher Oct. 1980 320 p refs

(Contract F33615-77-C-0075)

(AD-A097692; D94-10089-2-Rev-A) Avail: NTIS HC A14/MF A01 CSCL 01/3

This report describes the method and results of the fifth of eight tasks to 'Develop Maintenance METRICS To Forecast Resource Demands of Weapon Systems'. The purpose of this task was to analyze the data collected in tasks 1 through 4 to detect, test, and rank relationships between the study parameters and maintenance demand rates. GRA

N81-23358# Army Aviation Development Test Activity, Fort Rucker, Ala.

FUNCTIONAL TESTING AIRBORNE RADARS Final Report 27 Mar. 1981 37 p refs

(AD-A097562; TOP-6-3-223; DARCOM-R-310-6;

DRSTE-RP-702-105) Avail: NTIS HC A03/MF A01 CSCL 17/9

This document provides guidance and procedures for planning and conducting performance tests on airborne radar systems. The document addressed the following radar systems: Weather, Terrain Avoidance, and Airborne Transponders. It provides the test project officer with general information and guidance in test preparation, test controls, test implementation/conduct and data reduction. Author (GRA)

N81-23410\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MEAN-FLOW AND TURBULENCE MEASUREMENTS IN THE

# VICINITY OF THE TRAILING EDGE OF AN NACA (63 SUB 1)-012 AIRFOIL

1

James C. Yu Washington May 1981 45 p refs

(NASA-TP-1845; L-13959) Avail: NTIS HC A03/MF A01 CSCL 20D

The Langley aircraft noise reduction laboratory was used to measure mean flow and turbulence in the vicinity of a cuspedtrailing edge of two dimensional NACA 631-012 airfoil at zero angle of attack. Naturally transitioned flow and artificially tripped flow were investigated. Flow regions studied include the boundary layer and the near wake. Measurements were made at a free stream Reynolds number based on airfoil chord of 1.25 x 10 to the 6th power and a free stream Mach number of 0.1. Distributions of streamwise mean velocity, integral properties of the mean flow, turbulent intensities, and Reynolds shear stress are reported. For the naturally transitioned flow, the general trends observed are similar to those reported for a fully developed turbulent boundary layer over a flat plate under zero pressure gradient, with the exception of the notable streamwise variations in the turbulence properties for the airfoil flow. The main effect of flow tripping is to eliminate these streamwise variations. Observed changes in the mean flow and turbulence fields caused by tripping are expected on the basis of the Reynolds number based on the boundary layer thickness. ARH

**N81-23411\***# Science Applications, Inc., Canoga Park, Calif. Dept. of Combustion Science and Advanced Technology. **MULTIPLE-SCALE TURBULENCE MODELING OF BOUND**-

ARY LAYER FLOWS FOR SCRAMJET APPLICATIONS G. Fabris, P. T. Harsha, and R. B. Edelman Washington NASA May 1981 74 p refs

(Contract NAS1-15988)

(NASA-CR-3433; SAI-80-022-CP) Avail: NTIS HC A04/MF A01 CSCL 20D

As part of an investigation into the application of turbulence models to the computation of flows in advanced scramjet combustors, the multiple-scale turbulence model was applied to a variety of flowfield predictions. The model appears to have a potential for improved predictions in a variety of areas relevant to combustor problems. This potential exists because of the partition of the turbulence energy spectrum that is the major feature of the model and which allows the turbulence energy dissipation rate to be out of phase with turbulent energy production. The computations were made using a consistent method of generating experimentally unavailable initial conditions. An appreciable overall improvement in the generality of the predictions is observed, as compared to those of the basic two-equation turbulence model. A Mach number-related correction is found to be necessary to satisfactorily predict the spreading rate of the supersonic jet and mixing layer. S.F.

N81-23431# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMIC PANEL SYMPOSIUM ON SUBSONIC/ TRANSONIC CONFIGURATION/AERODYNAMICS

Horst Koerner Jan. 1981 19 p refs (AGARD-AR-146; ISBN-92-835-1380-0) Avail: NTIS HC A02/MF A01

Papers presented at the various sessions are highlighted. Topics cover prediction methods, weapons carriage, configuration optimization, powered jet interaction, and multicomponent interference. Conclusions from the discussion are considered from the point of view of computational fluid dynamics, interference aspects, and optimization. Recommendations are offered. A.R.H.

N81-23433\*# Stanford Univ., Calif. Dept. of Aeronautics and Acoustics.

APPLICATION OF HOLOGRAPHY TO THE STUDY OF HELICOPTER ROTOR FLOW FIELDS Semiannual Progress Report, 1 Jul. - 31 Dec. 1980

Donald Baganoff 29 May 1981 37 p refs

(Grant NAG2-45)

(NASA-CR-164293) Avail: NTIS HC A03/MF A01 CSCL 20F

The feasibility of an experiment which is intended to measure the density field about a model helicopter rotor using holographic interferometry is considered. The numerical simulation used to study the experiment is described as well as the measurement technique itself. Data generated by the simulation are presented and prospects for both determining the density field from these data, and for actually obtaining such data in practice are assessed. A few significant problems which may be expected to arise are indicated and discussed. Author

# N81-23438# Technology, Inc., Dayton, Ohio. STRUCTURAL INTEGRITY RECORDING SYSTEM (SIR) FOR U.S. ARMY AH-1G HELICOPTERS Final Report, Jul. 1975 - Nov. 1979

Thomas G. Farrell, Raymond B. Johnson, and Michael C. Tyler

Mar. 1981 216 p refs (Contract DAAJ02-75-C-0050; DA Proj. 1F2-62209-AH-76)

(AD-A097283: USAAVRADCOM-TR-80-D-15) Avail: NTIS HC A10/MF A01 CSCL 01/3

A Structural Integrity Recording System (SIRS) was designed and developed to track the fatigue damage accumulation on 10 critical helicopter components for the subsequent timely replacement of such components for safer and more economical helicopter operation. SIRS comprises three discrete but interrelated subsystems: an airborne microprocessor-based recorder, a portable flight-line data retrieval unit, and a software system. The validation of SIRS, initially configured for the AH-1G helicopter, consisted of two phases. Phase I (Development Test and Evaluation - DT E) covered the design, fabrication, laboratory qualification testing, reliability analysis, and flight-testing of the prototype SIRS recorder. Phase II (Initial Operational Test and Evaluation - IOT E) covered the evaluation of the entire system operation and the resultant data acquired during a 3-month recording period with five AH-1G's, each equipped with a SIRS recorder. As the documentation of both DT E and IOT E, this report describes the characteristics and functions of the entire system and details the successful performance of the SIRS recorder in the laboratory qualification testing and the flight environment. The SIRS recorder performed as designed. operated reliably, and yielded valid data. Author (GRA)

N81-23461\*# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering and Applied Mechanics.

HEAT GENERATION IN AIRCRAFT TIRES UNDER FREE ROLLING CONDITIONS

Samuel K. Clark and Richard N. Dodge Dec. 1980 90 p Sponsored by NASA

(NASA-CR-164273) Avail: NTIS HC A05/MF A01 CSCL 01C

Effort is directed toward construction of a rational method for evaluating internal temperatures of aircraft tires. Enhanced predictability of tire temperature buildup is a design tool in both the tire and airframe industries. S.F.

N81-23466# Naval Research Lab., Washington, D. C. Materials Modification and Analysis Branch.

APPLICATION OF ION IMPLANTATION FOR THE IMPROVE-MENT OF LOCALIZED CORROSION RESISTANCE OF M50 STEEL BEARINGS Interim Report

G. K. Hubler, J. K. Hirvonen, I. Singer, C. R. Gossett, C. R. Clayton, Y. F. Wang, H. E. Munson, and G. Kuhlman 30 Mar. 1981 48 p refs

(RR0220844; WF4140100)

(AD-A097230: NRL-MR-4481) NTIS Avail: HC A03/MF A01 CSCL 11/6

A program is currently underway to use ion implantation to improve the tribiological and corrosion characteristics of load bearing surfaces in both rolling element bearings and gears used in aircraft propulsion systems. This report describes that aspect of the program concerned with the use of ion implantation for surface alloying of bearing components in order to alleviate the problem of corrosion in M50 steel mainshaft aircraft engine bearings. Author (GRA)

N81-23486\*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

#### **MEGA16 - COMPUTER PROGRAM FOR ANALYSIS AND EXTRAPOLATION OF STRESS-RUPTURE DATA**

C. Robert Ensign May 1981 46 p refs

(NASA-TP-1809; E-495) Avail: NTIS HC A03/MF A01 CSCL 20K

The computerized form of the minimum commitment method of interpolating and extrapolating stress versus time to failure data, MEGA16, is described. Examples are given of its many plots and tabular outputs for a typical set of data. The program assumes a specific model equation and then provides a family of predicted isothermals for any set of data with at least 12 stress-rupture results from three different temperatures spread over reasonable stress and time ranges. It is written in FORTRAN 4 using IBM plotting subroutines and its runs on an IBM 370 time sharing system. MG

#### N81-23487\*# Kaman Aerospace Corp., Bloomfield, Conn. ANALYTICAL TESTING Final Report, 27 Jun. 1978 - 15 Sep. 1980

W. G. Flannelly, J. A. Fabunmi, and E. J. Nagy Washington NASA May 1981 154 p refs

(Contract NAS1-15414)

(NASA-CR-3429; R-1614) Avail: NTIS HC A08/MF A01 CSCL 20K

Analytical methods for combining flight acceleration and strain data with shake test mobility data to predict the effects of structural changes on flight vibrations and strains are presented. This integration of structural dynamic analysis with flight performance is referred to as analytical testing. The objective of this methodology is to analytically estimate the results of flight testing contemplated structural changes with minimum flying and change trials. The category of changes to the aircraft includes mass, stiffness, absorbers, isolators, and active suppressors. Examples of applying the analytical testing methodology using flight test and shake test data measured on an AH-1G helicopter are included. The techniques and procedures for vibration testing and modal analysis are also described. Author

N81-23713\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AN AIRPORT COMMUNITY NOISE-IMPACT ASSESSMENT MODEL

Richard DeLoach Jul. 1980 21 p refs Presented at the 98th Acoust. Soc. of Am. Meeting, Salt Lake City, Utah, 26-30 Nov. 1979

(NASA-TM-80198) Avail: NTIS HC A02/MF A01 CSCL 13B

A computer model was developed to assess the noise impact of an airport on the community which it serves. Assessments are made using the Fractional Impact Method by which a single number describes the community aircraft noise environment in terms of exposed population and multiple event noise level. The model is comprised of three elements: a conventional noise footprint model, a site specific population distribution model, and a dose response transfer function. The footprint model provides the noise distribution for a given aircraft operating scenario. This is combined with the site specific population distribution obtained from a national census data base to yield the number of residents exposed to a given level of noise. The dose response relationship relates noise exposure levels to the percentage of individuals highly annoved by those levels. Author

#### N81-23768# Federal Aviation Administration, Atlantic City, N.J. GROUNDSPEED/AIRSPEED DIFFERENCES AS A WIND SHEAR INDICATOR AND FLIGHT EVALUATION OF A DME-DERIVED SYSTEM TO DETERMINE GROUNDSPEED Final Report, Feb. 1978 - Feb. 1980

David M. Lawrence Feb. 1981 64 p refs

(FAA Proj. 154-451-180)

(AD-A097566; FAA-CT-80-29; FAA-RD-81-1) Avail: NTIS HC A04/MF A01 CSCL 01/3

The use of groundspeed in conjunction with airspeed as a wind shear indicator is discussed. It is shown that a satisfactory indication of headwind can be obtained using indicated airspeed and a low-cost groundspeed measurement device. This report describes the flight test and evaluation of a distance measuring equipment (DME) range-rate derived system for measuring airplane groundspeed. The system consists of a specially developed airborne unit operating in conjunction with unmodified very high frequency omnidirectional radio range (VOR)/DME ground stations. Operating at ranges up to 50 nautical miles in level flight directly toward or away from the ground station, the root mean square (RMS) groundspeed error is 3 to 5 knots. In landing approaches or climbout, the RMS error is 4 to 8 knots.

N81-23862\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

#### LATERAL ATTENUATION OF HIGH-BY-PASS RATIO ENGINED AIRCRAFT NOISE

William L. Willshire, Jr. Apr. 1981 38 p refs

(NASA-TM-81968) Avail: NTIS HC A03/MF A01 CSCL 20A

A flight experiment was conducted to investigate the lateral attenuation of high by pass ratio engined airplanes. A B-747 was flown at low altitudes over the ends of two microphone arrays. One array covering a lateral distance of 1600 m consisted of 14 microphones positioned over grass. The second array covered a lateral distance of 1200 m and consisted of 6 microphones positioned over a concrete runway. Sixteen runs were flown at altitudes ranging from 30 to 960 m. The acoustic information recorded in the field was reduced to one third octave band spectral time histories and synchronized with tracking and weather information. Lateral attenuation as a function of elevation angle was calculated in overall, A-weighted, tone-corrected perceived noise level, and effective perceived noise level units. The B-747 results are compared with similar results for a turbojet-powered T-38 airplane and the SAE recommended lateral attenuation prediction procedure. Less lateral attenuation was measured for the B-747 than for the T-38. The B-747 lateral attenuation values also fell below the SAE curve. Author

#### N81-23864# Boeing Vertol Co., Philadelphia, Pa. A STUDY OF THE EFFECT OF TERRAIN ON HELICOPTER NOISE PROPAGATION BY ACOUSTICAL MODELING Final Report

Harry Stemfeld, Jr. 23 Mar. 1981 57 p. refs (Contract DAAG29-78-C-0002) (AD-A097626; ARO-14795.1-E) Avail: NTIS HC A04/MF A01 CSCL 17/1

An experimental program was conducted to evaluate the applicability of acoustical modeling techniques to study the effects of terrain on helicopter noise propagation. Comparison of model results with flyover data of a full scale UH-1 helicopter showed very good correlation with 500 ft altitude data and moderately good correlation with 50 ft altitude data. Model studies of the effects of the blocking and channeling of sound by barriers, such as hills, shows good correlation with expected results for more complex cases. Author (GRA).

#### N81-23937# Boeing Aerospace Co., Seattle, Wash. WEAPONS SYSTEM SUPPORT RESOURCES DEMAND PARAMETERS - LOGISTICS Progress Report, Jan. - Dec. 1980

G. A. Walker 1 Feb. 1981 231 p refs (AD-A097517; D194-10074-2) Avail: HC A11/MF A01 CSCL 01/3

This document presents preliminary results for Phase 3 of a study to seek ways of developing more accurate measures and weightings to improve resource requirement predictions for operational and emerging weapon systems. These improved measures can then be used on new programs to predict maintenance demands (human and material), for design tradeoff studies early in the system development process to reduce the overall weapon system life cycle cost and increase mission readiness. During Phase 3 (1980) follow-on in-depth statistical

analysis of the preliminary findings was performed to identify various subsystem equipment maintenance resource demand vs generic parameter(s) sub-set(s) relationships, such as equipment, operational, environmental, maintenance, and general characteristics. The plan for the second half of Phase 3 (1981) is to further investigate those maintenance resource demands that have strongly correlated impact parameters within the various subsystems and equipments for identification of positive relationships and their cause factors. Author (GRA)

# N81-23966# Clemson Univ., S.C. Dept. of Mathematical Sciences.

#### A COST FUNCTION FOR MILITARY AIRFRAMES

Norman K. Womer May 1980 12 p refs Presented at the 9th Ann. DOD/FAI Acquisition Res. Symp., Annapolis, 9-11 Jun. 1981

(Contract N00014-75-C-0451; NR Proj. 047-202)

(AD-A097538: N122) Aveil: NTIS HC A02/MF A01 CSCL 12/1

Recent theoretical and empirical work in the areas of learning curves, production rate and cost estimation of airframes has seemed to yield contradictory conclusions. A model of acquisition process that captures the interaction between learning and both endogenous and exogenous production rate changes is developed by modifying a previous model to include production experience and yearly production targets. This permits a production program to be modeled as a series of discrete tasks connected by experience. The impacts of an exogenous increase or decrease in deliveries, of stretching a lot out over a longer period of time, and of several restrictions on production can be modeled by this procedure. Author (GRA)

N81-23967# Clemson Univ., S.C. Dept. of Mathematical Sciences.

# A COST FUNCTION FOR AN AIRFRAME PRODUCTION PROGRAM

Norman K. Womer and Thomas R. Gulledge Aug. 1980 17 p refs

(Contract N00014-75-C-0451; NR Proj. 047-202)

(AD-A097540: N125) Avail: NTIS HC A02/MF A01 CSCL 12/1

This research represents the expansion of previous work in the area of estimating program cost in military airframe production. The effort is unique in that it yields a model of the production process that considers the impact of learning and production rate on total program costs. To provide an empirical test of model validity, the parameters are estimated for the C141 airframe program. The empirical work is instructive in that it shows how particular care must be taken in formulating models of this type. This model should be particularly useful as a prototype for models of on going production programs. In particular, it can be used to estimate the cost impact of exogenous changes in the program delivery schedule, the 'crashes' and 'stretch-outs' that frequently characterize military aircraft programs. Author (GRA)

NTIS

# SUBJECT INDEX

# AERONAUTICAL ENGINEERING / A Continuing Bibliography (Suppl. 138)

## AUGUST 1981



The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, a title extension is added, separated from the title by three hyphens. The NASA or AIAA accession number is included in each entry to assist the user in locating the abstract in the abstract section of this supplement. If applicable, a report number is also included as an aid in identifying the document.

## Α

A-7 AIBCEAPT	
Implementing Aircraft Structural Life Manag	enent .
to reduce structural cost of ownership	
[SAWE PAPER 1331]	A81-31376
Design, development, and evaluation of ligh	tweight
hydraulic system, phase 1 1-7 aircraf	t
[AD-A097505]	N81-23075
ABORT APPARATUS	
Analysis of ejection seat stability using e	asy
program, volume 1	
FAD-A0965971	N81-22033
ACCELEBATION (PEYSICS)	
The behavior of quartz oscillators in the p	reseace
of accelerations in missile and aircr	aft
time-frequency navigation systems	
	A81-31285
ACOUSTIC ATTENDATION	101 01000
Lateral attenuation of high-hy-pass ratio e	nained
aircraft noise	
[ NA 5A-TM-8 1968 ]	N81-23862
ACOUSTIC RAISSION	101 10001
In-flight fatigue crack monitoring using ac	onstic
emission -	Justic
(110)101	181-32857
	R01 32037
ACTUSTIC ARASURRENTS	
ACCUSTIC BEASUREBERTS Comparison of predicted engine core poice w	1 <b>i</b> + h
CONSTIC BRASURERENTS Comparison of predicted engine core noise w	ith
CONDITIC BRASUBBRBTS Comparison of predicted engine core noise w proposed FAA helicopter noise certificati	ith .on
CONDIC BRADUKBERTS Comparison of predicted engine core noise w proposed PAA helicopter noise certificati reguirements (Nich-TM-81730)	ith .on .ve1-22830
CONSTIC BRASSBERRY Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TB-81739] Classification of opprating conditions of	ith .on 181-22839
ACCUSTIC BRASULTERENS Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TH-81739] Classification of operating conditions of turbomachings from solid horne courd	uith .on N81-22839
CONDITIC HARDWERENTS Comparison of predicted engine core noise w proposed PAA helicopter noise certificati requirements [NASA-TH-81739] Classification of operating conditions of turbomachines from solid borne sound	nith on N81-22839
ACCUSTIC BRADUMERENS Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TH-81739] Classification of operating conditions of turbomachines from solid borne sound ACCONSTIC EROBACIETOR	N81-23015
ACOUSTIC PROPAGATION Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TB-81739] Classification of operating conditions of turbomachines from solid borne sound ACOUSTIC PROPAGATION	ith on N81-22839 N81-23015
ACCUSTIC FROPAGATION Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TB-81739] Classification of operating conditions of turbomachines from solid borne sound ACCUSTIC FROPAGATION The propeller tip vorter. A possible contr	lith on N81-22839 N81-23015 Sibutor
ACCUSTIC BRADUMERENS Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TH-81739] Classification of operating conditions of turbomachines from solid borne sound ACCUSTIC PHOPAGATION The propeller tip vorter. A possible contr to aircraft cabin noise	lith on N81-22839 N81-23015 Tibutor
ACCURATE HARDWARKETS Comparison of predicted engine core noise w proposed PAA helicopter noise certificati requirements [NASA-TB-81739] Classification of operating conditions of turbomachines from solid borne sound ACCUSTIC PBOPAGATION The propeller tip vorter. A possible contr to aircraft cabin noise [NASA-TB-81768] CONTRO COMPANY	11th on N81-22839 N81-23015 Sibutor N81-22838
<ul> <li>ACOUSTIC SANAGAMENTS</li> <li>Comparison of predicted engine core noise we proposed FAA helicopter noise certification requirements         [NASA-TR-8739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FROPAGATION</li> <li>The propeller tip vortex. A possible contrate aircraft cabin noise         [NASA-TR-81768]</li> <li>ACOUSTIC SCATTBRING</li> </ul>	bith on N81-22839 N81-23015 Sibutor N81-22838
ACCOUNTIC EMADUMENTS Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TH-81739] Classification of operating conditions of turbomachines from solid borne sound ACCOUNTIC FROPAGATION The propeller tip vortex. A possible contr to aircraft cabin noise [NASA-TH-81768] ACCOUNTIC SCATTERING A study of the effect of terrain on helicop	bith on N81-22839 N81-23015 Sibutor N81-22838 Oter
ACCURSTIC EMASULABLENS Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TH-81739] Classification of operating conditions of turbomachines from solid borne sound ACOUSTIC FBOPAGATION The propeller tip vorter. A possible contr to aircraft cabin noise [NASA-TH-81768] ACOUSTIC SCATTRENEG A study of the effect of terrain on helicop noise propagation by acoustical modeling	hith on N81-22839 N81-23015 Sibutor N81-22838 oter
<ul> <li>ACOUSTIC BRADUMBERTS</li> <li>Comparison of predicted engine core noise we proposed FAA helicopter noise certification requirements</li> <li>[NASA-TB-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FROPAGATION</li> <li>The propeller tip vortex. A possible contrate aircraft cabin noise [NASA-TB-81768]</li> <li>ACOUSTIC SCATTBRING</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling [AD-A097626]</li> </ul>	bith on N81-22839 N81-23015 Sibutor N81-22838 oter N81-22864
<ul> <li>ACCUSTIC ENABLAGENESS</li> <li>Comparison of predicted engine core noise w proposed PAA helicopter noise certificati requirements [NASA-TH-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACCUSTIC FROPAGATION The propeller tip vortex. A possible contr to aircraft cabin noise [NASA-TH-81760]</li> <li>ACCUSTIC SCATTREING</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling [AD-A097626]</li> <li>ACTIVE CONTROL</li> </ul>	bith on N81-22839 N81-23015 Sibutor N81-22838 Ster N81-23864
<ul> <li>ACOUSTIC BRASSMARSHIS</li> <li>Comparison of predicted engine core noise we proposed FAA helicopter noise certification requirements         [NASA-TB-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FBOPAGATION</li> <li>The propeller tip vorter. A possible contration to aircraft cabin noise         [NASA-TB-81768]</li> <li>ACOUSTIC SCATTREADG</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling         [AD-A097626]</li> <li>Active Comprodict</li> </ul>	hith on N81-22839 N81-23015 Sibutor N81-22838 Ster N81-23864
<ul> <li>ACOUSTIC BRANDUMBERTS</li> <li>Comparison of predicted engine core noise w proposed FAA helicopter noise certificati requirements [NASA-TB-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FROPAGATION</li> <li>The propeller tip vorter. A possible contr to aircraft cabin noise [NASA-TB-81768]</li> <li>ACOUSTIC SCATTERING</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling [AD-A097626]</li> <li>Active CONTROL</li> <li>A new method of airfoil flutter control</li> </ul>	bith on N81-22839 N81-23015 Sibutor N81-22838 Ster N81-23864 A81-33844
<ul> <li>ACOUSTIC BRADUMBRENS</li> <li>Comparison of predicted engine core noise w proposed PAA helicopter noise certificati requirements [NASA-TH-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FROPAGATION The propeller tip vorter. A possible contr to aircraft cabin noise [NASA-TH-81768]</li> <li>ACOUSTIC SCATTERING</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling [AD-A097626]</li> <li>ACTIVE CONTROL</li> <li>A new method of airfoil flutter control</li> <li>Generalized active control - Its potential</li> </ul>	bith on N81-22839 N81-23015 Sibutor N81-22838 oter N81-23864 A81-33844 and
<ul> <li>ACOUSTIC BRASSMERSISTS</li> <li>Comparison of predicted engine core noise we proposed FAA helicopter noise certification requirements         [NASA-TB-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FBOPAGATION</li> <li>The propeller tip vorter. A possible contration of aircraft cabin noise         [NASA-TB-81768]</li> <li>ACOUSTIC SCATTRENEG</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling         [AD-A097626]</li> <li>Active Control - Its potential directions of research</li> </ul>	hith on N81-22839 N81-23015 Sibutor N81-22838 Oter N81-23864 A81-33844 and
<ul> <li>ACOUSTIC BRANDUMBERTS</li> <li>Comparison of predicted engine core noise we proposed FAA helicopter noise certification requirements         [NASA-TR-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FROPAGATION</li> <li>The propeller tip vorter. A possible contration of aircraft cabin noise         [NASA-TR-81768]</li> <li>ACOUSTIC SCATTERING</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling         [AD-A097626]</li> <li>ACTUVE CONTROL         A new method of airfoil flutter control         Generalized active control - Its potential directions of research         [AAAP PAPEE BT 80-29]</li> </ul>	hith on N81-22839 N81-23015 Sibutor N81-22838 Ster N81-23864 A81-33844 and A81-33928
<ul> <li>ACOUSTIC BRADUMBRENS</li> <li>Comparison of predicted engine core noise we proposed PAA helicopter noise certification requirements         [NASA-TH-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FROPAGATION</li> <li>The propeller tip vorter. A possible contribution to aircraft cabin noise         [NASA-TH-81768]</li> <li>ACOUSTIC SCATTERING</li> <li>A study of the effect of terrain on helicopinoise propagation by acoustical modeling         [AD-A097626]</li> <li>ACTIVE CONTROL         A new method of airfoil flutter control         Generalized active control - Its potential         directions of research         [AAP PAPER BT 80-29]         Bigh frequency drive mechanism for an active</li> </ul>	bith on N81-22839 N81-23015 Sibutor N81-22838 oter N81-23864 A81-33844 and A81-33928 G
<ul> <li>ACOUSTIC BRASSMERSISTS</li> <li>Comparison of predicted engine core noise we proposed FAA helicopter noise certification requirements         [NASA-TR-81739]</li> <li>Classification of operating conditions of turbomachines from solid borne sound</li> <li>ACOUSTIC FBOPAGATION</li> <li>The propeller tip vorter. A possible contration of aircraft cabin noise         [NASA-TR-81768]</li> <li>ACOUSTIC SCATTREADG</li> <li>A study of the effect of terrain on helicop noise propagation by acoustical modeling         [AD-A097626]</li> <li>ACTIVE CONTROL         A new method of airfoil flutter control</li> <li>Generalized active control - Its potential directions of research         [AAAF PAPEE NT 80-29]</li> <li>High frequency drive mechanism for an active controls systems aircraft control surface</li> </ul>	hith on N81-22839 N81-23015 Sibutor N81-22838 Oter N81-23864 A81-33844 and A81-33928 re

۰,

ADAPTIVE CONTROL	
Adaptive-vall wind-tunnel development for transonic testing	
F-8C adaptive control law refinement and so	A81-31367 ftware
[NASA-CR-163093]	N81-22059
Developments in the analysis and repair of	cracked
and uncracked structures	A81-31561
Bonded laminated structures in aircraft man Russian book	ufacture
ABBIAL PROTOGRAPHY	ACI-33700
sensor images	ited
Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous ve	A81-31114
Analysis, design and simulation of line sca	A81-32491
aerial surveillance systems	381-32002
ABBIAL BECOBBAISSAUCE	
Applications of new technology in the init	A81-31126
The displacement-thickness theory of trails	ing edge
Noice characteristics of two parallel date	A81-30785
unequal flow	
AIRFRAME BOISE of a small model transport a	A81-31601 ircraft
and scaling effects Boeing 747 [NASA-TP-1858]	N81-22832
ABBODYNAMIC BALANCE Apparatus for and method of compensating dj	namic
unbalance [NASA-CASE-GSC-12550-1]	N81-22358
ABBODYBAHIC CHARACTERISTICS Mathematical model of the linear unsteady	
aerodynamics of the entire aircraft	481-31039
Subsonic and transonic flow on a wing at d:	ifferent
	A81-31249
subsonic and transonic files on a sing at di sweep angles. II	liierent
Effectiveness of leading-edge vortex flaps	А81-31250 оп 60
and 75 degree delta Wings	A81-31368
Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear	jh angle
oscillations in a uniform stream	A81-32017
Comparison of computed and measured unstead	ly
[ONBRA, TP NO. 1981-12]	A81-32541
trailing edge of an axisymmetrical contou after-body	red
Study of a propulsive system aerodynam:	A81-33281 LC
characteristics of proposed model	<b>∆81-33673</b>
Vorter-flow aerodynamics - An emerging des; capability	ign 191_22742
Sea King mathematical model validation tria	lis,
Flight data channel Calibration [AD-A096587]	881-22043

Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Study overview --- aerodynamic characteristics [NASA-CB-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Evaluation N81-23030 of prediction methodologies [NASA-CB-152391-VOL-2] Analysis of wind tunnel test results for a N81-23031 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effects of configuration variations from baseline [NASA-CR-152391-VOL-3] Analysis of wind tunnel test results for a N81-23032 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 4: RALS B104 aerodynamic characteristics and comparisons with B205 configuration aerodynamic characteristics N81-23033 [NASA-CE-152391-VOL-4] Investigation of aerodynamic characteristics of wings having vortex flow using different numerical codes [NASA-CR-165706] 881-23034 Two-dimensional aerodynamic characteristics of the NACA 0012 airfoil in the Langley 8 foot transonic pressure tunnel [NASA-TM-81927] N81-23036 Pull-scale aerodynamic characteristics of a propellar installed on a small twin-engine aircraft wing panel [NASA-TM-81285] N81-23039 ABBODINABIC CONFIGURATIONS Application of an aerodynamic configuration modeling technique to the design and analysis of X-Wing aircraft configurations A81-32013 Method for predicting the jet-induced aerodynamics of V/STOL configurations in transition [AD-A097356] N81-23043 Digital Avionics Information System (DAIS). Volume 2: Impact of DAIS concept on life cycle cost. Supplement [AD-A097438] N81-23084 Technical evaluation report on the Fluid Dynamic Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AE-146] ABRODINAMIC PORCES N81-23431 A theoretical treatment of lifting surface theory of an elliptic wing A81-30653 Influence of hinge line gap on aerodynamic forces acting on a harmcnically oscillating thin profile in an incompressible flow. I, II A81~30956 Measurement of the aerodynamic forces acting on a harmonically oscillating wing at high subsonic speeds A81-31042 ARRODYNAMIC HRATING Tensile stress/strain characterization of non-linear materials A81-30915 ABBODYNABIC LOADS **BAPIDLOADS - A preliminary design loads prediction** technique for aircraft [SAME PAPER 1366] A01-31: The development of a theoretical and experimental model for the study of active suppression of A81-31388 wing flutter N81-22058 Some remarks on the unsteady airloads on oscillating control surfaces in subsonic flow N81-23055 Comparison of theoretical predictions of orbiter airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TH-81358] N81-23066 Performance deterioration based on simulated aerodynamic loads test, JT9D jet engine diagnostics program [NASA-CR-165297] N81-23086 ABRODIBABIC BOISE The displacement-thickness theory of trailing edge noise

SUBJECT INDEX

ABRODYNAMIC STABILITY A new method of airfoil flutter control A81-33644 Maximum likelihood identification of aircraft lateral parameters with unsteady aerodynamic modelling N81-22057 ABBODYNAMIC STALLING Role of laminar separation bubbles in airfoil leading-edge stalls A81-31613 Fluid mechanics mechanisms in the stall process of airfoils for helicopters A81-32779 ARRODYRANICS An experimental investigation of the aerodynamics and cooling of a horizontally-opposed air-cooled ano cooling of a horizontally-opposed air-cool aircraft engine installation [NSA-CE-3405] N81-2 Analytical study of the cruise performance of a class of remotely piloted, microwave-powered, high-altitude airplane platforms [NASA-TH-81969] N81-2 N81-22015 N81-22040 Aircraft modification management evaluation [AD-A096458] N81-229 Description of recent changes in the Langley 6- by N81-22974 28-inch transonic tunnel [NASA-TE-81947] N81-23096 ABBOBLASTICITY Non-linear oscillator models in bluff body aeroelasticity A81-30786 A Galerkin type finite element method for rotary-wing aeroelasticity in hover and forward flight A81-33050 A new method of airfoil flutter control A81-33844 The development of a theoretical and experimental model for the study of active suppression of wing flutter N81-22058 Structures and Materials Panel [AD-A089019] N81-22420 Experimental studies of scale effects on oscillating airfoils at transonic speeds N81-23054 ABRONAUTICAL ENGINBERING Principles of aircraft structural design /2nd revised and enlarged edition/ --- Bussian book A81-31800 Aircraft design then and now [AIAA PAPER 81-0917] A81-32933 The rise of air and space A81-33718 Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CR-159296] N81-22419 ABBONAUTICS Propeller and wing --- Bussian book A81-33696 ARROSPACE REGISTERRING Advanced composites - Evolution of manufacturing technology [AIAA PAPEE 81-0895] A81-32920 The rise of air and space A81-33718 ABROSPACE INDUSTRY Advanced composites - Evolution of manufacturing technology [AIAA FAPEE 81-0895] A81-32920 ABBOSPACE SYSTEMS Application of the parameter space method to aerospace vehicle digital control system design AE1-32642 ABROSPACE VEHICLES Bigh frequency angular vibration measurements in vehicles [AAS PAPER 81-024] A81-32886 AFTBRBODIES Wing-body carryover at supersonic speeds with finite afterbodies 181-31622 BIPERIMENTAL study of the separation at the trailing edge of an axisymmetrical contoured after-body 181-33281

```
A81-30785
```

#### AIECBAFT COBBUBICATION

AB-16 BRLICOPTER Structural Integrity Recording System (SIR) for U.S. Army AH-16 Helicopters [AD-A097283] N81-23438 Analytical testing [NASA-CB-3429] N81-23487 AIB Investigation of air solubility in jet A fuel at high pressures [NASA-CR-3422] N81-22130 AIR CABGO Flatbed - The universal transport airplane (SAWB PAFEE 1343) AIE CONDITIONING EQUIPARNT A81-31382 An analysis of thermal balance in the cooled cabin of a Sea King Belicopter [AD-A097199] N81-23077 AIB COOLING An experimental investigation of the aerodynamics and cooling of a horizontally-opposed air-cocled aircraft engine installation [NASA-CB-3405] N81-22015 Thermal and flow analysis of a convection air-cooled ceramic coated porous metal concept for turbine vanes [NASA-TM-81749] N81-22056 AIR COSHION LANDING SYSTEMS Calibration of an axial fan at various power settings for use on a quarter scale XC-8A air cushion model [AD-A097043] N81-22042 AIR DEPENSE Operator training systems/simulators A81-31109 AIR FLOR An experimental investigation of the aerodynamics and cooling of a borizontally-opposed air-cocled aircraft engine installation [ HASA-CB-3405 ] 881-22015 AIR INTAKES Investigation of instantaneous distortions in air intakes at high angles of attack [AAAF PAPEE NT 80-38] A81-33931 Analysis of total and static pressure fluctuations in an air intake at high incidence [AAAF PAPES NT 80-61] A81-33950 ALE BAVIGATION GFS Navstar, the universal positioning system of the future A81-30975 Control, navigation, and guidance --- of aircraft [AIAA PAPES 81-0859] A81-32 Dead reckoner navigation project A81-32910 N81-22010 AIB TBAPPIC CONTROL Operator training systems/simulators A81-31109 Discrete Address Beacon System A81-31134 Application of signal detection theory to decision making in supervisory control - The effect of the operator's experience A81-31288 SINCAT - A modular air traffic control simulator A81-33149 The use of airspace - One way to save fuel A81-33150 Increasing capacity at Paris airports [AIAA PAPEB 81-0802] A81-33890 Laser beacon collision avoidance systems N81-22009 Candidate CDTI procedures study [NASA-CE-165673] No. Potential effects of the introduction of the N81-22032 discrete address beacon system data link on air/ground information transfer problems N81-22037 [NASA-CR-166165] Summary of transponder data, May 1979 - November 1979 [AD-A097569] N81-23061 Electronic flight rules: An alternative separation assurance concept [AD-A097570] ¥81-23063 AIR TRAPPIC CONTROLLERS (PRESONDEL) Operator training systems/simulators A81-31109

Application of signal detection theory to decision making in supervisory control - The effect of the operator's experience A81-31288 SINCAT - A modular air traffic control simulator A81-33149 AIR TRANSPORTATION Maintenance tomorrow and the day after --- of wide-bodied transport aircraft A81-33790 Investigation of air transportation technology at Massachusetts Institute of Technology, 1980 N81-22000 MIT Annotated Biblicgrachy N81-22001 Investigation of air transportation technology at Ohio University, 1980 --- general aviation aircraft and navigation aids N81-22005 Investigation of air transportation technology at Frinceton University, 1980 N81-22008 AIRBORNE EQUIPMENT A high performance TV camera for use in target acquisition and laser designator systems A81-31115 Analysis, design and simulation of line scan aerial surveillance systems A81-32492 Airborne ground velocity determination by digital processing of electro-optical line sensor signals A81-32496 Autonomous target handoff from an airborne sensor to a missile seeker A81-32498 High temperature electronic requirements in aeropropulsion systems A81-32547 Bigh frequency angular vibration measurements in vebicles [AAS PAPEE 81-024] The impact of the All Electric Airplane on A81-32886 production engineering [AIAA PAPEE 81-0848] A81-32909 Punctional testing airborne navigation equipment [AD-A097115] N81-2 881-23062 Punctional testing airborne radars [ AD-A097562 ] N81-23358 AIRBORNE/SPACEBORNE COMPUTERS Airborne method to minimize fuel with fixed time-of-arrival constraints A81-31297 Microprocessor-based digital air data computer for flight test A81-32858 Airborne electronic displays A81-32999 Relationships for a flight performance computer N61-23014 Navaids calibration evaluation with a computer-controlled avionics data acquisition svstem N81-23020 Demonstration Advanced Avionics System (DAAS) functional description --- Cessna 402B aircraft [NASA-CE-152405] 881-23 881-23080 AIRCHAPT Design concepts for low-cost composite turbofan engine frame [ NASA-CB-165217 ] N81-22053 AIRCHAPT ACCIDENT INVESTIGATION A review of in-flight emergencies in the ASBS data hase [ NASA-CE-166166 ] N81-22031 AIBCHAFT ACCIDENTS Crashworthiness versus cost based on a study of severe Army helicopter accidents during 1970 and 1971 A81-32006 AIRCHAPT ANTENNAS An extremely lightweight fuselage-integrated pbased array for airborne applications A81-30779 AIRCRAFT COMMUNICATION A 7.5-GHz microstrip phased array for aircraft-to-satellite communication A81-30776

#### AIRCBAFT COMPARTMENTS

AIRCHART COMPARTMENTS The propeller tip vortex. A possible contributor to aircraft cabin noise [NASA-TH-81768] N81-228. An analysis of thermal balance in the cooled cabin N81-22838 of a Sea King Helicopter [AD-A097199] N81-23077 AIRCEAPT COMPIGUÉATIONS Plathed - The universal transport airplane [SAWE PAPER 1343] A81-31382 Application of an aerodynamic configuration modeling technique to the design and analysis of X-Wing aircraft configurations A81-32013 General aviation airplane fuel economy system model N81-22011 Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effects of configuration variations from baseline [NASA-CR-152391-VOL-3] N81-23032 AIRCRAFT CONSTRUCTION MATERIALS Aircraft applications of titanium - A review of the past and potential for the future [AIAA PAPER 81-0893] A81-3. Advanced composites - Evolution of manufacturing A81-32918 technology [AIAA PAPES 81-0895] A81-32920 Past and future trends in structures and dynamics --- of aircraft [AIAA PAPEE 81-0896] A81-32921 Advanced fiber reinforced thermoplastic structures [AD-A096759] AIRCBAFT CONTEOL N81-22106 Control, navigation, and guidance --- of aircraft [AINA PAPEB 81-0859] A81-32 A81-32910 Technology growth in mini-RPV systems [AIAA PAPEE 81-0936] A81-Generalized active control - Its potential and A81-32937 directions of research [AAAF PAPEE NT 80-29] A81-33928 High frequency drive mechanism for an active controls systems aircraft control surface N81-22400 AIRCRAFT DESIGN On the design of modern airfoil sections by numerical methods A81-30705 A computer code for the calculation of aircraft trailing vortices A81-30710 The 'light-weight' system - A novel concept for on-board weight and balance measurement using fiber optics [SAWE PAPER 1336] A81-31377 Operational responses to aft empty C.G. --- Center of Gravity location in Boeing 727-200 aircraft (SAWE PAPER 1338) A81-313 Test procedures used in determining aircraft suitability for STAN integral weight and balance A81-31378 system [SAWE PAPER 1339] Design considerations for future turboprop A81-31379 transports [SAWE PAPER 1340] A81-31380 [SAVE PAREN 1343] An Interactive Weight Accounting Program /IWP/ [SAVE PAPEN 1345] Computer aided technology interface with weights engineering -- aircraft design [SAVE PAPEN 1346] Note PAPEN 1346] Weights information systems using minicomputers [SAWE PAPEE 1347] A81-31385 The Modular Life Cycle Cost Model for advanced The Modular Life Cycle Cost Model for advanced aircraft systems - An overview [SAWE PAPER 1351] The structural weight fraction - Bevisited for fighter/attack type aircraft [SAWE PAPER 1365] A01-3136 BAPIDLCADS - A preliminary design loads prediction technique for aircraft [SAWE PAPER 1366] PABAM - A new weight sizing routine ----cost-effective computerized design for aircraft A81-31386 A81-31387 A81-31388 cost-effective computerized design for aircraft [SAWE PAPER 1367] A81-31389 Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] & &&1-313 481-31399

#### SUBJECT INDEX

aircraft design	k
ATTAIN ACTAN	•
[SAWE PAPER 1385]	A81-31401
A design analysis technique for evaluating	size
and weight of V/STOL lift fans	
[SAWE PAPER 1386]	A81-31402
Alfships - Transport of the future	101 11(00
Drinciples of aircraft structural design /	201-31099
revised and enlarged edition/ Russia	n hook
	A81-31600
Aircraft assembly Bussian book	
	A81-31872
Past and future trends in structures and d	ynamics
of aircraft	
[AIAA PAPEB 81-0896]	A81-32921
Design of low powered aircraft, a philosop	hy for
future personal sport aircraft	101 20000
latar PAPER 01-0303	A01-32320
FATAA PAPER A1-09123	A 61-32930
Commuter aircraft design	
[AIAA FAPES 81-0913]	A81-32931
Sun povered aircraft design	
[AIAA PAPEE 81-0916]	A81-32932
Aircraft design then and now	104 20022
LATAN PAPER 81-091/]	A81+32933
TATAN DEDRE A1-09261	181-30004
The art of designing excerimental aircraft	- An
OVERVIEW	
[AIAA FAPEE 81-0944]	A81-32939
Airborne electronic displays	
	A81-32999
Propeller and wing Russian book	
Nortow-flow service - An emerging dec	A81-33696
canability	190
00[001210]	A81-33717
Maintenance tomorrow and the day after	of
wide-bodied transport aircraft	
	A81-33790
The optimal lift-drag ratio of a civil air	craft
[ABAF FARES NT 80-30] Study of the characteristics of a baccaron	AB1-33923
in nonlinear theory	teu wiby
FAAF PAPER NT 80-407	191-33927
	401-33347
Global optimization of a gilder	201-33327
[AAAF PAPEE NT 80-36]	A01-33937
[AAAF PAPER NT 80-36] Design considerations for composite fusela	A81-33937 ge
GLOBAL OPTIMIZATION OF A GLIDER [AAAF PAPER NT 80-36] Design considerations for composite fusela structure of commercial transport aircra (NEL-CD-16206)	A81-33937 ge ft
GLOBAL OPTIMIZATION OF A GLIGER [AAAF PAPER NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NASA-CB-159296] Aircraft crash dynamics: Some major consi	A81-33937 ge ft N81-22419 derations
GIODAI OPTIMIZATION OF A GIIder [AAAF PAPER NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NASA-CB-159296] Aircraft crash dynamics: Some major consi	A01-33937 ge ft N81-22419 derations N81-22437
<ul> <li>Global optimization of a glider [AMAF PAPER NT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo</li> </ul>	A81-33937 ge ft N81-22419 derations N81-22437 site
<ul> <li>Global optimization of a glider         [AAAF PAPER NT 80-36]</li> <li>Design considerations for composite fusela         structure of commercial transport aircra         [Nasa-cB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo         blade and hub and nonmechanical control</li> </ul>	A81-33937 ge ft N81-22419 derations N81-22437 site System
<ul> <li>Global optimization of a glider [AAAF PAPER NT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NASA-CE-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo blade and bub and nonmechanical control for the tilt-rotor aircraft. Volume 1:</li> </ul>	A81-33937 ge ft W81-22419 derations N81-22437 site system
<ul> <li>GIODAI OPTIMIZATION OF A GIIder [AAAF PAPER NT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NASA-CE-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies</li> </ul>	A81-33937 ge ft N81-22419 derations N81-22437 site system
<ul> <li>Global optimization of a glider [AMAF PAPER NT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1]</li> </ul>	A81-33937 ge ft N81-22419 derations N81-22437 site system N81-23064
<ul> <li>Global optimization of a glider [AMAF PAPER by 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NaSA-CB-152336-1]</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control</li> </ul>	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 site System
<ul> <li>Global optimization of a glider [AAAF PAPER BY 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NASA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2:</li> </ul>	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-22437 site system N01-23064 site system Eroject
<ul> <li>Global optimization of a glider [AAB PAPER NT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NASA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and bub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo- blade and bub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data</li> </ul>	A01-33937 ge ft N01-22419 derations N01-22437 site System N01-23064 site system Froject
Global optimization of a glider [AAAF PAPER NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CE-152336-2]	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 site system Froject N01-23065
<ul> <li>Global optimization of a glider [AMAF PAPER by 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2]</li> <li>Technical evaluation report on the Fluid D</li> </ul>	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 site Froject N01-23065 ynamic
<ul> <li>Global optimization of a glider [AAAF PAPER BY 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NSA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2]</li> <li>Technical evaluation report on the Fluid D Famel Symposium on Subsonic/Transonic</li> </ul>	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 site system Froject N01-23065 ynamic
<ul> <li>Global optimization of a glider [AAB PAPER NT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NASA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2]</li> <li>Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics</li> </ul>	A01-33937 ge ft N01-22419 derations N01-22437 site System N01-23064 site System Froject N01-23065 ynamic
Global optimization of a glider [AAAF PAPER NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CE-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [ACAED-AR-146] FUCPDAPT HECIMES	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 system Froject N01-23065 ynamic N01-23431
<pre>Global optimization of a glider [AAAF PAPEN BY 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CR-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AR-146] IBCEMPT ENGINES</pre>	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 system Froject N01-23065 ynamic N01-23431 Eussian
<ul> <li>Global optimization of a glider [AMAF PAPEN BT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NaSA-CB-152336-1]</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NaSA-CB-152336-2]</li> <li>Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGABD-AB-146]</li> <li>IBCEMPT ENGINES</li> <li>Frinciples of aircraft-engine assembly book</li> </ul>	A01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 site system Froject N01-23065 ynamic N01-23431 Eussian
Global optimization of a glider [AAAF PAPER BY 80-36] Design considerations for composite fusela structure of commercial transport aircra [NASA-CB-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAD-AB-146] IBCEMPT ENGINES Frinciples of aircraft-engine assembly book	A 01-33937 ge ft N81-22419 derations N81-22437 site system N81-23064 site system Froject N81-23065 ynamic N81-23431 Eussian A 61-31799
<pre>Global optimization of a glider [AAAF PAPER NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CE-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AE-146] IBCMAFT BHGINES Frinciples of aircraft-engine assembly book High temperature electronic requirements i</pre>	A 01-33937 ge ft N01-22419 derations N01-22437 site system Froject N01-23065 ynamic N01-23431 Eussian A 01-31799 n
<ul> <li>Global optimization of a glider [AMAF PAPER BT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2]</li> <li>Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGARD-AB-146]</li> <li>INCEMPT ENGINES Frinciples of aircraft-engine assembly book</li> <li>Bigh temperature electronic requirements i aeropropulsion systems</li> </ul>	A 01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 system Froject N01-23065 ynamic N01-23431 Eussian A 01-31799 D
<ul> <li>Global optimization of a glider [AMAF PAPER BT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CR-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CR-152336-1]</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CR-152336-2]</li> <li>Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGARD-AR-146]</li> <li>IBCEMFT ENGINES Frinciples of aircraft-engine assembly book</li> <li>Bigh temperature electronic requirements i aeropropulsion systems</li> </ul>	A 61-33937 ge ft N81-22419 derations N81-22437 site system N81-23064 system Froject N81-23065 ynamic N81-23431 Bussian A 81-31799 n A 81-32547
<ul> <li>Global optimization of a glider [AMAF PAPER BT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2]</li> <li>Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGABD-AB-146]</li> <li>IBCENPT ENGINES Frinciples of aircraft-engine assembly book</li> <li>Bearing wear detection using radioactive i tagging</li> </ul>	A 01-33937 ge ft N01-22419 derations N01-22437 site system N01-23064 site system Froject N01-23065 ynamic N01-23431 Eussian A01-32547 rcn-55
<pre>Global optimization of a glider [AAA preper Nr 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [ACABD-AB-146] IBCEMPT ENGINES Frinciples of aircraft-engine assembly book Bigh temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE PEBFEINT 81-AM-6A-3]</pre>	A 61-33937 ge ft N61-22419 derations N81-22437 site system Froject N81-23064 system Froject N81-23065 ynamic N81-23431 Eussian A 81-31799 n A 81-32547 rcn-55 A 81-33868
Global optimization of a glider [AAAF PAPEE NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CE-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [ACAED-AR-146] INCENT BHGINES Frinciples of aircraft-engine assembly book Bigh temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE FREFINT 81-AM-6A-3] Prop-Fan technical progress leading to tec	A 61-33937 ge ft N61-22419 derations N61-22437 site system Froject N61-23065 ynamic N61-23431 Eussian A 61-31799 A 61-32547 rcn-55 A 61-33868 bnology
<pre>GloBal optimization of a glider [AAAF PAPEE NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CE-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AE-146] HBCBAFT ENGINES Frinciples of aircraft-engine assembly book Bigh temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE PEFFINT 81-AM-6A-3] Prop-Fam technical progress leading to tec readiness [Nather Engine assembly book]</pre>	A 61-33937 ge ft N81-22419 derations N81-22437 site system Froject N81-23064 system Froject N81-23431 Eussian A 81-31799 A 81-32547 rcn-55 A 81-33668 bnology
<pre>Global optimization of a glider [AAAF PAPEN BY 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2] Technical evaluation report on the Fluid D Famel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AR-146] HECHAPT ENGINES Frinciples of aircraft-engine assembly book High temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE FREFINT 81-AM-6A-3] Prop-Pan technical progress leading to tec readiness [ATAA FAFEE 81-0810] Polls=Payce EN 2116:255 proor plant</pre>	A 61-33937 ge ft N81-22419 derations N81-22437 site system N81-23064 site system Froject N81-23431 Fussian A81-32547 rcn-55 A81-33868 baology A81-33878
<pre>GloBal optimization of a glider [AAAF PAPEE NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [ACARD-AR-146] IBCENPT ENGINES Frinciples of aircraft-engine assembly book High temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE FEBEFHINT 81-AM-6A-3] Prop-Fan technical progress leading to tec readimess [AIAA FAFEE 81-0810] Bolls-Royce EE 211-535 power plant [AIAA FAFEE 81-08071</pre>	A 61-33937 ge ft N81-22419 derations N81-22437 site system N81-23064 site system Froject N81-23065 ynamic N81-23431 Eussian A 81-32547 rcn-55 A 81-33868 hnology A 81-33878 A 81-33868
<pre>GloBal optimization of a glider [AAAF PAPEE NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CE-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CE-152336-2] Technical evaluation report on the Fluid D Fanel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AR-146] Frinciples of aircraft-engine assembly book High temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE FREFEINT 81-AM-6A-3] Prop-Pan technical progress leading to tec readiness [AIAA FAFEE 81-0810] Bolls-Boyce EB 211-535 power plant [AIAA FAFES 81-0807]</pre>	A 61-33937 ge ft N61-22419 derations N81-22437 site system Froject N81-23064 system Froject N81-23431 Fussian A 81-31799 A 81-31799 A 81-31799 A 81-31799 A 81-33868 bbology A 81-33878 A 81-33878
<ul> <li>Global optimization of a glider [AAM PAPEE NT 80-36]</li> <li>Design considerations for composite fusela structure of commercial transport aircra [NaSA-CB-159296]</li> <li>Aircraft crash dynamics: Some major consi</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1]</li> <li>Preliminary design study of advanced compo- blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2]</li> <li>Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AB-146]</li> <li>IBCENFT ENGINES</li> <li>Frinciples of aircraft-engine assembly book</li> <li>Bigh temperature electronic requirements i aeropropulsion systems</li> <li>Bearing wear detection using radioactive i tagging [ASLE FEFFINT 81-AM-6A-3]</li> <li>Frop-Fan technical progress leading to tec readiness [AIAA FAFEE 81-0807]</li> <li>Investigation of instantaneous distortions intakes at high angles of attack</li> </ul>	A 61-33937 ge ft N61-22419 derations N61-22437 site system Froject N61-23065 ynamic N61-23431 Eussian A61-32547 rcn-55 A61-33666 bnology A61-33878 A61-33886 in air
<pre>GloBal optimization of a glider [AAMP PAPEE NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NaSA-CR-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CR-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CR-152336-2] Technical evaluation report on the Fluid D Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AR-146] HECHAFT ENGINES Frinciples of aircraft-engine assembly book Bigh temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE PERFINT 81-AM-6A-3] Prop-Fan technical progress leading to tec readiness [AIAA FAFEE 81-0810] Bolls-Encyce EE 211-535 power plant [AIAA FAFEE NT 80-38]</pre>	A 01-33937 ge ft N81-22419 derations N81-22437 site system Froject N81-23064 site system Froject N81-23065 ynamic N81-23431 Eussian A 81-32547 rcn-55 A 81-33868 bnology A 81-33878 A 81-33886 in air A 81-33931
<pre>GloBal optimization of a glider [AAAF PAPEE NT 80-36] Design considerations for composite fusela structure of commercial transport aircra [NASA-CB-159296] Aircraft crash dynamics: Some major consi Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CB-152336-1] Preliminary design study of advanced compo blade and hub and nonmechanical control for the tilt-rotor aircraft. Volume 2: planning data [NASA-CB-152336-2] Technical evaluation report on the Fluid D Fanel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGAED-AB-146] HECHAPT ENGINES Frinciples of aircraft-engine assembly book High temperature electronic requirements i aeropropulsion systems Bearing wear detection using radioactive i tagging [ASLE FREFEINT 81-AM-6A-3] Prop-Pan technical progress leading to tec readiness [AIAA FAFEE 81-0810] Bolls-Boyce EB 211-535 power plant [ATAA FAFEE NT 60-38] Propellers for economic flight at high spe [AAAF FAFEN NT 60-38]</pre>	A 61-33937 ge ft N81-22419 derations N81-22437 site system N81-23064 site system Froject N81-23065 ynamic N81-23431 Eussian A 61-32547 rcn-55 A 81-33868 haclogy A 81-33878 A 81-33878 A 81-33931 eds

Analysis of total and static pressure fluctuations in an air intake at high incidence [AAAF PAPES NT 80-61] A81-33950 experimental investigation of the aerodynamics and cooling of a horizontally-opposed air-cocled aircraft engine installation [NASA-CB-3405] N81-22015 Energy efficient engine flight propulsion system: Aircraft/engine integration evaluation [NASA-CR-159584] N8 Quiet Clean General Aviation Turbofan (QCGAT) N81~22051 technology study, volume 1 [NASA-CE-164222] 881-22052 NASA's aeronautics research and technology base [NASA-CR-164195] N81~22969 analysis of opportunistic maintenance policy for the P100PW100 aircraft engine [AD-A097548] 881-Аn 881-23025 Application of ion implantation for the improvement of localized corrosion resistance of N50 steel bearings [AD-A097230] N81-23466 AIBCBAPT BOUIPHENT The USAF Armament Division Structural Dynamics Lab A81-30689 Aircraft equipment /2nd revised and enlarged edition/ --- Bussian book A81-31823 Forward-looking infrared /FLIB/ sensor for autonomous vehicles A81-32490 Experiences with a Flight Data Recording System (PDES) in a German Airforce fighter bomber wing after field trials --- digital equipment N81-23009 Detection and location of faults in onboard aircraft systems with the aid of the Automatic Fault Identification System (APIS) N81-23022 Development of maintenance MBTBICS to forecast tesource demands of weapon systems (parameter polarization), revision A [AD-A097692] N81-23325 AIRCRAFT PUELS Airborne method to minimize fuel with fixed time-of-arrival constraints A81-31297 Fuel conservation integrated into airline economics [AIAA PAPER 81-0831] AIRCRAFT GUIDANCE A81-33884 Pucctional analysis and operational assessment of an onboard glide path guidance system for visual approaches (Visual approach monitor VAM) [ESA-TT-655] N81-220 N81-22038 AIECBAFT HAZABDS Techniques for evaluation of aircraft windscreen optical distortion **A81-32507** Is it safe - The safety assessment of aircraft systems. IV - Methods, techniques, and organisation A81-33789 Connercial aviation icing research requirements [NASA-CR-165336] N81-23069 Rotorcraft aviation icing research requirements: Besearch review and recommendations [BASA-CR-165344] N81-23070 AIRCBAPT BYDRAULIC SYSTEMS Design, development, and evaluation of lightweight hydraulic system, phase 1 --- A-7 aircraft [AD-A097505] B81-230 881-23075 AIBCBAFT INDUSTRY Buropean approaches to transport aircraft design [AIAA PAPBE 81-0926] A81-3 A81-32934 AIRCHAPT INSTRUMENTS The behavior of quartz oscillators in the presence of accelerations --- in missile and aircraft time-frequency navigation systems A81-31285 Development and testing of a new technology weight and balance indicator [SAWE PAPER 1341] A81-31381 Measurement of aircraft speed and altitude -- Book A81-32401 Orientation of measurement sensors for optimum end-of-life performance A81-32697 Laser Doppler airspeed and altitude sensor [AD-A096980] N81-22049

Contributions to the 9th Symposium on aircraft integrated data systems --- Conferences [ESA-TT-532] N81-23008 AIRCRAFT LANDING Airport capacity enhancement by innovative use of runway geometry [AIAA FAFEE 81-0801] A81-33891 Calibration of an axial fan at various power settings for use on a guarter scale XC-84 air cushion model CUSHION BOGEL [AD-A097043] 881-220/ Application of variable structure system theory to aircraft flight control --- AV-8A and the Augmentor Wing Jet STOL Research Aircraft [BASA-CB-164321] 881-230 N81-22042 N81-23093 AIRCBAFT MAINTBBANCH Maintenance tomorrow and the day after --- of wide-bodied transport aircraft A81-33790 Airliner maintenance for fuel efficiency [AIAA PAPEB 81-0787] AE1-33877 Development of maintenance metrics to forecast resource demands of weapon systems. Analysis and evaluation, revision A [AD-A096688] B81 Development of maintenance metrics to forecast ¥81-22971 resource demands of weapon system. Maintenance metrics and weightings, revision A [AD-A096689] Development of maintenance metrics to forecast N81-22972 resource demands of wearon systems. Analysis and results of metrics and weightings, revision [ AD-A096690 ] ¥81-22973 Aircraft modification management evaluation [AD-A096458] 881-22974 Structural design of BFBP patches for Mirage wing repàir [AD-A097195] [AD-A097195] An analysis of opportunistic maintenance policy for the P100PW100 aircraft engine N81-23024 [AD-A097548] N81-23 P-16 integrated logistics support: Still time to N81-23025 consider economical alternatives [FB81-137473] N81-23079 Weapons system support resources demand parameters - logistics [AD-A097517] N81-23937 AIBCBAPT MABBUVERS BAPIDLCAIS - A preliminary design loads prediction technique for aircraft [SAWE PAPER 1366] A81-31388 AIBCRAFT BOISE Improvement of the imaging of moving acoustic sources by the knowledge of their motion [ONEBA, TP NO. 1981-17] A8 A81-32534 Pederal policies affecting airport noise compatibility programs [AIAA FAPEB 81-0829] 181-33879 Broadband belicopter rotor noise [AAAF PAPES NT 80-58] A81-33949 Acoustic performance evaluation of an advanced UH-1 helicopter main rotor system [AHS PAPER 81-58] A81-A81-33952 Annoyance caused by light aircraft noise [BASA-TH-76533] N81-22589 The annoyance caused by airplane noise in the vicinity of Orly Airport and the reaction of neighboring residents [ NASA-TH-76575 ] 881-22590 The effect of airplane noise on the inhabitarts of areas near Okecie Airport in Warsaw [ HASA-TH-75879 ] N81-22593 The relationship between noise and annoyance around Orly [NSA-TH-76573] B61-225 Airframe noise of a small model transport aircraft ¥81-22594 and scaling effects --- Boeing 747 [NASA-TE-1858] N81-22832 The propeller tip vortex. A possible contributor to aircraft cabin noise [BASA-TB-81768] N81-22838 An airport community noise-impact assessment model [ BASA-TH-80198 ] N81-23713 AIRCRAFT FEBFORMARCE Mathematical model of the linear unsteady aerodynamics of the entire aircraft A81-31039

Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPEB 1383] 881-313 A81-31399 Analytical study of the cruise performance of a class of remotely piloted, microwave-powered, high-altitude airplane platforms [NASA-TH-81969] 881-N81-22040 Relationships for a flight performance computer N81-23014 The use of aircraft integrated data system at KLM -- performance monitoring N81-23019 AIRCRAFT PRODUCTION Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWB PAPEB 1383] Aircraft assembly --- Bussian book 481-91999 A81-31872 The impact of the All Electric Airplane on production engineering [AIAA PAPEB 81-0848] A81-32909 Bonded laminated structures in aircraft manufacture --- Russian book A81-33700 An aircraft manufacturer's view of airport R&D needs [AIAA PAPEB 81-0793] 181-33887 AIRCRAFT FRODUCTION COSTS A cost function for military airframes [AD-A097538] N81-23966 cost function for an airframe production program FAD-A0975401 881-23967 AIRCRAFT BELIABILITY Rapport tactical self protection systems design 181-31113 Bfficiency of the methods and algorithms used for estimating the reliability in aviation techniques A81-33173 Designing for aircraft structural crashworthiness [AIBA PAPER 81-0803] A81-33 A81-33882 Description of the British Civil Aviation Airworthiness Data Recording Programme (CAADBP) -- analysis of flight recorder data N81-23017 AIRCBAPT SAFETY Is it safe - The safety assessment of aircraft systems. IV - Methods, techniques, and organisaticn A81-33789 Maintenance tomorrow and the day after --- of wide-bodied transport aircraft A81-33790 Some design and procedural aspects of in-flight collision avoidance (AIAA PAPER 81-0805) A81-33885 A review of in-flight emergencies in the ASBS data base [NASA-CB-166166] N81-22031 Analysis of ejection seat stability using easy program, vclume 1 [AD-A096597] N81-22033 Description of the British Civil Aviation Airworthiness Data Recording Programme (CAADBP) -- analysis of flight recorder data N81-23017 AIECRAFT STABILITY CH-53E combat survivability assessment and survivability enhancement program [SAME PAPER 1384] A81-31400 Generalized active control - Its potential and directions of research [AAAF PAPER NT 80-29] A81-33928 AIRCRAPT STRUCTURES Implementing Aircraft Structural Life Management to reduce structural cost of ownership [SAWB PAPER 1331] A81-313 Developments in the analysis and repair of cracked A81-31376 and uncracked structures A81-31561 Principles of aircraft structural design /2nd revised and enlarged edition/ --- Bussian book A81-31800 Aircraft assembly --- Bussian book A81-31872 Aircraft guality assurance using close-range photogrammetry 181-32508 In-flight fatigue crack monitoring using acoustic emission A81-32857

#### SUBJECT INDEX

Structural optimization - Past, present and future [AIAA FAPES 81-0897] A81-32922 A new method for modal identification A61-33293 Bonded laminated structures in aircraft manufacture - Russian book A81-33700 Finite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane A81-33736 Global optimization of a glider [AAAF PAPBE BT 80-36] A81 Structural flight loads simulation capability, A81-33937 volume 1 [AD-A096572] N81-22044 Structural flight loads simulation capability. Volume 2: Structural analysis computer program user's panual [AD-A096594] N81-220 Bebavior of continuous filament advanced composite N81-22045 isogrid structure N81-22095 Service evaluation of aluminum-brazed titanium (APTi) --- aircraft structures [NASA-CE-3418] N81 N81-22129 A comparison of laboratory measured temperatures with predictions for a spar/skin type aircraft structure [ BASA-TH-81359] 881-23067 Aircraft wing weight build-up methodology with modification for materials and construction techniques [NASA-CE-166173] N81-23068 Patigue life variability in aluminum alloy aircraft structures (AD-A097198) N81-23249 AIRCRAFT SUBVIVABILITY CH-53B combat survivability assessment and survivability enhancement program [SAWB PAPER 1384] A81-314 ATTACK vs SCAN: A comparison of endgame aircraft A81-31400 survivability computer programs FAD-A0976631 ¥81-23076 AIRCRAFT TIRES Beat generation in aircraft tires under free rolling conditions [NASA-CB-164273] N81-23461 AIRCHAPT WARBS Calculation of the flow pattern behind an aircraft wing A81-31041 AIRPIRLD SURPACE MOVEMBERS Airport capacity enhancement by innovative use of runway geometry [AIAA FAPBE 81-0801] A81-33891 AIBPOIL PROPILES On the design of modern airfoil sections by numerical methods A81-30705 Approximations and short cuts based on generalized functions A81-30730 New interpretations in the theory of viscous incompressible fluid flow past airfoil profiles A81-31044 Concerning Khristianovich's transformation of a subsonic flow past an airfoil into a low-speed f) ON A81-31045 Fluid mechanics mechanisms in the stall process of airfoils for helicopters A81-32779 On St. Venant flexure and torsion problem for symmetrical airfoil sections A81-33245 Experimental study of the separation at the trailing edge of an axisymmetrical contoured after-body A81-33281 A new method of airfoil flutter control A81-33844 AIRPOILS Transonic Viscous-inviscid interaction over airfoils for separated laminar or turbulent flows 181-31612 Bole of laminar separation bubbles in airfoil leading-edge stalls AE1-31613

APPROACH INDICATORS

NACA 0012 airfoil in the Langley 8 foot	
tranconic Freesure tunnel	
[NASA-TE+01927] Analysis of turbulent flow about an isolate	N81-23036
airfoil using a time dependent Navier-St	okes
procedure	VACD
•	N81-23053
Oscillatory flows from shock induced separa	ations
on biconvex aerofoils of varying thicknes	ss in
Ventilated Wind tunnels	NO1-22056
Mean-flow and turbulence measurements in t	801-23030 he
vicinity of the trailing edge of an NACA	(63 sub
1)-012 airfoil	•
[NASA-TP-1845]	881-23410
AIRPRANE BATBBIALS	
Alforatt wing weight build-up methodology i	Vith
techniques	, 10 <b>1</b>
[NASA-CB-166173]	N81-23068
AIBPBAMES	
The structural weight fraction - Revisited	for
fighter/attack type aircraft	
[JAWE PAPER 1303] Crashworthinges decign parameter consistivit	18616-184
analysis	.,
[AD-A096550]	N81-22041
Airframe noise of a small model transport a	aircraft
and scaling effects Boeing 747	
[NASA-TP-1858]	N81-22832
ruel/engine/altitame trade off study	891-22022
Technical evaluation report on the Pluid D	
Panel Symposium on Subsonic/Transonic	120210
Configuration/Aerodynamics	
[AGABD-AB-146]	N81-23431
Structural Integrity Recording System (SIR)	) for
U.S. Army AH-16 Helicopters	NO1-33030
LAD-A057203 J A cost function for military airframes	801-23430
[AD-A097538]	N81-23966
A cost function for an airframe production	Frogram
[AD-A097540]	N81-23967
AIBLINE OPERATIONS	
AITIINET BAIDTENANCE for fuel efficiency	101-32077
LAIMA PAPER. 01-0/0/J	NO1-22011
Puel conservation integrated into airline (	economics
Fuel conservation integrated into airline ( [AIAA PAPEE 81-0831]	economics A81-33884
Puel conservation integrated into airline ( [AIAA PAPEE 81-0631] Investigation of air transportation technol	economics A81-33884 logy at
Puel conservation integrated into airline ( [AIAM PAPEE 81-0831] Investigation of air transportation technol Massachusetts Institute of Technology, 19	economics A81-33884 logy at 980
Puel conservation integrated into airline ( [ATAA PAPEE 81-0831] Investigation of air transportation techno. Massachusetts Institute of Technology, 19	economics A81-33884 logy at 980 N81-22000
Puel conservation integrated into airline ( [AIAA PAPEE 81-0831] Investigation of air transportation techno. Massachusetts Institute of Technology, 19 AIRPORT PLANDING Application of endfire arrays at contemport	economics A81-33884 logy at 980 N81-22000
Puel conservation integrated into airline ( [ATAN PAPER 81-0631] Investigation of air transportation technol Hassachusetts Institute of Technology, 1 AIRPORT PLANNING Application of endfire arrays at contempor clide-slope problem sites	economics A81-33884 logy at 980 N81-22000 ary
Puel conservation integrated into airline o [AIAN PAPEE 81-0831] Investigation of air transportation technol Bassachusetts Institute of Technology, 19 AIRPORT PLABUING Application of endfire arrays at contempora glide-slope problem sites	economics A&1-33884 logy at 980 N&1-22000 ary A&1-32695
Puel conservation integrated into airline o [AIAN PAPEE 81-0831] Investigation of air transportation technol Bassachusetts Institute of Technology, 19 AIRPORT PLABBING Application of endfire arrays at contempora glide-slope problem sites An aircraft manufacturer's view of airport	economics A61-33884 logy at 980 W61-22000 ary A81-32695 B6D needs
Puel conservation integrated into airline [ATAM PAPEE 81-0831] Investigation of air transportation technol Bassachusetts Institute of Technology, 19 AIRPORT PLANDING Application of endfire arrays at contempora glide-slcpe problem sites An aircraft manufacturer's view of airport [ATAM PAPEE 81-0793]	economics A81-33884 Logy at 980 N61-22000 ary A81-32695 R6D needs A81-33887
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AIRSPACE	
The use of allspace - one way to save fuel	161-22150
ATRSDERD	8c1-33130
Measurement of aircraft speed and altitude	Book
	A81-32401
Dead reckoner navigation project	•
	881-22010
Laser Doppler airspeed and altitude sensor	
[AD-A096980]	881-22049
indicator and flight oralization of a DWR.	Snear
system to determine groundeneed	-der Tilen
[AD-A097566]	881-23768
ALGORITHMS	
Efficiency of the methods and algorithms us	sed for
estimating the reliability in aviation to	echniques
	A81-33173
P-8C adaptive control law refinement and so	ortware
C NACA-CD-1630933	N91-22050
Relationshins for a flight performance com	301-22033 Niter
Actacionality for a firght performance com	N81-23014
ALTIBETBES	
Measurement of aircraft speed and altitude	Book
	A81-32401
ALUMINUM ALLOYS	
Tensile stress/strain characterization of	
hon-linear materials	181-20015
Service evaluation of aluminum-brazed titat	ainn
(ABTi) aircraft structures	
[NASA-CB-3418]	881-22129
Fatigue life variability in aluminum alloy	
aircraft structures	
[AD-A097198]	881-23249
Mechanical properties of aluminum coatings	C.D.
heat-resistant steels	
	A81-31668
ABPLIFIER DESIGN	
An X-band power Gals FET amplifier for mil:	ıtary
avionics ladar applications	A81-31122
ANALOG COMPUTERS	
A digital-analog hybrid system and its appl	licaticn
to the automatic flight control system	
simulation research	
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[NASA-TH-76457]	N81-22060
[NASA-TH-76457] NGLE OF ATIACE Investigation of instantaneous distortions	N81-22060 in air
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[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns.	N81-22060 in air A81-33931
[NASA-TH-76457] ANGLE OP ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAP FAPER NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773]	N81-22060 in air A81-33931 N81-22039
[NASA-TH-76457] ANGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROMETRY) Comparison of galenlated and measured helicopter	N81-22060 in air A81-33931 N81-22039
[NASA-TH-76457] ANGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROMETRY) Comparison of calculated and measured helico rotor lateral flapping angles	N81-22060 in air A81-33931 N81-22039 copter
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMETRY) Comparison of calculated and measured helico rotor lateral flapping angles	N81-22060 in air A81-33931 881-22039 copter A81-32018
[NASA-TH-76457] ANGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROMETRY) Comparison of calculated and measured helico rotor lateral flapping angles ANGULAE RESOLUTION	<pre>N81-22060 in air A81-33931 H81-22039 copter A81-32018</pre>
[NASA-TH-76457] ABGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROBERNY) Comparison of calculated and measured helico rotor lateral flapping angles ANGULAB RESOLUTION Detection of target multiplicity using mono-	N81-22060 in air A81-33931 H81-22039 Copter A81-32018 Dopulse
[NASA-TH-76457] ABGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (EKORBTRY) Comparison of calculated and measured helico rotor lateral flapping angles ANGOLAR RESOLUTION Detection of target multiplicity using mono- guadrature angle	N81-22060 in air A81-33931 N81-22039 Copter A81-32018 Dpulse
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMETRY) Comparison of calculated and measured helico rotor lateral flapping angles ANGULAE RESOLUTION Detection of target multiplicity using mono- guadrature angle	N81-22060 in air A81-33931 H81-22039 Cofter A81-32018 opulse A61-32696
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOBERE) Comparison of calculated and measured helico rotor lateral flapping angles ANGULAE RESOLUTION Detection of target multiplicity using mono guadrature angle ANTENHA DESIGN An extremely lightweight fuselage-integrate	N81-22060 in air A81-33931 881-22039 Cofter A81-32018 opulse A£1-32696 ed
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOBETRY) Comparison of calculated and measured helico rotor lateral flapping angles ANGOLAE BESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENHA DESIGN An extremely lightweight fuselage-integrato phased array for airborne applications	N81-22060 in air A81-33931 H81-22039 Cofter A81-32018 Dpulse A&1-32696 ed
[NASA-TH-76457] ANGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROBERNY) Comparison of calculated and measured helico rotor lateral flapping angles ANGULAR RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications	N81-22060 in air A81-33931 H81-22039 Copter A81-32018 Dopulse A61-32696 ed A81-30779
[NASA-TH-76457] ABGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEORBTRY) Comparison of calculated and measured helico rotor lateral flapping angles ANGULAE RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrated phased array for airborne applications ANTENNA BADIATION PATTERNS	N81-22060 in air A81-33931 H81-22039 Copter A81-32018 Depulse A61-32696 ed A81-30779
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMETRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAE RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrated phased array for airborne applications ANTENNA RADIATION PATTERNS MIS: Airplane system modeling	N81-22060 in air A81-33931 N81-22039 Cofter A81-32018 Dpulse A61-32696 ed A81-30779
<pre>[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAEEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMBTBY) Comparison of calculated and measured helic rotor lateral flapping angles ANGULAR RESOLUTION Detection of target multiplicity using mono guadrature angle ANTENHA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications ANTENHA REDIATION PATTERNS HIS: Airplane system modeling [HASA-CR-165700] ANTINCCANT NICSURA (Second) ANTENDA HISSING</pre>	N81-22060 in air A81-33931 N81-22039 Cofter A81-32018 opulse A61-32696 ed A81-30779 N81-23059
<pre>[NASA-TH-76457] ANGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROBEREY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGULAE RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications ANTENNA BADIATION PATTERNS MIS: Airplane system modeling [NASA-CE-165700] ANTIALCE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNS ATTALECHAPT HISSILES ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNS ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNS ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ATTACE VS SCAN: A comparison of endgame and ANTENNA SADIATION PATTERNA ANTENNA SADIATION PATTER</pre>	N81-22060 in air A81-33931 H81-22039 Cofter A81-32018 Dpulse A61-32696 ed A81-30779 N81-23059 ircraft
[NASA-TH-76457] ANGLE OF ATTACK Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROBERNY) Comparison of calculated and measured helico rotor lateral flapping angles ANGULAR RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications MISEN ADJATION PATTENNS MLS: Airplane system modeling [NASA-CR-165700] ANTALECAPT MISSILBS ATTACK vs SCAM: A comparison of endgame at survivability computer programs	N81-22060 in air A81-33931 H81-22039 copter A81-32018 opulse A61-32696 ed A81-30779 N81-23059 ircraft
<pre>[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMETRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAH RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrated phased array for airborne applications HIS: Airplane system modeling [HASA-CE-165700] ANTACK vs SCAN: A comparison of endgame a: survivability computer programs [AD-A097663]</pre>	N81-22060 in air A81-33931 H81-22039 cofter A81-32018 opulse A61-32696 ed A81-30779 N81-23059 ircraft K81-23076
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMETRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAE RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrat. phased array for airborne applications MIS: Airplane system modeling [NASA-CE-165700] ANTACE vs SCAN: A comparison of endgame a: survivability computer programs [AD-A097663] APPROACE AND LANDING TESTS (STS)	N81-22060 in air A81-33931 N81-22039 cofter A81-32018 opulse A61-32696 ed A81-30779 N81-23059 ircraft B81-23076
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FARES NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMBTBY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGULAR RESOLUTION Detection of target multiplicity using mono guadrature angle ANTENHA DESIGN An extremely lightweight fuselage-integrator phased array for airborne applications ANTENHA BADIATION PATTERNS HIS: Airplane system modeling [HASA-CR-165700] ANTIALECHAPT HISSILBS ATTACK vs SCAN: A comparison of endgame and survivability computer programs [AD-A09763] APPROACH AND LANDING TESTS (STS) Comparison of theoretical predictions of on	N81-22060 in air A81-33931 881-22039 cofter A81-32018 ppulse A&1-32696 ed A&1-32696 ed B&1-23059 ircraft B&81-23076 rbiter
<pre>[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAPEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOBERRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAR BESOLOTION Detection of target multiplicity using mono- guadrature angle ANTENNA BADIATION PATTERNS HIS: Airplane system modeling [NASA-CE-165700] ANTIALCENT DISSILES ATTACE vs SCAN: A comparison of endgame a: survivability computer programs [AD-A037663] APPROACE AND LANDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52</pre>	N81-22060 in air A81-33931 H81-22039 cofter A81-32018 opulse A81-32696 ed A81-32696 ed A81-30779 N81-23059 ircraft B81-23076 rbiter
<pre>[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMEREN) Comparison of calculated and measured helico rotor lateral flapping angles ANGOLAH RESOLUTION Detection of target multiplicity using mono guadrature angle ANTENNA BADIATION PATTERNS HIS: Airplane system modeling [NASA-E7-165700] ANTIAL RESOLUTION DETIMES ATTACK vs SCAN: A comparison of endgame at survivability computer programs [AD-A097663] APPROACH AND LANDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52 [HASA-CH-81358]</pre>	N81-22060 in air A81-33931 H81-22039 copter A81-32018 opulse A61-32696 ed A81-30779 N81-23059 irccraft B81-23076 cbiter t
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEORETRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAE RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications HIENNA RADIATION PATTERNS MIS: Airplane system modeling [NASA-CR-165700] ANTACK vs SCAN: A comparison of endgame a: survivability computer programs [AD-A097663] APPROACE AND LANDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TH-81358] APPROACE CONTROL	N81-22060 in air A81-33931 N81-22039 copter A81-32018 opulse A61-32696 ed A81-30779 N81-23059 ircraft B81-23076 cbiter
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAPEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROMETRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGULAE RESOLUTION Detection of target multiplicity using monor guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications ANTENNA BADIATION PATTERNS MLS: Airplane system modeling [HASA-CE-165700] ANTIACE vs SCAN: A comparison of endgame at survivability computer programs [AD-A097663] APPROACE AND LANDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52 [HASA-TH-81358] APPROACE CONTEOL	N81-22060 in air A81-33931 N81-22039 Copter A81-32018 opulse A&1-32696 ed A81-30779 N&1-23059 ircraft B&1-23076 rbiter t
<pre>[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAPEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOHEREY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGULAR RESOLUTION Detection of target multiplicity using monor guadrature angle ANTENNA BADIATION PATTERNS MIS: Airplane system modeling [HASA-CR-165700] ANTIALECHAPT MISSILES ATTACK vs SCAN: A comparison of endgame at survivability computer programs [AD-A09763] APPROACH AND LANDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TM-81358] APPROACH SUDIATION APPROACH SUDIATION Increasing capacity at Paris airports [AIAA FARES 81-0802] NUMBERS SUPPONED IN Comparison of theoretical predictions of a APPROACH SUDIATION CAPACITY SUPERATIONAL SUPERATION OF SUPERATIONAL SUPERAT</pre>	N81-22060 in air A81-33931 H81-22039 Cofter A81-32018 opulse A61-32696 ed A81-30779 W81-23076 rbiter t W81-23076 rbiter A81-23066 A81-33890
<pre>[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAPEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GROBERNY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAR BESOLOTION Detection of target multiplicity using mono- guadrature angle ANTENNA BADIATION PATTERNS HIS: Airplane system modeling [NASA-CE-165700] ANTIALCENT DISSILES ATTACE vs SCAN: A comparison of endgame a: survivability computer programs [AD-A037663] APPROACE AND LABDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TM-81358] APPROACE ONTHOL Increasing capacity at Paris airports [ATA FAFES 81-0802] APPROACE HEFICATORS Functional analysis and constional accord ANA FAFES and constional accord ANA FAFES and constional accord ANA FAFES and constional accord ANA FAFES and constional accord Detectional analysis and constional accord ANA FAFES and CONTACT ANA FAFES and Constional accord ANA FAFES AND ACCONSTINAL ANA FAFES AND ACCONSTINAL AND AND AND AND AND AND AND AND</pre>	N81-22060 in air A81-33931 H81-22039 cofter A81-32018 opulse A81-32696 ed A81-32696 ed A81-30779 N21-23059 ircraft B81-23076 cbiter t B81-23066 A81-33890
[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] NGLES (GEOMETRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAH RESOLUTION Detection of target multiplicity using mono- guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications ANTENNA BADIATION PATTERNS MIS: Airplane system modeling [HASA-CE-165700] ANTACK vs SCAN: A comparison of endgame a: survivability computer programs [AD-A097663] APPROACH AND LAEDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52 [MASA-CE-165700] ADFAACH-01358] APPROACH CONTROL Increasing capacity at Paris airports [AIAA FAFES 81-0802] APPROACH INFICATORS Functional analysis and operational assessi an onboard glide path enidence system for	N81-22060 in air A81-33931 H81-22039 copter A81-32018 opulse A61-32696 ed A81-30779 N81-23059 ircraft B81-23076 cbiter t B81-23066 A81-33890 ent of r viswal
<pre>[NASA-TH-76457] ANGLE OF ATTACE Investigation of instantaneous distortions intakes at high angles of attack [AAAF FAFEE NT 80-38] Kinematic properties of the helicopter in coordinated turns. [NASA-TP-1773] ANGLES (GEOMETRY) Comparison of calculated and measured helicor rotor lateral flapping angles ANGOLAR RESOLUTION Detection of target multiplicity using monor guadrature angle ANTENNA DESIGN An extremely lightweight fuselage-integrate phased array for airborne applications ANTENNA RADIATION PATTERNS MIS: Airplane system modeling [NASA-CR-165700] ANTACE vs SCAN: A comparison of endgame a: survivability computer programs [AD-A097663] APPROACE AND LANDING TESTS (STS) Comparison of theoretical predictions of on airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TH-81358] APPROACE CONTROL Increasing capacity at Paris airports [ATAPES A1-CR-0802] Pupcional analysis and operational assessi an onboard glide path guidance system for approaches (visual arrivace monitor VAM) </pre>	N81-22060 in air A81-33931 N81-22039 copter A81-32018 opulse A&1-32096 ed A81-30779 N&1-23059 ircraft B&1-23076 rbiter b&1-23066 A&1-33890 ment of r visual

#### APPROXIBATION

APPROXIMATION	aligad
functions	alized
A	81-30730
Arms Forces (Unite States) Arms aviation - A perspective into the eight [AIAA PAPES 81-0931] A	ies 81-32935
Transonic flutter study of a wind-tunnel mod	el of
an arrow-wing supersonic transport SCA model test in the Langley Transonic Dynami	T- 15F CS
Tunnel [NASA-TN-81962] NCCONDITION	81-23071
Principles of aircraft-engine assembly B book	ussian
A hiroraft assembly to Pussian book	81-31799
ACCRESNREES	81-31872
An airport community noise-impact assessment [NASA-TM-80198] N	mcdel 81-23713
ASYMPTOTIC METHODS	i+1
energetics and optimum motion of	
thrust-producing lifting surfaces [NASA-CR-165679] N	81-23035
ATNOSPHEBLIC CIRCULATICE	
planetary boundary layer made onboard an	
instrumented motorized glider	81-22666
ATTACK AIBCRAFT	
Analysis of ejection seat stability using ea program, volume 1	sy
[AD-A096597] N	81-22033
Volume 1: Impact of DAIS concept on life	cycle
cost [AD-A097339] N	81-23083
Digital Aviopics Information System (DAIS). Volume 2: Impact of DAIS concert on life	cvcle
cost. Supplement	01-00000
ATTITUDE INDICATORS	01-23084
Aircraft body-axis rotation measurement syst [NASA-CASE-FEC-11043-1] N	em 81-22048
Plight evaluation of the concept of the stag Peripheral Vision Horizon Device (PVHD) us	e A ing
the CH 135 aircraft of 403 Squadron - CBB	Gagetown
AUTOHATIC CONTROL	81-22050
Advanced composites - Evolution of manufactu technology	ring
[AIAA PAPEB 81-0895] A	81-32920
V/STOLAND digital avionics system for XV-15	tilt
rotor [NASA-CR-152320]	81-22047
F-8C adaptive control law refinement and sof	tware
[NASA-CB-163093]	81-22059
A digital-analog hybrid system and its appli to the automatic flight control system	cation
[NASA-TH-76457]	81-22060
MLS: Airplage system modeling	81-23059
Application of variable structure system the	ory to
Algorit flight control AV-8A and the Augmentor Wing Jet STOL Research Aircraft	
[NĂSĂ-CR-164321] N ADTONAȚIC TRST RODIPATAT	81-23093
A simulator to test compressor research faci	lity
control system software	81-31110
Centralized in-place pressure calibration sy for multiple turbine engine aerodynamic pr	sten essure
measurement systems	81-32947
AUTOMATIC TRAPPIC ADVISORY AND RESOLUTION	51 32047
Discrete Address Beacon System	81-31134
AVIONICS Rapport tactical self protection systems des	ign
A An X-band power Gaas PET amplifier for milit	81-31113 ary
amigning redar applications	

#### SUBJECT INDEX

V/STOL advanced technology rewards and ris aircraft design	k
[SAWE PAPER 1385] A review of current and future components : electronic warfare receivers	A81-31401 for
The impact of the All Blectric Airplane on	A81-32252
production engineering [AIAA FAPEE 81-0848]	A81-32909
Airborne electronic displays	A81-32999
The P/POD project: Programmable/Pilot Orio	ented
V/STOLANE digital avionics system for XV-1	NE1-22004 5 tilt
[NASA-CE-152320]	N81-22047
Navaids calibration evaluation with a computer-controlled avionics data acquis. system	ition
Demonstration Advanced Avienics System (DA	N81-23020
functional description Cessna 402B a.	ircraft
General Aviation Activity and Avionics Sur	Vey
NAVAIE Avionics Master Plan	881-23081
[AD-A097522] Groundspeed/airspeed differences as a wind	N81-23082 shear
indicator and flight evaluation of a DMB system to determine groundspeed	-derived
[AD-A097566] AXTAL PLON	181-23768
The role of coherent structures in the gene	eration
fulsh-cp-1642142	
[ #858-C8- 104214 ]	N81-22833
( BASA-CA-104214 ) B	N61-22833
B-56 AIBCRAFT	N81-22833
B-50 AIECEAPT Silver recovery from aircraft scrap (FB01-150021) BACKWASH	N81-22833 N81-23269
B B-50 AIBCBAPT Silver recovery from aircraft scrap (FB01-150021) BACEWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling	N81-22833 N81-23269 aft amic
B B-50 AIBCBAPT Silver recovery from aircraft scrap (FB01-150021) BACKWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BRACOBS	N81-22833 N81-23269 aft amic N81-22057
B B-56 AIBCBAPT Silver recovery from aircraft scrap [FB01-150021] BACKWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems	N61-22833 N61-23269 aft amic N61-22057 N81-22009
B B B-50 AIBCEAPT Silver recovery from aircraft scrap [FB01-150021] BACEWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACOMS Laser beacon collision avoidance systems BEBAINGLESS BOTOMS The bearingthese print pattern	N81-22833 N81-23269 aft amic N81-22057 N81-22009
B B-50 AIBCBAPT Silver recovery from aircraft scrap (FB01-150021) BACKWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEAACOMS Laser beacon collision avoidance systems BEABINGLESS BOTORS The tearingless main rotor BELL AIBCRAPT	N61-22833 N61-23269 aft amic N61-22057 N81-22009 A81-32008
B B-56 AIBCEAPT Silver recovery from aircraft scrap [FB81-150021] BACHBASH Harimum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems BEABINGLESS BOTORS The Learingless main rotor BELL AIRCEAPT Reduction of helicopter vibration through of hub-imedearce	N81-22833 N81-23269 aft N81-22057 N81-22009 A81-32008 control
B B-56 AIBCEAPT Silver recovery from aircraft scrap [FB81-150021] BACEWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACOMS Laser beacon collision avoidance systems BEARINGLESS BOTORS The tearingless main rotor BELL AIBCEAPT Reduction of helicopter vibration through of hub-impedance	N81-22833 N81-23269 aft N81-22057 N81-22009 A81-32008 control A81-32009
B B-56 AIBCEAPT Silver recovery from aircraft scrap (FB81-150021) BACEWASH Haximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems BEADEUSES BOTORS The bearingless main rotor BELL AIBCEAPT Reduction of helicopter vibration through of hub-impedance BENDING VIBRATION Coriolis effect on the vibration of flat r	N81-22833 N81-23269 aft amic N81-22057 N81-22009 A81-32008 control A81-32009 otating
B B-50 AIBCBAPT Silver recovery from aircraft scrap (FB01-150021) BACKWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems BEARINGLESS BOTORS The bearingless main rotor BELL AIBCEAPT Reduction of helicopter vibration through of hub-impedance BHDING VIBBATION Coriolis effect on the vibration of flat r low aspect ratio cantilever plates	N81-22833 N81-23269 aft nic N81-22009 A81-32008 control A81-32009 otating A81-30914
B B-50 AIBCEAPT Silver recovery from aircraft scrap (FB01-150021) BACKWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems BEARINGLESS BOTORS The bearingless main rotor BELL AIBCEAPT Reduction of helicopter vibration through of hub-impedance BHNDING VIBBATION Coriolis effect on the vibration of flat r low aspect ratio cantilever plates BIBLIOGEAPHIES BIT Annotated Bibliography	N81-22833 N81-23269 aft amic N81-22009 A81-32008 control A81-32009 otating A81-30914 N81-22001
B B-50 AIBCEAPT Silver recovery from aircraft scrap (FB01-150021) BACKWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems BEADEINGLESS BOTORS The bearingless main rotor BELL AIBCEAPT Beduction of helicopter vibration through of hub-impedance BEHDING VIBBATION Coriolis effect on the vibration of flat r low aspect ratio cantilever plates BIBLIOG RAPHIES MIT Annotated Bibliography BINDING Proceedure for pressure contact on high-pow	N81-22833 N81-23269 aft N81-22057 N81-22009 A81-32008 control A81-32009 otating A81-30914 N81-22001 er
B B-56 AIBCBAPT Silver recovery from aircraft scrap (FB81-150021) BACEWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems BEARINGLESS BOTORS The bearingless main rotor BELL AIBCBAPT Reduction of helicopter vibration through of hub-impedance BHNDING VIBBATION Coriolis effect on the vibration of flat r low aspect ratio cantilever plates BIBLIOGRAPHIES MIT Annotated Bibliography BINDING Procedure for pressure contact on high-pow semiconductor devices free of thermal fa [NASA-TM-75733]	N81-22833 N81-23269 aft amic N81-22007 N81-22009 A81-32008 control A81-32009 otating A81-30914 N81-22001 er tigue NE1-22054
B B-56 AIBCEAPT Silver recovery from aircraft scrap (FB01-150021) BACKWASH Maximum likelihood identification of aircr lateral parameters with unsteady aerodyn modelling BEACONS Laser beacon collision avoidance systems BEADINGERAPT Reduction of helicopter vibration through of hub-impedance BENDING VIBBATION Coriolis effect on the vibration of flat r low aspect ratio cantilever plates BIBLIOGRAPHIES NIT Annotated Bibliography BINDING Procedure for pressure contact on high-pow semiconductor devices free of thermal fa (NASA-TM-75733) BIOLOGICAL BFFECTS The effect of airplane noise on the inhabi	N81-22833 N81-23269 aft apic N81-22009 A81-32008 control A81-32008 otating A81-32009 otating A81-32009 otating A81-22001 er tigue N81-22054 tapts cf

[MASA-10-,50,5] BLADE TIPS An evaluation of a simplified near field noise model for supersonic helical tip speed propellers [MASA-TH-81727] N&1-22836 BLOWDOWN WIDD TOUBLES Bigh frequency drive mechanism for an active controls systems aircraft control surface N81-22400

BLOWBES Calibration of an axial fan at various power settings for use on a guarter scale XC-8A air (AD-A097043) BLOFF BODIES Non-linear oscillator models in bluff body arcelacticity B81-22042

aeroelasticity **▲81-30786** 

<u>8-4</u>

COLLISION AVOIDANCE

BODY-BING AND TAIL CONFIGURATIONS	
Wing-body carryover at supersonic speeds w	ith
finite afterbodies	
	A81-31622
BODY-HING CORFIGURATIONS	
Computation of pressure distribution on th	e DPVLR
wing-body model by the panel method	
Ing body model by the pulle method	N81-22029
BORTEC 333 ATBORAD	001-22025
DURING 727 ALECENTI	0
operational responses to art empty C.G	- Center
of Gravity location in Boeing 727-200 ai	rcraft
[SAWE PAPER 1338]	A81-31378
BOBING 737 AIRCRAFT	
CF#56-3 high by-pass technology for single	aisle
twips	
FAIAA PAPER 81-08081	A81-33889
BORTHG 747 ATRCRAPT	
Airframe noise of a small model transport	aircraft
and cooling offects Booing 7/7	alfetare
and scaling effects boeing /4/	
[NA SA-TP-1030]	801-22032
Lateral attenuation of high-by-pass ratio	engined
aircraft noise	
[NASA-TM-81968]	N81-23862
BORON BEINFORCED NATERIALS	
Structural design of BPEP patches for Mira	ge wing
repair	
[AD-A097195]	N81-23024
	201 20020
BOURDIRY LIVER SECARATION	
BOUNDARY LAYER SEPARATION	<b>F</b>
BOUNDARY LAYES SEPARATION Transonic viscous-inviscid interaction ove	I ont flows
BOUNDARY LAYER SEFARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul	r ent flows
BOUSDARY LAYER SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul	r ent flows A81-31612
BOUSDARY LAYES SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Bole of laminar separation bubbles in airf	r ent flows A81-31612 oil
BOUBDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls	r ent flows A81-31612 oil
BOUSDARY LAYES SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Eole of laminar separation bubbles in airf leading-edge stalls	r ent flows A81-31612 oil A81-31613
BOUSDARY LAYES SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls Oscillatory flows from shock induced separ	r ent flows A81-31612 oil A81-31613 ations
BOUBDARY LAYER SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne	r ent flows A81-31612 oil A81-31613 ations ss in
<ul> <li>BOUSDARY LAYES SEPARATION</li> <li>Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul</li> <li>Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in
BOUBDARY LAYER SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056
<ul> <li>BOUNDARY LAYER SEPARATION</li> <li>Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul</li> <li>Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYER TRANSITION</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056
BOUNDARY LAYER SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Eole of laminar separation bubbles in airf leading-edge stalls Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels BOUNDARY LAYER TRANSITION Multiple-scale turbulence modeling of bound	r ent flows A81-31612 oil A81-31613 ations ss in K81-23056 dary
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun how flows for scrantor applications</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Hultiple-scale turbulence modeling of boun layer flows for scranjet applications     </li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls         Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels     </li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [MASA-CE-3433]     </li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CR-3433]</li> <li>BEAZING</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411
<ul> <li>BOUNDARY LAYES SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYES TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CE-3433]</li> <li>BMAXING Service evaluation of aluminum-brazed tita</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications (NASA-CR-3433)</li> <li>BBATING Service evaluation of aluminum-brazed tita (ABII) aircraft structures</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Role of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scramjet applications [NASA-CE-3433]</li> <li>BHAZING Service evaluation of aluminum-brazed tita (ABTi) aircraft structures [NASA-CE-3418]</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications (NASA-CE-3433)</li> <li>BRATING Service evaluation of aluminum-brazed tita (ABTi) aircraft structures [NASA-CE-3418]</li> <li>BROADEMD</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Role of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CE-3433]</li> <li>BEAZING Service evaluation of aluminum-brazed tita (NBTi) aircraft structures [NASA-CE-3416]</li> <li>BEOADBAND Broadband belicopter rotor noise</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129
<ul> <li>BOUNDARY LAYES SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Role of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYES TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CE-3433]</li> <li>BPAZING Service evaluation of aluminum-brazed tita (NASA-CE-3416]</li> <li>BPOADBAND Broadband helicopter rotor noise [AAP PAREM BT 80-581</li> </ul>	r ent flows A81-31612 oil á81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Role of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications (NASA-CE-3433)</li> <li>BBAINE Service evaluation of aluminum-brazed tita (ABIi) aircraft structures [NASA-CE-3418]</li> <li>BDOADBAND Broadband helicopter rotor noise [AAAF PAFEE NT 60-58]</li> <li>BUBBLES</li> </ul>	r ent flows A81-31612 oil Á81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Role of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CE-3433]</li> <li>BEAXING Service evaluation of aluminum-brazed tita (NSIA-CE-3416)</li> <li>BUOADBAND Broadband helicopter rotor noise [AAP PARES NT 80-58]</li> <li>BUBBLES</li> <li>Pole of laminar separation bubbles in airf</li> </ul>	r ent flows A81-31612 oil á81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949 oil
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Role of laminar separated laminar or turbul leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications (NASA-CE-3433)</li> <li>BHAING Service evaluation of aluminum-brazed tita (ABTi) aircraft structures (NASA-CE-3418)</li> <li>BPAADBAND Broadband helicopter rotor noise (AAFP PAFELS WT 80-58)</li> <li>BOLE of laminar separation bubbles in airf</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949 oil
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Bole of laminar separated laminar or turbul Role of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSIFION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CE-3433]</li> <li>BBAXING Service evaluation of aluminum-brazed tita (NASH-CE-3416]</li> <li>BPOADBAND Broadband helicopter rotor noise [AAAF PAREE BT 80-56]</li> <li>BOUBLES Bole of laminar separation bubbles in airf leading-edge stalls</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949 oil
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils fcr separated laminar or turbul Bole of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconver aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CE-3433]</li> <li>BHAZING Service evaluation of aluminum-brazed tita (ABI) aircraft structures [NASA-CE-3416]</li> <li>BPOADBAND Broadband helicopter rotor noise [AAAP PARES NT 80-58]</li> <li>BUBBLES Role of laminar separation bubbles in airf leading-edge stalls</li> </ul>	r ent flows A81-31612 oil Å81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949 oil A81-31613
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Role of laminar separated laminar or turbul leading-edge stalls Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications (NASA-CE-3433)</li> <li>BBAING Service evaluation of aluminum-brazed tita (ABIi) aircraft structures [NASA-CE-3418]</li> <li>BPOADBAND Broadband helicopter rotor noise [AAAP PAFEE NT 60-58]</li> <li>BUBBLES Role of laminar separation bubbles in airf leading-edge stalls</li> <li>BULK ACOUSTIC BAYE DEVICES</li> </ul>	r ent flows A81-31612 oil A81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949 oil A81-31613
<ul> <li>BOUNDARY LAYEE SEPARATION Transonic viscous-inviscid interaction ove airfoils for separated laminar or turbul Role of laminar separation bubbles in airf leading-edge stalls</li> <li>Oscillatory flows from shock induced separ on biconvex aerofoils of varying thickne ventilated wind tunnels</li> <li>BOUNDARY LAYEE TRANSITION Multiple-scale turbulence modeling of boun layer flows for scranjet applications [NASA-CE-3433]</li> <li>BHAZING Service evaluation of aluminum-brazed tita (NBTi) aircraft structures [NASA-CE-3416]</li> <li>BPOADBAND Broadband helicopter rotor noise [AAP PAFEE NT 80-58]</li> <li>BOUBLES Role of laminar separation bubbles in airf leading-edge stalls</li> <li>BULK ACOUSTIC MAVE DEVICES The behavior of guartz oscillators in the</li> </ul>	r ent flows A81-31612 oil á81-31613 ations ss in N81-23056 dary N81-23411 nium N81-22129 A81-33949 oil A81-31613 presence

time-frequency navigation systems

CALIBRATING

CAMBRAS

cushion model

(NASA-TP-1759)

fiber optics [SAWE PAPEE 1336]

[AD-A097043] CANBBBBD WINGS

CANADAIR AIRCRAFT

CANTILBVEB BEAMS

С

Calibration of an axial fan at various power settings for use on a guarter scale XC-8A air

Pressure and force data for a flat wing and a warped conical wing bawing a shockless

Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles

The 'light-weight' system - A novel concept for on-board weight and balance measurement using

On St. Venant flexure and torsion problem for

recomparession at Mach 1.62

symmetrical airfoil sections

runway geometry [AIAA PAPEE 81-0801] 101-33891 CABGO AIRCBART Platted - The universal transport airplane [SAWE PAPEE 1343] A81-31382 CAPRTACKS An opto-electronic method for wind tunnel model alignment A81-32849 CASCADE FLOR A time marching finite volume method for blade-to-blade flows using a body-fitted curvilinear mesh A81-30717 Study of the secondary flow in the downstream of a noving blade row in an axial flow fan A81-31767 CENTER OF GRAVITY Operational responses to aft enpty C.G. --- Center of Gravity location in Boeing 727-200 aircraft [SAWE PAPER 1338] A81-31378 A flight test real-time GW-CG computing system A81-32860 CBRAMIC COATINGS Thermal and flow analysis of a convection air-cooled ceramic ccated porous metal concept for turbine wanes [NASA-TH-81749] N81-22056 CBRANICS Structures and Materials Panel N81-22420 [AD-A089019] CERTIFICATION Comparison of predicted engine core noise with proposed FAA heliccpter noise certification requirements [NASA-TH-81739] N81-22839 Rotorcraft aviation icing research requirements: Research review and recommendations [NASA-CB-165344] N81-23070 CESSEA 4028 AIBCBAPT Demonstration Advanced Avionics System (DAAS) functional description --- Cessna 402B aircraft [NASA-CB-152405] CB-47 BBLICOPTEB 881-23080 Drive system technology advancements ---transmissions for CH-47D helicopter A81-32015 Ploor and fuel vibration isolation systems for the Boeing Vertol connercial Chinook A81-32016 CHARGE COUPLED DEVICES Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles A81-32491 CIRCULAR CYLINDERS. Wing-body carryover at supersonic speeds with finite afterbodies A81-31622 CIVIL AVIATION Quiet propulsive-lift technology ready for civil and military applications A81-32521 European approaches to transport aircraft design [AIAA FAFES 81-0926] A81-The art of designing experimental aircraft - An A81-32934 ονεινίεν [AIAA PAPEE 81-0944] A61-32939 An aircraft manufacturer's view of airport B&D needs [AIA RAPES 81-0793] Description of the British Civil Aviation A81-33887 Airworthiness Data Becording Programme (CAADBP) --- analysis of flight recorder data 881-23017 General Aviation Activity and Avionics Surve [AD-A097604] COCKPITS NA1-23081 Application of computer colour raster displays in the cockpit in research flight simulation [AD-A096542] N81-22063 COLLISION AVOIDANCE

Airport capacity enhancement by innovative use of

CAPACITY

Contractor avoidance Some design and procedural aspects of in-flight collision avoidance [ATAA PAPER 81-0805] Laser beacon collision avoidance systems

B81-22009

CABTILEVEB PLATES Coriolis effect on the vibration of flat rotating low aspect ratio cantilever plates A81-30914

A-9

A81-31285

181-22042

881-22016

A81-32491

A81-31377

A81-33245

Section of computer colour matter disclose is	
the cocknit in research flight simulation	
[AD-A096542] N81-22063	
CONBAT	
The variable-speed tail-chase aerial combat problem	
A81-31295	
CONBUSTION PRODUCTS	
A mobile emissions laboratory for on-line analysis	
or compustion products from gas turpine engines	
BOITJ2072 Combustion system processes leading to corresive	
denosits	
[NA SA-TM-81752] N81-23243	
CONNERCIAL AIRCRAFT	
Floor and fuel vibration isolation systems for the	
Boeing Vertol connercial Chinook	
A81-32016	
Concepts for improving the damage tolerance of	
composite compression panels	
A81-32825	
Jet aircraft design	
The optimal lift-drag ratio of a civil aircraft	
(AAAF PAPER NT 80-351 A81-33923	
Connercial aviation icing research requirements	
[NASA-CR-165336] N81-23069	
COMPENSATORS	
Apparatus for and method of compensating dynamic	
unbalance	
[NASA-CASE-GSC-12550-1] N81-22358	
COMPOBENT BELIABILITY	
Location of faults in jet engines by calculation	
of component characteristics	
Reduction of measured data and nossibilities for	
early detection of sensor break-down	
881-23016	
Structural Integrity Recording System (SIR) for	
U.S. Army AH-16 Belicopters	
[AD-A097283] N81-23438	
[AD-A097283] N81-23438 COMPOSITE MATERIALS	
[AD-A097283] N81-23438 COMPOSITE MATIRIALS Advanced composites - Evolution of manufacturing	
[AD-A097283] N81-23438 COMPOSITE MATERIALS Advanced composites - Evolution of manufacturing technology	
[AD-A097283] N81-23438 COMPOSITE MATERIALS Advanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895] A81-32920 Docing composite for lon-cost composite threadon	
[AD-A097283] N81-23438 COMPOSITE MATERIALS Advanced composites - Evolution of manufacturing technology [AIAA PAPER 81-0895] A81-32920 Design concepts for low-cost composite turbofan enoine frame	
[AD-A097283] N81-23438 COMPOSITE MATERIALS Advanced composites - Evolution of manufacturing technology [AIAA PAPER 81-0895] A81-32920 Design concerts for low-cost composite turbofan engine frame [NSA-CE-165217] N81-22053	
[AD-A097283] N81-23438 COMPOSITE MATERIALS Advanced composites - Evolution of manufacturing technology [AIAA PAPER 81-0895] A81-32920 Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217] N81-22053 Design considerations for composite fuselage	
[AD-A097283] N81-23438 COMPOSITE MATERIALS Advanced composites - Evolution of manufacturing technology [AIAA PAPER 81-0895] A81-32920 Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217] N81-22053 Design considerations for composite fuselage structure of commercial transport aircraft	
[AD-A097283]       N81-23438         COMPOSITE MATERIALS       Advanced composites - Evolution of manufacturing technology         [ATAA PAPEB 81-0695]       A81-32920         Design concepts for low-cost composite turbofan engine frame       N81-22053         [NASA-CR-165217]       N81-22053         Design considerations for composite fuselage structure of commercial transport aircraft       [NASA-CR-159296]	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MSA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [N&SA-CE-159296]N81-22419Structures and Materials Panel1	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[AIAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology[AIAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frameN81-22053[NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraftN81-22419[NASA-CE-159296]N81-22420COMPOSITE STBUCTURESN81-22420	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology[ATAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite	
[AD-A097283]       N81-23438         COMPOSITE MATERIALS       Advanced composites - Evolution of manufacturing technology [AIAA PAPER 81-0895]       A81-32920         Design concepts for low-cost composite turbofan engine frame [NASA-CR-165217]       N81-22053         Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CR-159296]       N81-22419         Structure and Materials Panel [AD-A089019]       N81-22420         COMPOSITE STBUCTURES       Behavior of continuous filament advanced composite isogrid structure	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[AIAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology[AIAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frameN81-22053[NASA-CR-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraftN81-22419[NASA-CR-159296]N81-22420COMPOSITE STBUCTURESBehavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology[ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frameN81-22053[NSA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NSA-CR-159296]N81-22420COMPOSITE STRUCTURESBehavior of continuous filament advanced composite isogrid structureN81-22420Design considerations for composite fuselage structureN81-22420COMPOSITE STRUCTURESBehavior of continuous filament advanced composite isogrid structureMS1-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NSA-CE-159296]	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology[ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame (NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [AD-A089019]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NSA-CE-159296]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NSA-CE-159296]N81-22419Preliminary design study of advanced compositeN81-22419	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[AIAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [MSA-CE-159296]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [MSA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control systemN81-22419	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology[AIAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frameN81-22053[MSA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraftN81-22419[INSA-CE-159296]N81-22420COMPOSITE STBUCTURESBehavior of continuous filament advanced composite isogrid structureBehavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NSA-CE-159296]N81-22419Preliminary design study of advanced composite blade and bub and nonnechanical control system for the tilt-rotor aircraft. Volume 1:	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [AD-A089019]N81-22419Structures and Materials Panel [AD-A089019]Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structureStructureN81-22095Design considerations for composite fuselage structureStructureN81-22095Design considerations for composite fuselage structureStructureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]Design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[AIAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [MASA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotcr aircraft. [NASA-CE-152336-1]N81-23064	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[ATAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]N81-22419Structure of commercial transport aircraft [MASA-CE-159296]N81-22420COMPOSITE STBUCTURESBehavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [MASA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [MASA-CE-15236-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [MASA-CE-15236-1]N81-23064	
[AD-A097283]N81-23438COMPOSTTE MATERIALSAdvanced composites - Evolution of manufacturing technology[ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame[MASA-CR-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft[NASA-CR-159296]N81-22419Structure of commercial transport aircraft[NASA-CR-159296]N81-22420COMPOSITE STBUCTURESBehavior of continuous filament advanced composite isogrid structureN81-22420COMPOSITE STBUCTURESBehavior of continuous filament advanced composite isogrid structureN81-22429Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CR-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft.Volume 1: Engineering studies [NASA-CR-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft.Volume 1: Engineering studies [NASA-CR-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft.Volume 2: Encider	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]Structure of commercial transport aircraft [AD-A089019]N81-22419Structures and Materials Panel [AD-A089019]Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]Design considerations for composite fuselage structure for the tilt-rotor aircraft. Volume 1: Engineering studies [MASA-CE-152336-1]N81-23064Preliminary design study of advanced composite blade	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-152296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-152396]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [MSA-CE-15236-21]N81-23065	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[ATAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frameN81-22053[MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraftN81-22419[MASA-CE-159296]N81-22419Structures and Materials Panel (AD-A089019)N81-22420COMPOSITE STBUCTURESBebavior of continuous filament advanced composite isogrid structureN81-2295]Design considerations for composite fuselage structure cf commercial transport aircraft [NSA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [MASA-CE-15236-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [MASA-CE-15236-2]N81-23065COMPRESSION LOADSN81-23065N81-23065	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CR-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CR-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STBUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22420Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CR-159296]N81-22420Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CR-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CR-152336-2]N81-23065COMPENSION LOADS Heat generation in aircraft tires under freeN81-23064	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURESN81-22420Design considerations for composite fuselage structure of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf conmercial transport aircraft [NASA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2]N81-23065COMPRESSION LOADS Heat generation in aircraft tires under free rolling conditionsN81-23065	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structures and Materials Panel (AD-A089019)N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-152396]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-15236-1]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Empineering study cf advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2]N81-23065COMPRESSION LOADSHeat generation in aircraft tires under free rolling conditions [NASA-CE-164273]N81-23461	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[ATAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frameN81-22053[MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraftN81-22419[MASA-CE-159296]N81-22420COMPOSITE STBUCTURESBehavior of continuous filament advanced composite isogrid structureN81-2295Design considerations for composite fuselage structure of commercial transport aircraft [NSA-CE-159296]Design considerations for composite fuselage structure of commercial transport aircraft [NSA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Bugineering studies [MSA-CE-15236-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [WSA-CE-15236-2]N81-23065COMPRESSION LOADSHeat generation in aircraft tires under free rolling conditions [WSA-CE-164273]N81-23461	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STBOCTURESBehavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-152336-1]N81-22095Design for the tilt-rotor aircraft. Volume 1: Engineering studies [MASA-CE-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2] <td col<="" td=""></td>	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22409COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]N81-22095Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Emgineering study cf advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2]N81-23065COMPRESSION LOADS Heat generation in aircraft tires under free rolling conditions [NASA-CE-164273]N81-23461COMPRESSOB BLADIS Development of a noninterference compressor blade stress measurement systemN1 2007	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-152296]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-152296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1]N81-23064Preliminary design study cf advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CE-152336-2]N81-23065COMPRESSION LOADSHeat generation in aircraft tires under free rolling conditions [NASA-CE-164273]N81-23461COMPRESSION LOADSN81-23461Compression BLADIS Development of a noninterference compressor blade stress measurement systemA81-32874	
<pre>[AD-A097283] N81-23438 COMPOSITE MATERIALS Advanced composites - Evolution of manufacturing technology [AIAA PAPER 81-0895] A81-32920 Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217] N81-22053 Design considerations for composite fuselage structure of commercial transport aircraft [AD-A089019] N81-22419 Structures and Materials Panel [AD-A089019] N81-22420 COMPOSITE STBUCTURES Behavior of continuous filament advanced composite isogrid structure N81-22095 Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296] N81-22419 Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] N81-23064 Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CE-152336-2] N81-23065 COMPDESSION LOADS Heat generation in aircraft tires under free rolling conditions [NASA-CE-164273] N81-23461 COMPDESSON BLADIS Development of a noninterference compressor blade stress measurement system there of the use of liquid crystal thermodraphy to study flow cor turbenchicor.</pre>	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structure of commercial transport aircraft [AD-A089019]N81-22420COMPOSITE STRUCTURESN81-22420COMPOSITE STRUCTURESN81-22420Design considerations for composite fuselage structure of conmercial transport aircraft [NASA-CE-159296]N81-22495Design considerations for composite fuselage structure cf conmercial transport aircraft [NASA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Rngineering studies [NASA-CE-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2]N81-23064COMPBESSION LOADS Heat generation in aircraft tires under free rolling conditions [NASA-CE-164273]N81-23461COMPBESSOB BLADIS Development of a noninterference compressor blade stress measurement system A81-32874A81-32874Investigation of the use of liquid crystal thermography to study flow over turbomachinery bladeA81-32874	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]W81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]W81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [MASA-CE-152306]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering study cf advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2]N81-23065COMPDESSION LOADS Heat generation in aircraft tires under free rolling conditions [NASA-CE-164273]N81-23049Development of a noninterference compressor blade stress measurement system A81-23074A81-23074Investigation of the use of liquid crystal thermography to study flow over turbomachinery blades flo-A0972891N81-23089	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Bvolution of manufacturing technology[ATAA PAPEB 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [MASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [MASA-CE-159296]N81-22419Structures and Materials Fanel [AD-A089019]N81-22420COMPOSITE STRUCTURES Behavior of continuous filament advanced composite isogrid structureN81-22495Design considerations for composite fuselage structure cf commercial transport aircraft [MASA-CE-15236]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [MASA-CE-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CE-152336-2]N81-23065COMPRESSION LOADS Heat generation in aircraft tires under free rolling conditions [MASA-CE-164273]N81-23461COMPRESSOB BLADIS Development of a noninterference compressor blade stress measurement system A81-32874N81-23069COMPRESSOB EPFICIENCYN81-23069	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STBUCTURESN81-22420Composite structure isogrid structureN81-22420Composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]N81-22495Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-159296]N81-22095Design considerations for composite fuselage structure cf commercial transport aircraft [NASA-CE-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-2]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2]N81-23064COMPERSSOB LOADS Heat generation in aircraft tires under free rolling conditions [NASA-CE-164273]N81-23461COMPERSSOB BLADIS Development of a noninterference compressor blade stress measurement system [AD-32874N81-23089COMPERSSOB B	
[AD-A097283]N81-23438COMPOSITE MATERIALSAdvanced composites - Evolution of manufacturing technology [ATAA PAPER 81-0895]A81-32920Design concepts for low-cost composite turbofan engine frame [NASA-CE-165217]N81-22053Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CE-159296]N81-22419Structures and Materials Panel [AD-A089019]N81-22420COMPOSITE STRUCTURESN81-22420COMPOSITE STRUCTURESN81-22420Design considerations for composite fuselage structure of conmercial transport aircraft [NASA-CE-159296]N81-22419Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1]N81-23064Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2]N81-23064COMPBESSION LOADS Heat generation in aircraft tires under free rolling conditions [NASA-CE-164273]N81-23461COMPBESSOB BLADIS Development of a noninterference compressor blade stress measurement system A81-32874N81-23069COMPBESSOB BPICIBACY A simulator to test compressor research facility control system softwareN81-23069	

#### SUBJECT INDEX

COMPRESSORS Investigation of instantaneous distortions in air intakes at high angles of attack [AAAF PAPEE NT 80-38] A81-33931 Component research for future propulsion systems [NASA-TH-82613] COMPUTATIONAL PLUID DYNAMICS N81-22055 A theoretical treatment of lifting surface theory of an elliptic wing A81-30653 On the design of modern airfoil sections by numerical methods A81-30705 A computer code for the calculation of aircraft trailing vortices A81-30710 A time marching finite volume method for blade-to-blade flows using a body-fitted curvilinear mesh A81-30717 Approximations and short cuts based on generalized functions 181-30730 Subsonic gas flow past a wing profile A81-31034 Calculation of the flow pattern behind an aircraft wing 181-31041 Study of the secondary flow in the downstream of a moving blade row in an axial flow fan 181-31767 Study of the characteristics of a base-vented wing in nonlinear theory [AAAP FAFEE NT 80-40] A81-33927 Technical evaluation report on the Fluid Dynamic Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [ AGARD-AR- 146 ] NE1-23431 COMPUTER DESIGN Microprocessor-based digital air data computer for flight test A81-32858 COMPUTER GRAPHICS Computer aided technology interface with weights engineering --- aircraft design [SAWE PAPEE 1346] A81-31384 Vortex-flow aerodynamics - An emerging design capability A81-33717 Application of computer colour raster displays in the cockpit in research flight simulation [AD-A096542] N81-22063 A study of real-time computer graphic display technology for aeronautical applications [NASA-CE-164221] NR1-22727 ATTACK v5 SCAN: A comparison of endgame aircraft survivability computer programs [AC-A097663] NE1-23076 COMPUTER BETWORKS Weights information systems using minicomputers [SAWE PAPEE 1347] A81-A81-31385 COMPUTEE PROGRAMMING A study of real-time computer graphic display technology for aeronautical applications [NASA-CB-164221] N81-22727 COMPUTER FROGRAMS A computer code for the calculation of aircraft trailing vortices A81-30710 A simulator to test compressor research facility control system software A81-31110 An Interactive Weight Accounting Program /IWAP/ [SAME FAPEB 1345] A81-313 RAPIDLOADS - A preliminary design loads prediction technique for aircraft A81-31383 [SAWE PAPER 1366] A&1 Analysis of ejection seat stability using easy AE1-31388 program, volume 1 [AD-A096597] Structural flight loads simulation capability. Volume 2: Structural analysis computer program N81-22033 user's manual [AD-A096594] N81-22045 [NBSA-CE-159081] N81-[NBSA-CE-159081] N81-[NBSA-CE-159081] N81-22722 .

CRACK PROPAGATION

SCI Identification (SCIDNT) program user's guide --- maximum likelihood method for linear rotorcraft models [ NASA-CE- 159082 ] N81-22723 LASA-VA-199021 NLSCIDNT user's guide maximum likehood parameter identification computer program with nonlinear rotorcraft model [NASA-CE-159083] N81-22724 [NASA-CA-159055] SCI model structure determination program (05B) user's guide --- optimal subset regression [NASA-CB-159084] N81-N81-22725 INDES User's guide multistep input design with nonlinear rotorcraft modeling [NASA-CE-159085] N81-22726 Investigation of aerodynamic characteristics of wings having vortex flow using different numerical codes [NASA-CE-165706] N81-23034 EGA16 - Computer program for analysis and extrapolation of stress-rupture data [NASA-TP-1809] COMPUTER SYSTEMS DESIGN N81-23486 Weights information systems using minicomputers [SAWE PAPER 1347] COMPUTER TECHNIQUES A81-31385 Adaptive-wall wind-tunnel development for transonic testing A81-31367 COMPUTERIZED DESIGE On the design of modern airfoil sections by numerical methods A81-30705 An Interactive Weight Accounting Frogram /IWAP/ [SAWE PAPER 1345] A81-31383 Computer aided technology interface with weights engineering --- aircraft design (SAWB PAPER 1346) PAEAM - A new weight sizing routine --381-31384 cost-effective computerized design for aircraft [SAWE PAPER 1367] A81-31389 Pressure and force data for a flat wing and a warped conical wing having a shockless recomparession at Mach 1.62 [NASA-TP-1759] N81-22016 A study of real-time computer graphic display technology for aeronautical applications [NASA-CE-164221] 88 N81-22727 COMPUTEBIZED SIBULATION Advanced target tracking by dynamic scene analysis A81-32499 Antenna design and development for the microwave subsystem experiments for the terminal configured wehicle project [NASA-CR-164220] N8 A study of real-time computer graphic display N81-22282 technology for aeronautical applications [NASA-CB-164221] 881-22 User's manual for flight Simulator Display System N81-22727 (PSDS) [NASA-CB-164295] ¥81-23095 COMPOTERS NASA's aeronautics research and technology base [NASA-CB-164195] N81-22969 CONPREENCES Optics in metrology and quality assurance; Froceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980 A81-32504 Structures and Materials Panel [AD-A089019] N81 Contributions to the 9th Symposium on aircraft N81-22420 integrated data systems --- Conferences [BSA-TT-532] 881-23008 CONFIGURATION MANAGEMENT Orientation of measurement sensors for optimum end-of-life performance A81-32697 Electronic flight rules: An alternative separation assurance concept [AD-A097570] 881-23063 CONICAL BODIBS Leading-edge separation from a thick, conical, slender wing at small angles of incidence 161-31687 CONICAL PLON Pressure and force data for a flat wing and a warped conical wing having a shockless recomparession at Mach 1.62 [NASA-TP-1759] 881-22016

CONTINUOUS BADIATION Low-frequency radio navigation system (NASA-CASE-NPO-15264-1.) N81-22036 CONTROL BOUIPHENT Aircraft equipment /2nd revised and enlarged edition/ --- Russian book A81-31823 CONTROL SINULATION Operator training systems/simulators A81-31109 SINCAT - A modular air traffic control simulator A81-33149 CONTROL STABILITY Application of the parameter space method to aerospace vehicle digital control system design A81-32642 CONTROL SURFACES Influence of binge line gap on aerodynamic forces acting on a barmonically oscillating thin profile in an incompressible flow. I, II 181-30956 High frequency drive mechanism for an active controls systems aircraft control surface N81-22400 Some remarks on the unsteady airloads on oscillating control surfaces in subsonic flow N81-23055 CONVECTIVE FLOW Thermal and flow analysis of a convection air-cooled ceramic ccated porous metal concept for turbine vanes [NASA-IM-81749] 881-22056 CONVERGENCE Topology of three-dimensional separated flows [HASA-TH-81294] B8 N81-23037 COOLING SYSTEMS An experimental investigation of the aerodynamics and cooling of a hcrizontally-opposed air-ccoled aircraft engine installation [NASA-CB-3405] COBIOLIS BPFECT 881-22015 Coriolis effect on the vibration of flat rotating low aspect ratio cantilever plates A81-30914 CORROSTOR Combustion system processes leading to corrosive deposits [NASA-TH-81752] CORROSION BESISTANCE N81-23243 Erosion resistant coatings [NASA-TM-75870] **B81-22098** Service evaluation of aluminum-brazed titanium (ABTi) --- aircraft structures [NASA-CB-3418] 881-22129 [NASA-CE-3418] Development of a water displacing, touch-up faint NS1-23268 [AD-A097125] Application of ion implantation for the improvement of localized corrosion resistance of 850 steel bearings [AD-A097230] NE1-23466 COST ANALYSIS A cost function for military airframes [AC-A097538] NE1-23966 COST EFFECTIVENESS PAEAM. - A new weight sizing routine ---cost-effective computerized design for aircraft [SAWB PAPEB 1367] A81-31 A81-31389 Crashworthiness versus cost based on a study of severe Army belicopter accidents during 1970 and 1971 A81-32006 COST ESTIMATES A cost function for military airframes [AD-A097538] 881-23966 A cost function for an airframe production program (AD-A097540) B81-23967 [AD-A097540] COST BBDUCTION Implementing Aircraft Structural Life Management to reduce structural cost of ownership [SAWE FAFRE 1331] A81-31376 P-16 integrated logistics support: Still time to consider economical alternatives [FE81-137473] 881-23079 CRACE PROPAGATION Experimental determination of the stress intensity factor for cracks with a curvilinear front in complex parts /gas turbine blades/ A81-31264

<u>a-11</u>

#### CRASE INJURIES -

Developments in the analysis and repair of cracked and uncracked structures A81-31561 In-flight fatigue crack monitoring using acoustic emission A81-32857 CRASH THJURTRS Crashworthiness versus cost based on a study of severe Army helicopter accidents during 1970 and 1071 181+32006 CRASHES Crashworthiness design parameter sensitivity analysis [AD-A096550] 881-22041 Aircraft crash dynamics: Some major considerations N81-22437 CRERP RUPTURE STRENGTS HEGA16 - Computer program for analysis and extrapolation of stress-rupture data [NASA-TP-1809] N81-23486 CBOSS COBBBLATION Accuracy of noise-modulated radio altimeter A81-32694 CROSS FLOR Pressure and force data for a flat wing and a warped conical wing having a shockless recomparession at Mach 1.62 [NASA-TP-17591 81-22016 CENCEBNIC WIND TUBBELS Description of 0.186-scale model of high-speed duct of national transonic facility [NASA-TH-81949] N81-22061 CRISTAL OSCILLATORS The behavior of guartz oscillators in the presence of accelerations --- in missile and aircraft time-frequency navigation systems A81-31285 CUSHIONS Study to develop improved fire resistant aircraft passenger seat materials [NASA-CE-152408] 881-23 N81-23058

#### D

DACROB (IBADBBABK)	
Air Force Geophysics Laboratory aerodynamic	ally
tethered balloon, 45,000 cubic feet	
[AD-A096758]	N81-22023
DAMAGE ASSESSMENT	
Structural Integrity Recording System (SIR)	for .
N.S. Army AB-16 Beliconters	
ran-a0972831	N81-23438
	101 13430
Namaide calibration evaluation with a	
savalus caliblacion evaluation with a	tion
computer-controlled avionics data acquisi	CIUD
system	804-33030
	a91-23020
Summary of transponder data, May 1979 - Nov	emper
1979	
[AD-A097569]	N81-23061
DATA CONVERSION ROUTIBES	
Processing of AIDS flight recorder data for	a
quick look with the aid of a hybrid compu	ter
system	
	N81-23023
DATA LINKS	
Potential effects of the introduction of the	e
discrete address beacon system data link	Ċn
air/groupd information transfer problems	
[NASA-CR-166165]	N81-22037
DATA FROCESSING	
Contributions to the 9th Symposium on aircu	aft
integrated data systems Conferences	
[RSA-TT-532]	N81-23008
Description of the British Civil Aviation	
Airworthiness Data Recording Programme ((	AADRP)
analysis of flight recorder data	
abarjoit of filger footact and	N81-23017
The SYDAS flight data proceesing excton	301 23011
The Sibas Highe data processing spaces	N91-23019
Dependenting of ATDS flight recorder data for	101-23010
processing of Albs flight recorder data for	. a
dates took with the aid of a partit comp	iter
system	
Distral Amionica Tofornation Curter (DITC)	001-23023
Digital Avionics information system (DAIS).	
volume 1: impact of DAIS concept on 1110	e căcte
COST	
[AD-A097339]	N81~23083

#### SUBJECT INDEX

Digital Avionics Information System (DAIS). Volume 2: Impact of DAIS concept on life cycle cost. Supplement [AD-A097438] N81-23084 DATA BECOBDIEG Structural Integrity Becording System (SIR) for U.S. Army AH-1G Helicopters [AD-A097283] N81-2 N81-23438 DATA BEDUCTION The SYDAS flight data processing system N81-23018 DATA SHOOTHING DEKFIS user's quide: Discrete Extended Kalman Filter/Smoother program for aircraft and rotorcraft data consistency [NASA-CE-159081] N81-22 The reconstruction of flight paths from AIDS data N81-22722 with the aid of modern filtering methods -kalman filters NA1-23021 DEAD BECKONIEG Dead reckoner navigation project N81-22010 DECISION MAKING Application of signal detection theory to decisica making in supervisory control - The effect of the operator's experience A81-31288 Investigation of air transportation technology at Massachusetts Institute of Technology, 1980 N81-22000 DRICING Connercial aviation icing research requirements [NASA-CB-165336] N81-23069 DELTA FUNCTION Approximations and short cuts based on generalized functions A81-30730 DELTA BIEGS Effectiveness of leading-edge vortex flars on 60 and 75 degree delta wings A81-31368 DEPOSITION Combustion system processes leading to corrosive deposits [NASA-TH-81752] N81-23243 DESIGN ANALYSIS A design analysis technique for evaluating size and weight of V/STOL lift fans [SAWE PAPER 1386] A81-A81-31402 Application of an aerodynamic configuration modeling technique to the design and analysis of X-Wing aircraft configurations A81-32013 The art of designing experimental aircraft - An overview [ATAA FAPES 81-0944] A81-3. SINCAT - A modular air traffic control simulator A81-32939 A81-33149 Description of recent changes in the Langley 6- by 28-inch transonic tunnel [NASA-TH-81947] N81-23096 DESTABILIZATION. Aircraft body-axis rotation measurement system [NASA-CASE-FBC-11043-1] N81 N81-22048 DIGITAL COMPUTERS Hicroprocessor-based digital air data computer for flight test A81-32858 A digital-analog hybrid system and its application to the automatic flight control system simulation research [NASA-TH-76457] N81-22060 DIGITAL BADAB SISTERS A new generation IFF - The AN/AFX-100/V/ transponder A81-31132 DIGITAL SINULATION A nonlinear propulsion system simulation tebnique for piloted simulators [NASA-TH-82600] N81-23085 DIGITAL SYSTERS Airborne ground velocity determination by digital processing of electro-optical line sensor signals AE1-32496 Application of the parameter space method to aerospace vehicle digital control system design

A81-32642

EFFECTIVE PERCEIVED BOISE LEVELS

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[SAVE FAFEB 1347]	A81-31385
DRAG	
An experimental investigation of the aerody	namics
and cooling of a hcrizontally-opposed aim	-cooled
aircraft engine installation	
[NASA-CB-3405]	N81-22015
DBAG BEDUCTION	
The optimal lift-drag ratio of a civil aird	raft
[AAAF FAPBE NT 80-35]	<b>▲81-33923</b>
Isprovement of the energy efficiency of hel	icopters
(AAAP PAPEB NT 80-33]	A81-33933
DUCTED PAILS	
Calibration of an axial fan at various powe	E
settings for use on a guarter scale XC-8	air
cushion model	
[AC-A097043]	881-22042
DYNAMIC CHARACTERISTICS	
Reduction of heliconter wibration through (	ontrol
of hub-ispedance	
or hab impedance	381-32009
Apparatus for and mothed of componenting du	namic
apparatus for and method of compensating d	namic
UBCALANCE	N61-22260
[ MASA-CASE-GSC- 12550-1 ]	ac1-22536
DIRACL LUNDS	
Bodern techniques of conducting a flight in	bads
survey based on experience gained on the	BIACK
Hawk belicopter	
	A81-32014
DYNAMIC PROGRAMMING	
The variable-speed tail-chase aerial combat	. problem
	A 61-31295
DYNAMIC BESPONSE	
Dynamic errors of the Kalman filtering of	
trajectory parameters for radar track	ing of
aircraft maneuvers	
	A81-33687
Transonic flutter and gust-response tests a	ınd
analyses of a wind-tunnel model of a tor:	sicn
free wing airplane	
[ NASA-TH-81961 ]	B81-23072
DYNAMIC STRUCTURAL ABALYSIS	
The USAF Armament Division Structural Dyna	
	lics Lab
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Computer aided technology interface with we engineering aircraft design [SAWE PAPEB 1346] Measuring dynamic stresses on helicopter transmission gear teeth utilizing telement Past and future trends in structures and dy of aircraft [AIAA PAPEB 81-0896] A new method for modal identification Finite element analysis of asymmetric, late natural vibrations of a deformable aerop Aircraft crash dynamics: Some major conside Analytical testing [NASA-CE-3429]	<pre>hics Lab A81-3C689 iights A81-31384 ry A81-32659 namics A81-32921 A81-32921 A81-32921 A81-3293 ral ane A81-33736 lerations N81-22437 N81-23487</pre>
Computer aided technology interface with we engineering aircraft design [SAME PAPEB 1346] Measuring dynamic stresses on helicopter transmission gear teeth utilizing telement Past and future trends in structures and dy of aircraft [ATAA PAPEB 81-0896] A new method for modal identification Finite element analysis of asymmetric, late natural vitrations of a deformable aeropy Aircraft crash dynamics: Some major conside Amalytical testing [MASA-CE-3429]	<pre>hics Lab A81-3(689) hights A81-31384 ry A81-32259 namics A81-32921 A81-32921 A81-3293 real Lane A81-33736 leraticns N81-22437 N81-23487</pre>
Computer aided technology interface with we engineering aircraft design [SAWE PAPEB 1346] Measuring dynamic stresses on helicopter transmission gear teeth utilizing telement Past and future trends in structures and dy of aircraft [ATAA PAPEB 81-0896] A new method for modal identification Pinite element analysis of asymmetric, late natural vibrations of a deformable aeropy Aircraft crash dynamics: Some major conside Analytical testing [WASA-CE-3429] E ECOBORIC AWALTSIS	hics Lab A81-3C689 Hights A81-31384 Fry A81-32559 Namics A81-32921 A81-32921 A81-3293 Hane A81-33736 Heraticns N81-22437 N81-22437
Computer aided technology interface with we engineering aircraft design [SAWE PAPEB 1346] Measuring dynamic stresses on helicopter transmission gear teeth utilizing telement Past and future trends in structures and dy of aircraft [AIAA PAPEB 81-0896] A new method for modal identification Pinite element analysis of asymmetric, late natural vibrations of a deformable aeropy Aircraft crash dynamics: Some major conside Analytical testing [NASA-CE-3429] E ECOBORIC ANALLYSIS The rise of air and space	<pre>hics Lab A81-3C689 iights A81-31384 ry A81-32659 namics A81-32921 A81-32921 A81-32921 A81-33293 ral A81-33736 lerations N81-22437 N81-23487</pre>
Computer aided technology interface with we engineering aircraft design [SAWE PAPEB 1346] Measuring dynamic stresses on helicopter transmission gear teeth utilizing telement Past and future trends in structures and dy of aircraft [ATAA PAPEB 81-0896] A new method for modal identification Finite element analysis of asymmetric, late natural vitrations of a deformable aeropy Aircraft crash dynamics: Some major conside Analytical testing [NASA-CE-3429] ECOMONIC ANALYSIS The rise of air and space	<pre>hics Lab A81-3C689 hights A81-31384 ry A81-32259 namics A81-32921 A81-32921 A81-33293 real Lane A81-33736 N81-23487 A81-33718</pre>
Computer aided technology interface with we engineering aircraft design [SAWE PAPEB 1346] Measuring dynamic stresses on helicopter transmission gear teeth utilizing telement Past and future trends in structures and dy of aircraft [ATAA PAPEB 81-0896] A new method for modal identification Pinite element analysis of asymmetric, late natural vibrations of a deformable aerop Aircraft crash dynamics: Some major conside Analytical testing [WASA-CB-3429] E ECOBORIC ANALLYSIS The rise of air and space Puel conservation integrated into airline of	hics Lab A81-3C689 A91-3C689 A81-31384 Fry A81-32559 Namics A81-32921 A81-32921 A81-3293 Fral Berations N81-22437 N81-22437 N81-23487 A81-33718 Sconomics
Computer aided technology interface with we engineering aircraft design [SAME PAPEB 1346] Measuring dynamic stresses on helicopter transmission gear teeth utilizing telement Past and future trends in structures and dy of aircraft [ATAA PAPEB 81-0896] A new method for modal identification Pinite element analysis of asymmetric, late natural vibrations of a deformable aeropy Aircraft crash dynamics: Some major conside Analytical testing [NASA-CE-3429] E ECOBORIC ANALYSIS The rise of air and space Puel conservation integrated into airline of [ATAA PAPEE 81-08311]	<pre>hics Lab A81-3C689 hights A81-31384 ry A81-32259 namics A81-32921 A81-32921 A81-33293 ral A81-33736 lerations N81-22437 N81-23487 A81-33718 connmics A81-33718</pre>

- Structural optimization Past, present and future [AIAA FAPEE 81-0897] A&1-32522 ECOBORY DBORY The use of airspace.- One way to save fuel &&1-33150
- A&1-331

   BPPECTIVE PEBCBIVED NOISE LEVELS

   Annoyance caused by light aircraft noise

   (NASA-TH-76533)

   The annoyance caused by airplane noise in the

   vicinity of Orly Airport and the reaction of

   neighboring residents

   (BASA-TH-76575)
   B&1-225

   Lateral attenuation of high-by-pass ratio engined
   aircraft noise

   (BASA-TH-81966)
   B&1-238

   881-22589 N81-22590
  - 881-23862

A- 13
## EJECTION SEATS

RJECTION SEATS Analysis of ejection seat stability using easy program, volume 1 [AD-A096597] N81-22033 Velocity tolerance of escape systems [AD-A096881] N81-22035 BLASTIC DEFORMATION On St. Venant flexure and torsion problem for symmetrical airfoil sections A81-33245 Pinite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane A81-33736 REBCTRIC CONTROL The impact of the All Blectric Airplane on production engineering [AIAA PAPER 81-0848] A81-32909 BLECTBIC BOUIPHENT The impact of the All Electric Airplane on production engineering [AIAA PAPEE 81-0848] A81-32909 ELECTRO-OPTICAL PROTOGRAPHY Analysis, design and simulation of line scan aerial surveillance systems A81-32492 BLECTRO-OPTICS High temperature electronic requirements in aeropropulsion systems A81-32547 ELECTBONAGNETIC INTERFERENCE A high performance TV camera for use in target acquisition and laser designator systems A81-31115 BLECTROPIC CONTROL A microprocessor based land navigator AR1-32833 ELECTRODIC COUNTREMBASURES Rapport tactical self protection systems design A81-31113 A review of current and future components for electronic warfare receivers A81-32252 ELECTBONIC EQUIPMENT Bigh temperature electronic requirements in aeropropulsion systems A81-32547 RLECTBOREFIELEG Silver recovery from aircraft scrap [PB81-150021] N81-23269 ELEVATION ANGLE Maximum likelihood elevation angle estimates of radar targets using subarertures A81-32691 BLLIPHICITY A theoretical treatment of lifting surface theory of an elliptic wing A81-30653 EABRGENCIES A review of in-flight emergencies in the ASRS data base [NASA-CR-166166] N81-22031 ENDFIRE ARRAYS Application of endfire arrays at contemporary glide-slope problem sites A81-32695 BEBRGY CODSERVATION Airliner maintenance for fuel efficiency [AIAA PAPER 81-0787] A Energy modeling for aviation fuel efficiency A81-33877 [AIAA PAPEE 81-0789] A81-33883 Puel conservation integrated into airline economics [AIAA PAPEE 81-0831] A81-3388 A81-33884 Energy efficient engine flight propulsion system: Aircraft/engine integration evaluation [NASA-CE-159584] N81-22051 RNGINE DESIGN Numerical methods for studying the stress-strain state and service life of aircraft gas-turbine engine disks A81-31258 Principles of aircraft-engine assembly --- Bussian book A81-31799 Bolls-Boyce BB 211-535 power plant [AIAA PAPER 81-0807] A81-33886 CP856-3 high by-pass technology for single aisle twins [AIAA PAPEE 81-0808] A61-33889

#### SUBJECT INDEX

Quiet Clean General Aviation Turbofan (QCGAT) technology study, volume 1 [NASA-CB-1642221 N81-22052 Design concepts for lcw-cost composite turbofan engine frame [NASA-CB-165217] N81-22053 BEGINE FAILURE Engine parameter trend analysis with LEADS 200: Possibilities and limitations --- using flight recorder data N81-23010 Investigations into local fault detection on turbojet engines --- nonitoring instruments NE1-23011 Location of faults in jet engines by calculation of component characteristics N81-23012 ENGINE MONITORING INSTRUMENTS Engine parameter trend analysis with LEADS 200: Possibilities and limitations --- using flight recorder data N81-23010 Investigations into local fault detection on turbojet engines --- monitoring instruments N81-23011 The engine usage monitoring system: An heuristic approach to cost effective data monitoring and analysis --- onboard fatigue monitoring NA1-23013 Classification of operating conditions of turbomachines from solid borne sound N81-23015 Reduction of measured data and possibilities for early detection of sensor break-down N81-23016 BEGINE BOISE Installation effects on propeller noise [AIAA PAPBE 80-0993] A81-31369 Analysis of axial fan noise with the help of the Lowson formalism [AAAF PAPER NT 80-54] Broadband helicopter rotor noise A81-33948 [AAAF FAPES NT 80-58] A81-Comparison of predicted engine core noise with proposed FAA helicopter noise certification A81-33949 requirements [ BASA-TH-81739 ] N81-22839 Lateral attenuation of high-by-pass ratio engined aircraft noise [NASA-TH-81968] N81-23862 BEGINE PARTS Principles of aircraft-engine assembly --- Bussian book A81-31799 The rejuvenation of properties in turbine engine hot section components by hot isostatic pressing [AD-A097551] 881-230 N81-21088 BHGINB STARTERS Hydrodynamic modelling of the starting process in liquid-propellant engines A81-31287 BEGINE TESTING LABORATORIES A mobile emissions laboratory for on-line analysis of combustion products from gas turbine engines AE1-32872 O.N.E.B.A. ramjet test facilities A81-33285 REGINE TESTS High temperature electropic requirements in aeropropulsion systems A81-32547 Centralized in~place pressure calibration system for multiple turbine engine aerodynamic pressure measurement systems A81-32847 Development of a noninterference compressor blade stress measurement system A81-32874 CPM56-3 high by-pass technology for single aisle twins [AIAA PAPEB 81-0808] A81-33889 Propellers for economic flight at high speeds A81-33936 [AAAF PAPES NT 80-34] Design concepts for low-cost composite turbofan engine frame [NASA-CR-165217] N81-22053

EQUATIONS OF NOTION Approximations and short cuts based on gene	eralized
BROSION	A81-30730
Brosion resistant coatings [NASA-TH-75870] BBBOB ABALYSIS Desting leasting finding with a subtinued	N81-22098
two element interferometer	engto
Dynamic errors of the Kalman filtering of	A81-31125
trajectory parameters for radar trac. aircraft maneuvers	king of
ESCAPE SYSTEMS	181-33687
Analysis of ejection seat stability using o program, vclume 1	easy
[AD-A096597] An investigation of two safe escape from ba	N81-22033 ase
flight profiles [AD-A096571]	N81-22034
Velocity tclerance of escape systems [AD-A096881]	N81-22035
Crashvorthiness design parameter sensitivi analysis	ty
[AD-Â096550] Bulbe Bouations of Motion	N81-22041
A time marching finite volume method for hlade-to-blade flows using a body-fitted curvilinear mesh	
EVASIVE ACTIONS	181-30717
The variable-speed tail-chase aerial comba	t problem A81-31295
A mobile emissions laboratory for on-line a	analysis ·
of combustion products from gas turbine	engines A81-32872
The art of designing experimental aircraft	- An
[AIAA PAPEE 81-0944] EXPLOSIVE PORATEG	A81-32939
Increasing the strength properties of shee by explosive forming of them with optimi	t parts zaticn
	<b>▲81-33174</b>
Efficiency of the methods and algorithms us estimating the reliability in aviation to	sed for echnigues A81-33173
BITRAPOLATION MBGA16 - Computer program for analysis and extrapolation of stress-rupture data [NASA-TP-1809]	¥81-23486
E	
P-16 AIRCRAP?	
Bapport tactical self protection systems d	esign A81-31113
P-16 integrated logistics support: Still	time to

	181-31113
P-16 integrated logistics support: consider economical alternatives	Still time to
[PB81-137473]	N81-23079
PABRICS	
Air Force Geophysics Laboratory aer tethered balloon, 45,000 cubic fe	odynamically et
FAD-A0967581	881-22023
FAILURE AWALYSIS	
Mechanical properties of aluminum c heat-resistant steels	oatings on
	181-31668
Orientation of measurement sensors end-of-life performance	for optimum
• •	¥81-32697
Is it safe - The safety assessment systems. IV - Methods, techniques organisation	of aircraft , and
··· <b>·</b>	<b>A81-33789</b>
Investigations into local fault det	ection on
tarbojet engines monitoring i	nstruments
	N81-23011
Location of faults in jet engines b of component characteristics	y calculation
	N81-23012
Reduction of measured data and poss	ibilities fcr
early detection of sensor break-d	OWD
,	881-23016

.

AKGAID = CONDUTOR DECOTAD FOT ADALVESS ADO	
extrapolation of stross-runture data	
EXCLAPTIALION OF SCLESS-LUPTURE WALK	801-22096
ERASE-IE-1003 J	801-23400
A review of in-flight energencies in the N	ses data
hase	DDD Gdig
[ NASA-CR-166166 ]	N81-22031
PAN BLADES	
Analysis of axial fan noise with the helt	of the
Lowson formalism	
[ AAAF FAFEE NT 80-54 ]	A81-33948
PATIGUE (MATEBIALS)	
The engine usage monitcring system: An he	uristic
approach to cost effective data monitori:	ng and
analysis onboard fatigue monitoring	
	N81-23013
FATIGUE LIPE	
Fatigue strength of gas turbine engine rot	OL
tlades in connection with structural cha-	nges in
service	
	A81-31673
Structures and Materials Panel	
[ND-N089019]	N81-22420
ratique life variability in aluminum alloy	
	No4 00000
[AU-AVJ/130] Structural Integrity Recording System (SID)	00.1-23243 1 for
U.S. Army AB-10 Holicontors	
far-A0972831	N81-23438
PATIGUE TESTS	201 20400
In-flight fatigue crack monitoring using a	constic
emission	
	A81-32857
FAULT TOLEBANCE	
AN/TPX-54 interrogator	
·····	A81-31131
PEASIBILITY ABALYSIS	
Inflight aircraft vibration modes and their	r effect
on aircraft radar cross section	
	A81-31370
PEEDBACK CONTROL	
Application of the parameter space method	to .
aerospace vehicle digital control system	design
	A81-32642
P-8C adaptive control law refinement and s	ortware
deveropment	
ENACA CD-1630033	ne1-22050
[NASA-CB-163093]	N81-22059
[NASA-CR-163093] FIBEB OPTICS The light-weight! system - A novel concep	N81-22059
[NASA-CB-163093] FIBEB OFTICS The 'light-weight' system - A novel concep on-board weight and balance measurement	N81-22059 t for
[NASA-CB-163093] FIBEB OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics	N81-22059 t for using
[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAME FAFE 13361]	N81-22059 t for using A81-31377
[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel	N81-22059 t for using A21-31377 model
[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment	N81-22059 t for using A81-31377 model
[NASA-CB-163093] FIBEB OFTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment	N81-22059 t for using A81-31377 model A81-32849
[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER REIMFORCED COMPOSITES	N81-22059 t for using A81-31377 model A81-32849
[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BRINFORCED COMPOSITES Advanced fiber reinforced thermoplastic st	N81-22059 t for using A81-31377 odel A81-32849 ructures
[NASA-CB-163093] FIBEB OFTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBEB REIMPORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759]	N81-22059 t for using A81-31377 odel A81-32849 ructures N81-22106
<pre>[NASA-CB-163093] FIBEB OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBEB BELIFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AE-A096759] Structural design of BFEP patches for Mira</pre>	N81-22059 t for using A81-31377 model A81-32049 ructures N81-22106 ge wing
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFER 1336] An opto-electronic method for wind tunnel alignment FIBER REIMPORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFBP patches for Bira repair</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32849         ructures         B&1-22106         ge wing
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER ERIMPORED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Mira repair [AD-A097195]</pre>	N81-22059 t for using A81-31377 model A81-32049 ructures N81-22106 ge wing B81-23024
<pre>[NASA-CB-163093] FIBEB OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBEB BEINFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Mira repair [AD-A097195] FIELD EFFECT TEAMSISTORS</pre>	N81-22059         t for         using         A81-32849         ructures         N81-22106         ge wing         N81-23024
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER ERIMPORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Bira repair [AD-A097195] FIELD ERFRCT TENNISISTORS An X-band power GaAs PEI amplifier for mil </pre>	N81-22059         t for         using         A81-31377         odel         A81-32649         ructures         N81-22106         ge wing         881-23024         itary
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER RENFFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFBP patches for Bira repair [AD-A097195] FIELD &amp;PFECT TEAMSISTOBS An X-band power GaAS PET amplifier for mil avionics radar applications</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32849         ructures         N&1-22006         ge wing         N&1-23024         itary
<pre>[NASA-CB-163093] FIBEB OFTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBEB REIMFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFBP patches for Bira repair [AD-A097195] FIBLD RFPECT TRANSISTORS An X-band power GAAS PEI amplifier for mil avionics radar applications</pre>	N81-22059 t for using A81-31377 model A81-32049 ructures N81-22106 ge Wing B81-23024 itary A81-31122
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BENIFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AL-A096759] Structural design of BFEP patches for Bira repair [AD-A097195] FIBLD EFFECT TENESISTORS An X-band power GAAS FET amplifier for mil avionics radar applications FIGETEB AIRCENT Infiliable aircraft wibration modes and thei </pre>	<pre>N81-22059 t for using A81-31377 odel A81-32849 N81-22106 ge ving B81-23024 itary A81-31122 r effect</pre>
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER ERIMPORCED CORPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Hira repair [AD-A097195] FIBLD EFFECT TENNESISTORS An X-band power GAAS PET amplifier for mil avionics radar applications FIGETER AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32649         ructures         b&1-22106         ge Wing         B&1-23024         itary         A&1-31122         r effect
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER RENFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFBP patches for Bira repair [AD-A097195] FIELD EPFECT TEAMSISTORS An X-band power GaAS PET amplifier for mil avionics radar applications FIGETEB AIRCEAFT Inflight aircraft vibration modes and thei on aircraft radar cross section</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32849         ructures         N&1-22006         ge wing         N&1-23024         itary         A&1-31122         r effect         A&1-31700
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BENEFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AL-A096759] Structural design of BFEP patches for Mira repair [AD-A097195] FIELD EFFECT TEAMSISTORS An X-band power GaAS PEI amplifier for mil avionics radar applications FIGETEE AIRCENTT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited</pre>	N81-22059         t for         using         A&1-31377         odel         A&1-32649         ructures         B&1-22106         ge wing         B&1-23024         itary         A&1-31122         r effect         A&1-31370
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER ERIMPORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Bira repair [AD-A097195] FIBLD ERFECT TENESISTORS An X-band power GAAS PET amplifier for mil avionics radar applications FIGETEB AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack tyre aircraft</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32649         ructures         B&1-22106         ge Wing         B&1-23024         itary         A&1-31122         r effect         A&1-31370         fcr
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER ERIMPORCED CORPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Hira repair [AD-A097195] FIELD RFPECT TEAMSISTORS An X-band power GaAs PET amplifier for mil avionics radar applications FIGETEE AIECENTT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1365]</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32649         ructures         N&1-22006         ge wing         N&1-23024         itary         A&1-31122         r effect         A&1-31370         fcr         A&1-3187
<pre>[NASA-CB-163093] FIBEB OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBEB BEIMPOBCED COMPOSITES Advanced fiber reinforced thermoplastic st [Ac-A096759] Structural design of BFEP patches for Mira repair [AD-A097195] FIELD BFF8CT TEAMSISTORS An X-band power GaAs PEI amplifier for mil avionics radar applications FIGETED AIRCEAFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1365] BAFIDLCAIS - A preliminary design loads pr</pre>	<pre>N81-22059 t for using A01-31377 odel A81-32049 ructures N01-22106 ge wing N81-23024 itary A01-31122 r effect A01-31370 fcr A01-31387 edicticn</pre>
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BENFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AL-A096759] Structural design of BFEP patches for Bira repair [AD-A097195] FIBLD EFFECT TENESISTORS An X-band power GaAs PEI amplifier for mil avionics radar applications FIGETER AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1365] BAFIDLCAIS - A preliminary design loads pr technigue for aircraft</pre>	<pre>N81-22059 t for using A81-31377 odel A81-32649 N81-22106 ge ving N81-23024 itary A81-31122 r effect A81-31370 for A81-31387 ediction</pre>
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER ERIMPORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Mira repair [AD-A097195] FIBLD ERPECT TENNESISTORS An X-band power GAAS PET amplifier for mil avionics radar applications FIGETER AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1365] BAFIDICAIS - A preliminary design loads pr technique for aircraft [SAWE FAPEE 1366]</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32649         ructures         b&1-22106         ge Wing         B&1-23024         itary         A&1-31122         r effect         A&1-31370         fcr         A&1-31387         edicticn         A&1-31388
<pre>[NASA-CB-163093] FIBEB OFTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBEB REIMPORED COMPOSITES Advanced fiber reinforced thermoplastic st [Ac-A096759] Structural design of BFBP patches for Hira repair [AD-A097195] FIBLD RFFECT TRANSISTORS An X-band power GaAs PEI amplifier for mil avionics radar applications FIGETER AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPER 1366] Aircraft design then and now</pre>	<pre>N81-22059 t for using A01-31377 odel A01-32049 ructures N01-23024 itary A01-23024 itary A01-31122 r effect A01-31387 cdicticn A01-31388</pre>
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<pre>[NASA-CB-163093] FIBEB OFTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBEB REIMPORED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFBP patches for Hira repair [AD-A097195] FIBLD RFPECT TRANSISTORS An X-band power GAAS PET amplifier for mil avionics radar applications FIGETER AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE FAPEB 1365] BAPIDLCAIS A preliminary design loads pr technique for aircraft [SAWE FAPEB 1366] Aircraft design then and now [AIAA FAPEE 81-0917] Aercodynamic trials with the linear motor-d platform at the Toulcuse Aeronautic Test</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32649         ructures         B&1-22106         ge wing         B&1-23024         itary         A&1-31122         r effect         A&1-31387         edicticn         A&1-31388         A&1-31389         A&1-31389         A&1-31388
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BENFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Mira repair [AD-A097195] FIELD EPPECT TEANSISTORS An X-band power GaAS PEI amplifier for mil avionics radar applications FIGETES AIBCENTT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1366] NAFIDLCARS - A preliminary design loads pr technique for aircraft [SAWE FAPEE 31366] Aircraft design then and now [AIAA FAPEE 81-0917] Aerodynamic trials with the linear motor-d platform at the Tonlcuse Aeronautic Test  for aircraft acceleration and decele</pre>	<pre>N81-22059 t for using A81-31377 ■0del A81-32849 Fuctures N81-22106 ge wing N81-23024 itary A&amp;1-31122 r effect A81-31387 ediction A81-31388 A&amp;1-32933 riven ing Certer ration</pre>
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<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BRIMPORED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Mira repair [AD-A097195] FIELD BFFECT TRANSISTORS An X-band power GaAs FEI amplifier for mil avionics radar applications FIGETER AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1366] Aircraft design then and now [AIAM FAPEE 61-0917] Aerodynamic trials with the linear motor-d platform at the Toulcuse Aeronautic Test [AAMF PAPEE HT 80-41] Analysis of wind tunnel test results for a Gamen and parts and parts and parts and the for a gamen and and and and and and and and and an</pre>	N81-22059         t for         using         A&1-31377         odel         A&1-32649         Futures         B&1-22106         ge wing         N&1-23024         itary         A&1-31122         r effect         A&1-31370         fcr         A&1-31387         A&1-31388         A&1-31388         A&1-31388         A&1-31388         A&1-31388         A&1-31389         A&1-33943
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BENFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AL-A096759] Structural design of BFBP patches for Mira repair [AD-A097195] FIELD EFFECT TEAMSISTORS An X-band power GaAS PEI amplifier for mil avionics radar applications FIGETER AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1365] BAPIDLCAIS - A preliminary design loads pr technique for aircraft [SAWE FAPEE 31366] Aircraft design then and now [AIAA FAPEE 81-0917] Aerodynamic trials with the linear motor-d platform at the Toulcuse Aeronautic Test  for aircraft acceleration and decele tests [AMF PAPEE NT 80-41] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fibeter/attack tare and results for a 9.39-per cent scale model of a VSTOL fibeter/attack tare the Toulcuse Autor to fibeter/attack tare the fibeter fibeter fibeter fibeter fibeter fiberer fiberer fibeter fibeter fiberer fiberer fibeter fiberer fiberer fiberer fibeter fiberer f</pre>	<pre>N81-22059 t for using A81-31377 odel A81-32849 ructures N81-22106 ge ving N81-23024 itary A81-31122 r effect A81-31387 rediction A81-31388 A81-32933 riven ing Center ration A81-33943 Av</pre>
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] Am opto-electronic method for wind tunnel alignment FIBER ERIFFORCED COMPOSITES Advanced fiber reinforced thermoplastic st [AC-A096759] Structural design of BFEP patches for Bira repair [AD-A097195] FIELD EFFECT TENENISTORS An X-band power GAAS PET amplifier for mil avionics radar applications FIGETEE AIRCENFT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1365] BAFIDICAIS - A preliminary design loads pr technique for aircraft [SAWE FAPEE 1366] Aircraft design then and now [AIAM FAPEE 81-0917] Aerodynamic trials with the linear motor-d platform at the Toulcuse Aeronautic Test  for aircraft acceleration and decele tests [AAAF PAPEE HT 80-41] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stu overview acceleration characteriction of the structural weight of a vSTOL fighter/attack aircraft. Volume 1: Stu overview</pre>	N81-22059         t for         using         A&1-31377         model         A&1-32649         ructures         B&1-22106         ge wing         B&1-23024         itary         A&1-31122         r effect         A&1-31387         ediction         A&1-31388         A&1-31389         ing Certer         ration         A&1-33943         dy
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BRIMPORED COMPOSITES Advanced fiber reinforced thermoplastic st [A-A096759] Structural design of BFBP patches for Hira repair [AD-A097195] FIELD RFRCT TRANSISTORS An X-band power GaAs PET amplifier for mil avionics radar applications FIGETER AIRCENT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1365] AMYE PAPEE 1366] Aircraft design then and now [AIAM FAPEE 81-0917] Aerodynamic trials with the linear motor-d platform at the Toulcuse Aeronautic Test  for aircraft acceleration and decele tests [AAAF PAPEE HT 80-41] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stu overview aerodynamic characteristics [MA1A F2724]</pre>	N81-22059         t for         using         A&1-31377         odel         A&1-32649         ructures         b&1-22106         ge wing         N&1-23024         itary         A&1-31122         r effect         A&1-31387         ediction         A&1-31388         A&1-31388         A&1-31388         A&1-31388         A&1-31388         A&1-33943         dy         B&1-23020
<pre>[NASA-CB-163093] FIBER OPTICS The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE FAFEE 1336] An opto-electronic method for wind tunnel alignment FIBER BRIMPORED COMPOSITES Advanced fiber reinforced thermoplastic st [AL-A096759] Structural design of BFEP patches for Mira repair [AD-A097195] FIBLD EPPECT TEAMSISTORS An X-band power GaAS PEI amplifier for mil avionics radar applications FIGETEM AIRCENTT Inflight aircraft vibration modes and thei on aircraft radar cross section The structural weight fraction - Revisited fighter/attack type aircraft [SAWE PAPEE 1366] Ahicraft design then and now [AIAM FAPEE 81-0917] Aerodynamic trials with the linear motor-d platform at the Toulcuse Aeronautic Test [AAMF PAPEE M 80-41] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stu Overview aerodynamic chracteristics [MASA-CB-152391-VOL-1]</pre>	N81-22059         t for         using         A&1-31377         odel         A&1-32649         ructures         B&1-22106         ge ving         N&1-23024         itary         A&1-31122         r effect         A&1-31387         edicticn         A&1-31388         A&1-31389         A&1-33943         dy         B&1-23030

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#### FILABERTS

Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Evaluation Ingater/attack and faith. Volume 2: Maluation of prediction methodologies [NASA-CR-152391-VOL-2] N81-23 Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effects of N81-23031 Ingret/attack aircraft. Volume 3: Erects O configuration variations from baseline [NASA-CE-152391-VOL-3] N81-2: Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 4: EALS E104 N81-23032 aerodynamic characteristics and comparisons with E205 configuration aerodynamic characteristics [NASA-CE-152391-VOL-4] N81-2 N81-23033 Transonic flutter and gust-response tests and analyses of a wind-tunnel model of a torsion free wing airplane [NASA-TH-81961] N81-23072 FILABERTS Behavior of continuous filament advanced composite isogrid structure N81-22095 FILM COOLING Computation of wall temperature and heat flux distributions of the film cooled walls A81-30802 FINITE DIFFERENCE TERORY Transonic Viscous-inviscid interaction over airfoils for separated laminar or turbulent flows A81-31612 Pactors which influence the behavior of turbofan forced mixer nozzles [AIAA PAPER 81-0274] FINITE BLEMBET METHOD 181-32549 A time marching finite volume method for blade-to-blade flows using a body-fitted curvilinear mesh A81-30717 Coriolis effect on the vibration of flat rotating low aspect ratio cantilever plates A81-30914 Numerical methods for studying the stress-strain state and service life of aircraft gas-turbine engine disks 181-31258 Developments in the analysis and repair of cracked and uncracked structures 181-31561 A Galerkin type finite element method for rotary-wing aeroelasticity in hover and forward flight A81-33050 Pinite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane A81-33736 FIRE CONTEOL Operator training systems/simulators A81-31109 FIRE PREVENTION Crashworthiness design parameter sensitivity analysis [AD-10965501 N81-22041 Study to develop improved fire resistant aircraft passenger seat materials [NASA-CE-152408] N81+23058 PIXED WINGS DEKFIS user's guide: Discrete Extended Kalman Filter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081] N81-22722 PLAPPING Use of multiblade sensors for on-line rotor tip-path plage estimation A81-32010 Comparison of calculated and measured belicopter rotor lateral flapping angles A81-32018 PLIGHT ALTITUDE Measurement of aircraft speed and altitude -- Book A81-32401 . Laser Doppler airspeed and altitude sensor [AD-A096980] N81-22049 PLIGHT CONTROL Investigation of air transportation technology at Frinceton University, 1980

#### SUBJECT IEDEX

Aircraft body-axis rotation measurement system (IASA-CASE-FRC-11043-1) BC1-22048
Flight evaluation of the concept of the stage A Peripheral Vision Horizon Device (FVHD) using the CH 135 aircraft of 403 Squadron - CEB Gagetcun N81-22048 [AD-A096870] N81-22050 FLIGET LOAD BECONDERS Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-31399 FLIGHT OFTIBIZATION Fuel conservation integrated into airline economics [AIAA PAPES 81-0831] A81-33884 FLIGHT PATHS Energy modeling for aviation fuel efficiency [AIAA PAPEB 81-0789] A& An investigation of two safe escape from base Å81-33883 flight profiles [AD-A096571] N81-22034 The reconstruction of flight paths from AIDS data with the aid of modern filtering methods --kalman filters NE1-23021 FLIGHT EECORDERS Contributions to the 9th Symposium on aircraft integrated data systems --- Conferences [BSA-TT-532] N81-23008 (PDBS) in a German Airforce fighter bomber wing after field trials --- digital equipment Rengine parameter trend analysis with LEADS 200: Possibilities and limitations --- using flight recorder data N81-23010 The engine usage monitoring system: An heuristic approach to cost effective data monitoring and analysis --- onboard fatigue monitoring N81-23013 Description of the British Civil Aviation Airworthiness Data Recording Programme (CAADEP) --- analysis of flight recorder data N81-23017 The SYDAS flight data processing system N81-23018 The use of aircraft integrated data system at KLB --- performance monitoring N81-23019 Detection and location of faults in onboard aircraft systems with the aid of the Automatic Pault Identification System (AFIS) N81-23022 Processing of AILS flight recorder data for a guick look with the aid of a hybrid computer system N81-23023 PLIGHT SAFETY An investigation of two safe escape from base flight profiles [AD-A096571] N81-22034 Study to develop improved fire resistant aircraft passenger seat materials [NASA-CB-152408] N&1-234 FLIGHT SIRULATION N&1-23058 Bathematical model of the linear unsteady aerodynamics of the entire aircraft A81-31039 Performance deterioration based on simulated aerodynamic loads test, JT9D jet engine diagnostics program [NASA-CB-165297] N81-230 User's manual for flight Simulator Display System N81-23086 (PSDS) [NASA-CB-164295] N81-23095 FLIGHT SINULATORS Application of computer colour raster displays in the cockpit in research flight simulation [AD-A096542] NE1-22063 A nonlinear propulsion system simulation tehnique for piloted simulators [NASA-TH-82600] N81-23085 PLIGHT STABILITY TESTS Maximum likelihood identification of aircraft lateral parameters with unsteady aerodynamic modelling N81-22057 Analytical testing [NASA-CB-3429] N81-23487

N81-22008

PLIGHT TEST INSTRUMENTS A mobile emissions laboratory for on-line analysis of combustion products from gas turbine engines AA1-32872 PLIGHT TRSTS Design and testing of float landing gear systems for helicopters A81-32007 Modern techniques of conducting a flight loads survey based on experience gained on the Black Hawk heliccpter A81-32014 Microprocessor-based digital air data computer for flight test A81-32858 A flight test real-time GW-CG computing system 481-32860 Sun powered aircraft design [AIAA PAPES 81-0916] A81-32932 Results of a Loran-C flight test using an absolute data reference --- whf monirange navigation system and discrete address beacon system N81-22006 Plight evaluation of the concept of the stage A Peripheral Vision Horizon Device (PVHD) using the CH 135 aircraft of 403 Squadron - CEB Gagetown [AD-A096870] N81-22050 Groundspeed/airspeed differences as a wind shear indicator and flight evaluation of a DMB-derived system to determine groundspeed [AD-A097566] N81-23768 PLIE DETECTORS Forward-looking infrared /FLIR/ sensor for autchonous vehicles A81-32490 Advanced target tracking by dynamic scene analysis A81-32499 FLOORS Ploor and fuel vibration isolation systems for the Boeing Vertol connercial Chinook A81-32016 FLOTATION Design and testing of float landing gear systems for helicopters A81-32007 FLOW CHARACTERISTICS Description of 0.186-scale model of high-speed duct of national transonic facility [ NA SA-TH-81949 ] N81-22061 Sche remarks on the unsteady airloads on oscillating control surfaces in subsonic flow N81-23055 PLOW DISTORTION Subsonic gas flow past a wing profile A81~31034 Investigation of instantaneous distortions in air intakes at high angles of attack [AAAP PAPER NT 80-38] A81-33931 PLOW DISTRIBUTION Calculation of the flow pattern behind an aircraft wing A81~31041 Application of holography to the study of helicopter rotor flow fields [NASA-CB-164293] N81-23433 PLON REASUREMENT Experimental investigation of oscillating subscnic iets A81-32777 The role of coherent structures in the generation of noise for subsonic jets [NASA-CE-164214] N81-22833 PLOW STABILITY Oscillatory flows from shock induced separations on biconver aerofoils of varying thickness in ventilated wind tunnels N81-23056 PLON TEBORY New interpretations in the theory of viscous incompressible fluid flow past airfoil profiles A81-31044 FLOW VELOCITY Concerning Khristianovich's transformation of a subsonic flow past an airfoil into a low-speed flow A81-31045

PLOW VISUALIZATION Investigation of the use of liquid crystal thermography to study flow over turbomachinery blades [ AD-10972891 N81-23089 FLUID DYBABICS NASA's aeronautics research and technology base [ NASA-CE-164195] N81-22969 FLUIDICS Dead reckoner navigation project N81-22010 PLUTTER The development of a theoretical and experimental model for the study of active suppression of wing flutter N81-22058 PLUTTER ANALYSIS Non-linear oscillator models in bluff body aeroelasticity A81-30786 Influence of binge line gap on aerodynamic forces acting on a harmonically oscillating thin profile in an incompressible flow. I, II A81-30956 A new method of airfoil flutter control A81-33844 Transonic flutter study of a wind-tunnel model of an arrow-wing supersonic transport --- SCAT-15F model test in the Langley Transonic Dynamics Tunnel [ NASA-TH-8 1962 ] N81-23071 PLY BY WIBE CONTROL Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Bngineering studies
[NASA-CR-152336-1] N81-23064 Preliminary design study of advanced composite blade and bub and nonmechanical control system for the tilt-rctor aircraft. Volume 2: Froject planning data [NASA-CE-152336-2] N81-23065 PLVIDG PLATFORMS Analytical study of the cruise performance of a class of remotely piloted, microwave-powered, high-altitude airplane platforms [NASA-TH-81969] N81-22040 PODLING Combustion system processes leading to corrosive deposits [NASA-TH-8 1752] 881-23243 PBACTUBB BBCHABICS Structures and Materials Panel [AD-A089019] N81-22420 PRACTURE STRENGTE Increasing the strength properties of sheet farts by explosive forming of them with optimization of the production parameters A81-33174 FRABCE Increasing capacity at Paris airports [AIAA FAPRE 81-0802] A81-33890 The relationship between noise and annoyance around Orly [NASA-TH-76573] N81-22594 PREE VIBEATION Finite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane A81-33736 FRICTION National runway friction measurement program [AD-A097334] 881-23097 FUEL CONSURPTION Airborne method to minimize fuel with fixed time-of-arrival constraints A81-31297 The impact of the All Blectric Airplane on production engineering [AIAA PAPEE 81-0848] A81-32909 The use of airspace - Cne way to save fuel A81-33150 Airliner maintenance for fuel efficiency [AIAA PAPER 81-0787] A81-33877 [AILA PAPER 81-0789] Rolls-Boyce EB 211-535 power plant **181-33883** [AIAA PAPEE 81-0807] AE1-33886 Propellers for economic flight at high speeds [AAAF FAFEE NT 80-34] A81-33936

A-17

## PUBL PRODUCTION

CALERKIN MRTHOD

General aviation airplane fuel economy system model N81-22011 Bnergy efficient engine flight propulsion system: Aircraft/engine integration evaluation [NASA-CR-159584] N81-22051 FUEL PRODUCTION Future U.S. jet fuels - A refiner's viewpoint [AIAA PAPER 81-0770] A8 FUEL TANKS 181-33876 Ploor and fuel vibration isolation systems for the Boeing Vertol connercial Chinook A 81-32016 PURLS NASA's aeronautics research and technology base [ NASA-CR-164 195 ] N81-22969 PULL SCALE TESTS Equilibrium spinning of a typical single-engine low-wing light aircraft A81-31598 Full-scale aerodynamic characteristics of a propellar installed on a small twin-engine aircraft wing panel [NASA-TH-81285] N81-23039 FUNCTIONAL DESIGN SPECIFICATIONS Demonstration Advanced Avionics System (DAAS) functional description --- Cessna 402B aircraft [NASA-CB-152405] 881-23080 FUSBLAGES An extremely lightweight fuselage-integrated phased array for airborne applications 181-30779 Design considerations for composite fuselage structure of commercial transport aircraft [NASA-CR-159296] N81-22419

# Ģ

- A Galerkin type finite element method for rotary-wing aeroelasticity in hower and forward flight Ag1-33050
- GALLIUM ABSENIDES An X-band power GaAs PET amplifier for military avionics radar applications
- GAME THEORY
- The variable-speed tail-chase aerial combat problem A81-31295
- Subsonic gas flow past a wing profile A81-31034
- GAS TUBBINE ENGINES Computation of wall temperature and heat flux distributions of the film cooled walls
  - A81-30802 Numerical methods for studying the stress-strain state and service life of aircraft gas-turbine engine disks A81-31258
  - Experimental determination of the stress intensity factor for cracks with a curvilinear front in complex parts /gas turbine blades/ A81-31264
  - Mechanical properties of aluminum coatings on heat-resistant steels A81-31668
  - Patigue strength of gas turbine engine rotor blades in connection with structural changes in service AA1-31673
  - Centralized in-place pressure calibration system for multiple turbine engine aerodynamic pressure measurement systems
  - A mobile emissions laboratory for on-line analysis of combustion products from gas turbine engines A81-32872
  - Thermoplastic strengthening of a gas-turbine engine disk lock joint - Determination of the residual stresses A81-33169
  - Bearing wear detection using radioactive iron-55 tagging
  - [ASIE PREPRINT 81-AM-6A-3] A81-33868 The rejuvenation of properties in turbine engine hot section components by hot isostatic pressing [AD-A097551] B81-23088

## SUBJECT INDEX

GAS TURBINES Method for evaluating the resistance of gas-turbine installation disks to thermal cycling A81-33168 GEAR TRETH Beasuring dynamic stresses on helicopter transmission gear teeth utilizing telemetry **ิ**ลี1-32859 GRNERAL AVIATION ATECRAPT Jet aircraft design [AIAA FAPEE 81-0912] A81-32930 The rise of air and space A81-33718 Designing for aircraft structural crashworthiness (AIAA PAPBR 81-0803) A&1-33 BIT Annotated Bibliography AE1-33882 N81-22001 Use of Loran-C for general aviation aircraft navigation NE1-22002 The P/FOD project: Programmable/Pilot Oriented Display --- general aviation aircraft N81-22004 Investigation of air transportation technology at Ohio University, 1980 --- general aviation aircraft and navigation aids N81-22005 General aviation airplane fuel economy system model N81-22011 An investigation of two safe escape from base flight profiles [AD-A096571] N81-22034 Quiet Clean General Aviation Turbofan (QCGAT) technology study, volume 1 [NASA-CE-164222] N81-22052 General Aviation Activity and Avionics Survey [AD-A097604] N81-23081 GENERAL DYNAMICS AIBCRAFT Aircraft quality assurance using close-range photogrammetry A81-32508 GINBALS Aircraft body-axis rotation measurement system [NASA-CASE-FRC~11043-1] N81 N81-22048 GLIDE LANDINGS Application of endfire arrays at contemporary glide-slope problem sites A81-32695 GLIDE PATHS Punctional analysis and operational assessment of an onboard glide path guidance system for visual approaches (visual approach monitor VAM) [ESA-TT-655] N81-2203 Application of variable structure system theory to N81-22038 aircraft flight control --- AV-8A and the Augmentor Sing Jet STOL Besearch Aircraft [NASA-CR-164321] N81-23093 GLIDERS Global optimization of a glider [AAAP FAPEs NT 80~36] A81-33937 Analytical study of the cruise performance of a class of remotely filoted, microwave-powered, high-altitude airplane platforms [NASA-TH-81969] NE1-22040 Investigative technical measurements of the planetary boundary layer made onboard an instrumented motorized glider [ BEFT-149 ] N81-22666 GLOBAL POSITIONING SYSTEM GPS Navstar, the universal positioning system of the future A81-30975 GOVEBBEET/INDOSTEY BELATIONS Pederal policies affecting airport noise compatibility programs [ATAA FAPES 81-0829] A81-33879 GRAPHITE Advanced fiber reinforced thermoplastic structures [AD-A096759] N81-22106 GRAPHITE-BFOXY COMPOSITE BATBEIALS Concepts for improving the damage tolerance cf composite compression ganels A81-32825 GROUDD RFFECT (ABBODYNABICS) Steady flow and static stability of airfoils in extreme ground effect

181-31686

BELICOPTEES

GOUDDU DEFELT (LUDDUBILATIUBS)	
Application of endfire arrays at contemporal	C V
alide-slope croblem sites	- 1
J	A81-32695
GROUND SPERD	
Airborne ground velocity determination by d	idital
processing of electro-optical line sensor	signals
processing of electro optical time sensor	AB1-32496
Groundenood (sircrosed differences as a wind	choar
indicator and flight oralisation of a DKP-	dorizod
Succession and sight evaluation of a phe-	Ter I ved
System to determine groundspeed	NO1-23769
CBOURD BRCMC	801-23700
The USB learnersh Digision Chrystered Duran	ing tab
The USAF Albanent Division Structural Dynam.	1CS Lan
	A01-30003
Actodynamic trials with the linear motor-dr	lven
plation at the Toulouse Aeronautic Testi:	ng Center
for alforait acceleration and deceleration	aticD
tests	
[AAAF PAFEE NT 80-41]	181-33943
GROUND-AIB-GROUND COMMUNICATIONS	
Potential effects of the introduction of the	e
discrete address beacon system data link (	OB
all/ground information transfer problems	
[NASA-CR-166165]	881-22037
[NASA-CE-166165] GUIDADCE (ROTION)	881-22037
[NASA-CR-166165] GOIDADCE (BOTION) Control, mavigation, and guidance of ai	881-22037 rcraft
[NSA-CR-166 165] GUIDANCE (BOTION) Control, mavigation, and guidance of ai [AIAA PAPER 61-0859]	881-22037 rcraft 881-32910
<ul> <li>GUIDATCE (MOTION)</li> <li>GUIDATCE (MOTION)</li> <li>Control, navigation, and guidance of ai (AIAA PAPEM 81-0859)</li> <li>GUIDATCE SENSORS</li> </ul>	881-22037 rcraft 881-32910
<ul> <li>GUIDANCE (BOTION)</li> <li>GUIDANCE (BOTION)</li> <li>CONTROL, NAVIGATION, and guidance of ai [AIAA PAPER 81-0859]</li> <li>GUIDANCE SEMSORS</li> <li>Orientation of measurement sensors for opti</li> </ul>	881-22037 rcraft A81-32910 BUM
<ul> <li>GUIDANCE (BOTION)</li> <li>GUIDANCE (BOTION)</li> <li>CONTROL, MAYIGATION, and guidance of ai [AIAA PAPER 61-0859]</li> <li>GUIDANCE SENSORS Orientation of measurement sensors for opti end-of-life performance</li> </ul>	881-22037 rcraft A81-32910 Bum
<ul> <li>GUIDANCE (MOTION)</li> <li>GUIDANCE (MOTION)</li> <li>GUIDANCE (MOTION)</li> <li>GUIDANCE (MOTION)</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for optiend~of-life performance</li> </ul>	N81-22037 rcraft A81-32910 mum A81-32697
<ul> <li>All/ground information transfer problems [NSA-CE-166165]</li> <li>GUIDANCE (MOTION)</li> <li>Control, navigation, and guidance of ai [AIAA PAPBE 81-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Aircraft body-axis rotation measurement sys</li> </ul>	881-22037 rcraft A81-32910 mum A81-32697 tem
<ul> <li>All/ground informatics transfer problems [NASA-CR-166165]</li> <li>GUIDANCE (MOTION)</li> <li>CONTROL, marigation, and guidance of ai [AIAA PAPER 61-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Alicraft body-axis rotation measurement sys [NASA-CASE-ERC-11043-1]</li> </ul>	N81-22037 rcraft A81-32910 mum A81-32697 tem K81-22048
<ul> <li>All/ground informatics transfer problems [NASA-CE-166165]</li> <li>GUIDANCE (MOTION)</li> <li>CONTROL, navigation, and guidance of ai [AIAA PAPEB 81-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS</li> </ul>	N81-22037 rcraft A81-32910 num A81-32697 tem N81-22048
<ul> <li>All/ground informatics transfer problems [NSA-CE-166165]</li> <li>GUIDANCE (MOTION)</li> <li>Control, navigation, and guidance of ai [AIAA PAPEB 81-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS Transonic flutter and gust-response tests a</li> </ul>	881-22037 rcraft A81-32910 mum A81-32697 tem 881-22048 nd
<ul> <li>All/ground informatics transfer problems [NASA-CR-166165]</li> <li>GUIDANCE (MOTION)</li> <li>CONTROL, marigation, and guidance of ai [AIAA PAPER 61-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Alicraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS</li> <li>Transonic flutter and gust-response tests a analyses of a wind-tunnel model of a tors</li> </ul>	881-22037 rcraft A81-32910 mum A81-32697 tem N81-22048 nd ion
<ul> <li>All/ground informatics transfer problems [NSA-CE-166165]</li> <li>GUIDANCE (MOTION)</li> <li>CONTROL, marigation, and guidance of ai [AIAA PAPEB 61-0659]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS</li> <li>Transonic flutter and gust-response tests a analyses of a wind-tunnel model of a tors free wind airclane</li> </ul>	881-22037 rcraft A81-32910 mum A81-32697 tem N81-22048 nd ion
<ul> <li>All/ground informatics transfer problems [N&amp;SA-CE-166165]</li> <li>GUIDANCE (MOTION)</li> <li>Control, navigation, and guidance of ai [AIAA PAPBE 81-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end-of-life performance</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS</li> <li>Transonic flutter and gust-response tests a analyses of a wind-tunnel model of a tors free wing airplane [NASA-TASE-FIG1]</li> </ul>	881-22037 rcraft A81-32910 mum A81-32697 tem 881-22048 nd ion N81-23072
<ul> <li>All/ground informatics transfer problems [NASA-CR-166165]</li> <li>GUIDANCE (MOTION)</li> <li>Control, marigation, and guidance of ai [AIAA PAPER 61-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS</li> <li>Transonic flutter and gust-response tests a analyses of a wind-tunnel model of a tors free wing airplane [NASA-TM-81961]</li> <li>GUROSTBLITZERS</li> </ul>	881-22037 rcraft A81-32910 aum A81-32697 tem 881-22048 nd ion 881-23072
<ul> <li>All/ground informatics transfer problems [NASA-CR-166165]</li> <li>GUIDANCE (MOTION)</li> <li>Control, navigation, and guidance of ai [AIAA PAPEB 61-0659]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end~of-life performance</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS</li> <li>Transonic flutter and gust-response tests a analyses of a wind-tunnel model of a tors free wing airplane [NASA-TM-81961]</li> <li>GUSTABLIEZEBS</li> <li>Aircraft body-axis rotation measurement sys</li> </ul>	881-22037 rcraft A81-32910 mum A81-32697 tem N81-22048 nd ion N81-23072 tem
<ul> <li>All/ground informatics transfer problems [NAS-CE-166165]</li> <li>GUIDANCE (MOTION)</li> <li>Control, navigation, and guidance of ai [AIAA PAPER 61-0859]</li> <li>GUIDANCE SENSORS</li> <li>Orientation of measurement sensors for opti end-of-life performance</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> <li>GUST LOADS</li> <li>Transonic flutter and gust-response tests a analyses of a wind-tunnel model of a tors free wing airplane [NASA-TM-81961]</li> <li>GYBOSTABLIIZERS</li> <li>Aircraft body-axis rotation measurement sys [NASA-CASE-FRC-11043-1]</li> </ul>	881-22037 rcraft A81-32910 mum A81-32697 tem N81-22048 nd ion N81-23072 tem N81-22048

Η

---

H-23 HELICOPTEE	
CH-53B combat survivability assessment and	
survivability enhancement program	
[SAWE PAPER 1384]	A81-31400
HANG GLIDERS	
The development of the secondary wing struc	tore
for a rigid wing hang glider sandwich	
structure techniques	
(B0-251)	N81-22046
HARMONIC OSCILLATION	
Influence of hinge line gar on aerodynamic	forces
acting on a harmonically occillating this	LOLCCO
profile in an incompressible flow T II	
profile in an incompressible fion. 1, if	101-10056
Monorphist of the consideration forecast acti-	A01-30330
heasurement of the derodynamic forces actin	ig on a
Balgonically oscillating wing at high sur	50810
speeds	104 24042
	A81-31042
HARRISS AIRCRAFT	<b>-</b>
Application of variable structure system th	eory to
alforaft flight control AV-EA and the	3
Augmentor Wing Jet STOL Besearch Aircraft	
[NASA-CB-164321]	881-23093
HEAD-UP DISPLAYS	
Punctional analysis and operational assesse	lent of
an onboard glide path guidance system for	: visual
approaches (visual approach monitor VAM)	
[BSA-II-655]	181-22038
BEAT BALANCE	
An analysis of thermal balance in the coole	ed cabin
of a Sea King Helicopter	
[AD-A097199]	N81-23077
BBAT PLUI	
Computation of wall temperature and heat fi	lux
distributions of the film cooled walls	
	A81-30802
HEAT GEBERATION	
Heat generation in aircraft tires under fre	e
rolling conditions	
[ BASA-CE-164273]	881-23461
HEAT BESISTANT ALLOYS	
Mechanical properties of aluminum coatings	OD
heat-resistant steels	

#### A81-31668

Thermal and flow analysis of a convection air-cooled ceramic coated porous metal concept for turbine vanes [ NASA-TH-81749 ] N81-22056 A comparison of laboratory measured temperatures with predictions for a spar/skin type aircraft structure [ BASA-TH-81359] 881-23067 HEAT TRANSPER CORPFICIENTS Computation of wall temperature and heat flux distributions of the film cooled walls A81-30802 BELICOPTEB CONTROL Use of multiblade sensors for on-line rotor tip-path plane estimation A81-32010 BELICOPTEE DESIGN Belicopter rotor blade effects on mast-mounted sensor images A81-31114 CH-53E combat survivability assessment and survivability enhancement program [SAWE FAPEE 1384] A81-31400 Design and testing of float landing gear systems for belicopters A81-32007 The bearingless main rotor 181-32008 Reduction of helicopter vibration through control of hub-impedance A81-32009 Drive system technology advancements ---transmissions for CB-47D helicopter 181-32015 Helicopter wibratics control - A survey A81-33047 Improvement of the energy efficiency of helicopters [AAAF PAPER NT 80-33] A81-3393. BELICOPTER ENGINES A81-33933 Broadband helicopter rotor noise [AAAF FAPBE WT 80-58] A81 Comparison of predicted engine core noise with proposed PAA helicopter noise certification A81-33949 requirements [NASA-TH-81739] 881-22839 BELICOPTEE PEEFORMANCE Crashworthiness versus cost based on a study of severe Army helicopter accidents during 1970 and 1971 A81-32006 The tearingless main rotor AE1-32008 Fluid mechanics mechanisms in the stall process of airfoils for helicopters A81-32779 Acoustic performance evaluation of an advanced UB-1 helicopter main rotor system [AHS PAPES 81-58] A81-33952 Sea Ring mathematical model validation trials. Flight data channel calibration [AD-A096587] 881-22043 BELICOPTEE PROPELLER DEIVE Drive system technology advancements ---transmissions for CB-47D helicopter A81-32015 Measuring dynamic stresses on helicopter transmission gear teeth utilizing telemetry AE1-32859 BELICOPTEES Pressure distribution computation on a non-lifting symmetrical helicopter blade in forward flight A81-33291 Propeller and wing --- Bussian book A81-33696 Rinematic properties of the helicopter in coordinated turns [BASA-TP-1773] N81-22039 Component research for future propulsion systems 881-22055 [NASA-18-82613] Structures and Materials Panel [AD-A089019] 881-22420 An analysis of thermal balance in the cooled cabin

BEAT TRANSPER

An analysis of the mail balance in the cooled Cable of a Sea King Helicopter [AD-A097199] 881-23077 A study of the effect of terrain on helicopter

A study of the effect of tertain on helicopter noise propagation by acoustical modeling [AD-A097626] BE1-23864

#### HIGH PREQUENCIES.

SUBJECT INDEX

HIGH PEEQUENCIES High frequency angular vibration measurements in vehicles. TAAS PAPER 81-024] A81-32886 BIGH PBBSSOBB Investigation of air solubility in jet A fuel at bigb pressures [NASA-CB-3422] N81-22130 HIGH TEMPERATURE ENVIRONMENTS High temperature electronic requirements in aeropropulsion systems A81-32547 Procedure for pressure contact on high-power semiconductor devices free of thermal fatigue [NASA-TH-75733] NA1-22054 RISTORIES 
 ITOBLES

 Buropean approaches to transport aircraft design

 Cartan paper Al-09261

 A81-32934
 The art of designing experimental aircraft - Ap overview [AIAA PAPER 81-0944] A81-32939 The rise of air and space A81-33718 HOLOGRAPHIC INTERPREDETRY Application of holography to the study of helicopter rotor flow fields [NASA-CR-164293] N81-23433 HONTHE DEVICES Autonomous target handoff from an airborne sensor to a missile seeker 381-32498 HOT PRESSIEG The rejuvenation of properties in turbine engine hot section components by hot isostatic pressing [AD-A097551] N81-23088 HOVERING Application of variable structure system theory to aircraft flight control --- AV-8A and the Augmentor Wing Jet STOL Research Aircraft [NASA-CR-164321] N81-23093 HUBS Reduction of helicopter vibration through control of hub-impedance A81-32009 Preliminary design study of advanced composite blade and hut and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Include the studies [NASA-CB-152336-1] B81-2 Preliminary design study of advanced composite blade and hub and nonmechanical control system 881-23064 for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CR-152336-2] N81-23065 HOLLS (STRUCTORES) Air Force Geophysics Laboratory aerodynamically tethered ballcon, 45,000 cubic feet [AD-A096758] N81-22023 HUMAN PACTORS BEGINBERING Flight evaluation of the concept of the stage A Peripheral Vision Borizon Device (PVHD) using the CH 135 aircraft of 403 Squadron - CFB Gagetown [AD-A096870] N81-22050 HUMAN BBACTIONS The annoyance caused by airplane noise in the vicinity of Orly Airport and the reaction of neighboring residents [NASA-TM-76575] N81-225 An airport community noise-impact assessment mcdel [NASA-TM-80198] N81-237 N81-22590 N81-23713 HYBRID COMPUTERS A digital-analog bybrid system and its application to the automatic flight control system simulation research [NASA-TM-76457] N81-22060 Processing of AIDS flight recorder data for a guick look with the aid cf a hybrid computer system N81-23023 HYDRODYNAMICS Hydrodynamic modelling of the starting process in liquid-propellant engines A81-31287 HYPERSONIC VEHICLES A comparison of laboratory measured temperatures with predictions for a spar/skin type aircraft structure [NASA-TH-813591 N81-23067

## 1

ICE FORMATION Rotorcraft aviation icing research requirements: Research review and recommendations [NASA-CE-165344] ICE PREVENTION N81-23070 Connercial aviation icing research requirements [NASA-CE-165336] N81-23069 Rotorcraft aviation icing research requirements: Besearch review and recommendations [NASA-CB-165344] N81-23070 IPP SYSTEMS (IDBETIFICATION) A new generation IFF - The AN/APX-100/V/ transponder A81-31132 New technology applied to an IPP diversity transponder A81-31133 IMAGE BOTION COMPENSATION Moving target identification /MTI/ algorithm for passive sensors A81-32502 THACK PROCESSING Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles A81-32491 Analysis, design and simulation of line scan aerial surveillance systems A81-32492 Autonomous target handoff from an airborne sensor to a missile seeker A81-32498 Advanced target tracking by dynamic scene analysis A81-32499 Mowing target identification /MTI/ algorithm for passive sensors 481-32502 INAGING TRCHNIODES Improvement of the imaging of moving acoustic sources by the knowledge of their motion [ONERA, TP NO. 1981-17] A81-32534 INPACT DAMAGE Concepts for improving the damage tolerance cf composite compression ganels 181-32825 INPACT RESISTANCE Concepts for improving the damage tolerance of composite compression panels A81-32825 INPACT TESTING MACHINES Designing for aircraft structural crashworthiness [AIAA PAPER 81-0803] A81-33 .IMPACT TESTS 181-33582 Concepts for improving the damage tolerance of composite compression ganels A81-32825 IN-FLIGHT MCDITORING Modern techniques of conducting a flight loads survey based on experience gained on the Black Hawk belicopter A81-32014 In-flight fatigue crack monitoring using acoustic emission A81-32857 Some design and procedural aspects of in-flight collision avoidance [AITA FAPBB 81-0805] A81 Sea King mathematical model validation trials. Plight data channel calibration A81-33885 [AD-A096587] N81-22043 Contributions to the 9th Symposium on aircraft integrated data systems --- Conferences [ ESA-11-532] N81-23008 Experiences with a Flight Data Recording System (FDRS) in a German Airforce fighter homber wing after field trials --- digital equipment 881-23009 Engine parameter trend analysis with LEADS 200: Possibilities and limitations --- using flight recorder data N81-23010 Investigations into local fault detection on turbojet engines --- monitoring instruments N81-23011 The engine usage monitoring system: An heuristic approach to cost effective data monitoring and analysis --- onboard fatigue monitoring N81-23013

A-20

## SUBJECT INDEX

~

## KEVLAR (TRADEBARK)

Relationships for a flight performance comp	uter
Classification of operating conditions of	N81-23014
turbomachines from sclid borne sound	
	N81-23015
The SYDAS flight data processing system	N01-22010
The use of aircraft integrated data system	at KLM
performance monitoring	
	N81-23019
Detection and location of faults in onboard	natic
Pault Identification System (APIS)	Macic
······································	N81-23022
Structural Integrity Recording System (SIR)	for
U.S. ALBY AN-IG HELLCOPLELS	N81-23438
INCIDENCE	
Analysis of total and static pressure fluct	uations
IN AD AIT INTAKE AT HIGH INCIDENCE TAAAP FAPRE NY 80-613	A81-33950
INCOMPRESSIELE FLOW	
Influence of hinge line gap on aerodynamic	forces
acting on a harmonically oscillating thin profile in an incompressible flow. I. II	
profine in an incompressible fion. 1, if	A81-30956
New interpretations in the theory of viscou	s
incompressible fluid flow past airfoil pr	cfiles
Mean-flow and turbulence measurements in th	801-31044 e
vicinity of the trailing edge of an NACA	(63 sub
1)-012 airfoil	
[NASA-TP-1845] TURDATAL HINTCLATON	N81-23410
Technology growth in mini-BPV systems	
[AIAA PAPBE 81-0936]	A81-32937
INFORMATION SYSTEMS Reights information systems using minicompu	tors
[SAWE PAPER 1347]	A81-31385
INPRABED INAGERY	
Helicopter rotor blade effects on mast-moun sensor images	ted
Sensor Istges	A81-31114
Moving target identification /MTI/ algorith	n fcr
passive sensors	
	181-32502
INPRABED SCANNERS	A81-32502
INPRABBD SCANNERS Applications of new technology in the infra	A81-32502
INPRANED SCANNERS Applications of new technology in the infra Porward-looking infrared (PLIR/ sensor for	A81-32502 red A81-31126
IMPRANED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autonomous wehicles	A81-32502 red A81-31126
INPRANED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autonomous vehicles	A81-32502 red A81-31126 A81-32490
INPRANED SCANNERS Applications of new technology in the infra Porward-looking infrared /FLIE/ sensor for autchnonous vehicles INPOT INPES Oser's quide pultistep input design w	A81-32502 red A81-31126 A81-32490
INPRARED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autonomous vehicles INPOT INDES Oser's guide multistep input design w nonlinear rotorcraft modeling	A81-32502 red A81-31126 A81-32490 ith
<pre>IMPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autonomous vehicles IMPOT IMPDT IMPDS Oser's guide multistep input design w nonlinear rotorcraft wodeling [NASA-CE-159085]</pre>	A81-32502 red A81-31126 A81-32490 tith N81-22726
<pre>INPEARED SCANNERS Applications of new technology in the infra Porward-looking infrared /FLIE/ sensor for autonomous vehicles INPOT INDES Oser's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTROMENT APPROACE Increasing connects at Paris airports</pre>	A81-32502 red A81-31126 A81-32490 fith N81-22726
<pre>IMPRABED SCAMBERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft wodeling [NASA-CE-159085] IMSTRUMENT APPROACH Increasing capacity at Paris airports [AIAF PAPER 81-0802]</pre>	A81-32502 red A61-31126 A81-32490 A1th N81-22726 A81-33890
<pre>IMPRABED SCAMBERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous vehicles IMPOT INDES Oser's guide multistep input design w nonlinear rotorcraft wodeling [NASA-CE-159085] INSTRUMENT APPROACE Increasing capacity at Paris airports [AIAF PAPER 81-0802] INSTRUMENT EBROES</pre>	A81-32502 red A61-31126 A81-32490 Vith N81-22726 A81-33890
<pre>IMPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES Oser's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at Paris airports [AIAM PAPER 81-0802] INSTRUMENT ENRORS Measurement of aircraft speed and altitude</pre>	A81-32502 red A81-31126 A81-32490 with N81-22726 A81-33890 Book A81-32401
INPRARED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous vehicles INPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling (NASA-CE-159085) INSTRUMENT APPROACE Increasing capacity at faris airports [AIAM PAPEB 81-0802] INSTRUMENT ENROPS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter	A81-32502 red A81-31126 A81-32490 ith N81-22726 A&1-33890 Book A&1-32401
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPUT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at faris airports [AIAM PAPER 81-0602] INSTRUMENT EMPROBS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter</pre>	A81-32502 red A81-31126 A81-32490 ith N81-22726 A61-33890 Book A81-32401 A81-32694
<pre>IMPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTBOMBET APPROACE Increasing capacity at Paris airports [AIAM PAPER 81-0802] INSTBUMBET APPER 81-0802] INSTBUMBET BEBOES Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti capacity is participation</pre>	A81-32502 red A81-31126 A81-32490 itb N81-22726 A81-33890 Book A81-32401 A81-32694 mum
<pre>IMPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at Paris airports [AIAM PAPER 81-0802] INSTRUMENT BERORS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance</pre>	A81-32502 red A81-31126 A81-32490 with N81-22726 A81-33890 Book A81-32401 A81-32694 mum A81-32697
<pre>IMPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autchomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at Faris airports [AIAM PAPER 81-0802] INSTRUMENT BEROBS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land nawigator</pre>	A81-32502 red A81-31126 A81-32490 with N81-22726 A81-33890 Book A81-32401 A81-32694 mum A81-32697 N01-22726
<pre>IMPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autonomous vehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft wodeling [NASA-CE-159085] INSTRUMENT APPR0ACH Increasing capacity at Paris airports [AIAM PAPER 81-0602] INSTRUMENT BEROBS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land nawigator INSTRUMENT LANDING SYSTEMS</pre>	A81-32502 red A81-31126 A81-32490 hith N81-22726 A61-33890 Book A81-32401 A81-32694 mum A81-32697 A61-32833
<ul> <li>IHPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /FLIE/ sensor for autcnomous wehicles</li> <li>IHPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085]</li> <li>INSTRUMENT APPROACH Increasing capacity at Paris airports [AIAF PAPER 81-0802]</li> <li>INSTRUMENT BERORS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator</li> <li>INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora</li> </ul>	A81-32502 red A81-31126 A81-32490 A81-22726 A61-33890 Book A81-32401 A81-32694 mum A81-32697 A61-32833 ry
<pre>IMPRABED SCAMBERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft wodeling [NSA-CE-159085] INSTRUMENT APPROACE Increasing capacity at Paris airports [AIAF PAPER 61-0602] INSTRUMENT APPROACE Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTENS Application of endfire arrays at contempora glide-slope problem sites</pre>	A81-32502 red A81-31126 A81-32490 ith N81-22726 A61-33890 Book A81-32401 A81-32694 mum A81-32697 A81-32695
<pre>IMPRABED SCANDERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES Oser's guide multistep input design w nonlinear rotorcraft wodeling [NASA-CE-159085] INSTRUMENT APPROACE Increasing capacity at Paris airports [AIAF PAPER 81-0802] INSTRUMENT APPROACE Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SYSTEMS Application of endire arrays at contempora glide-slope problem sites Increasing capacity at Paris airports</pre>	A81-32502 red A81-31126 A81-32490 with N81-22726 A&1-33890 Book A&1-32401 A&1-32694 mum A&1-32697 A&1-32833 ry A&1-32695
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES Oser's guide multistep input design w nonlinear rotorcraft wodeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at Paris airports [AIAF PAPER 81-0802] INSTRUMENT APPROACH Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTEMS Application of endire arrays at contempora glide-slope problem sites Increasing capacity at Paris airports [AIAF PAPER 61-0802]</pre>	A81-32502 red A81-31126 A81-32490 rith N81-22726 A&1-33890 Book A&1-32401 A&1-32694 mum A&1-32697 A&1-32833 ry A&1-32695 A&1-32695 A&1-32695
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at Paris airports [AIAM PAPEN 81-0802] INSTRUMENT ENDEDS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at Paris airports [AIAM FAPEN 81-0802] INTENDEDGATION ANGRESSION</pre>	A81-32502 red A81-31126 A81-32490 iith N81-22726 A&1-33890 Book A81-32401 A&1-32694 mum A&1-32697 A&1-32833 ry A&1-32695 A&1-32695 A&1-33890
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at Paris airports [AIAM PAPEN 81-0802] INSTRUMENT ENRORS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at Paris airports [AIAM FAPEN 81-0802] INTENDOGATION ANJTY-54 interrogator</pre>	A81-32502 red A81-31126 A81-32490 ith N81-22726 A&1-33890 Book A&1-32401 A&1-32694 mum A&1-32697 A&1-32833 ry A&1-32695 A&1-32695 A&1-33890 A&1-33890 A&1-3131
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at faris airports [AIAM PAPEB 81-0802] INSTRUMENT ANDERS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land nawigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at faris airports [AIAM FAPEB 81-0802] INTERMOGATION ANJTY-54 interrogator INVENTORY ANDERSENT</pre>	A81-32502 red A81-31126 A81-32490 ith N81-22726 A&1-33890 Book A&1-32401 A&1-32694 mum A&1-32697 A&1-32833 ry A&1-32695 A&1-32890 A&1-33890 A&1-31131
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at faris airports [AIAM PAPEB 81-0802] INSTRUMENT ANDERS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land nawigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at faris airports [AIAM FAPEB 61-0602] INTEDMENT LANDING SISTEMS Application A MICROFICE APPED 61-0602] INTEBMOGATION AN/TPI-54 interrogator</pre>	A81-32502 red A81-31126 A81-32490 itb N81-22726 A£1-33890 Book A81-32401 A81-32694 mum A81-32697 A&1-32833 ry A&1-32695 A&1-32890 A&1-33890 A&1-31131 B&1-22974
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at faris airports [AIAM PAPEB 81-0602] INSTRUMENT APPROBS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at faris airports [AIAM FAPEB 61-0602] INTENDGATION ANJTY-54 interrogator INVENTORY MANGEMENT Aircraft modification management evaluation [AD-A096456] INOM ISOTOPES</pre>	A81-32502 red A81-31126 A81-32490 ith N81-22726 A61-33890 Book A81-32401 A81-32694 mum A81-32697 A61-32833 ry A81-32695 A61-32833 ry A81-32695 A61-33890 A61-31131 B61-22974
<pre>IMPRAMED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at faris airpoits [AIAM PAPEB 81-0602] INSTRUMENT APPROBS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at faris airpoits [AIAM FAPEB 81-0802] INTEDMENT LANDING SISTEMS Application May Problem sites Increasing capacity at faris airpoits [AIAM FAPEB 81-0802] INTENGATION AN/TRI-54 interrogator INVENTORY MANAGEMENT Aircraft modification management evaluation [AD-A096458] IROM ISOTOPES Bearing wear detection using radioactive ir states.</pre>	A81-32502         red         A81-31126         A81-32490         ith         N81-22726         A£1-33890         Book         A81-32401         A81-32694         mum         A81-32697         A61-32833         ry         A81-32695         A81-33890         A81-32695         A81-31131         W81-22974         con-55
<pre>IMPRABED SCAMBERS Applications of new technology in the infra Porward-looking infrared /FLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPROACH Increasing capacity at Paris airports [AIAF PAPER 81-0802] INSTRUMENT BERORS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at Paris airports [AIAF APPES 61-0802] INTERMOGATION AB/TPI-54 interrogator INVENTORI MANAGEMENT Aircraft modification management evaluation [AD-A096458] IROM ISOTOPES Bearing wear detection using radioactive in tagging [ALE PEPEINT 81-AM-6A-3]</pre>	A81-32502 red A81-31126 A81-32490 itb N81-22726 A£1-33890 Book A61-32401 A81-32694 mum A81-32697 A81-32697 A81-32833 ry A81-32695 A£1-33890 A81-31131 N81-22974 con-55 A81-33868
<pre>IHPRABED SCANNERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IHPOT INDES User's guide multistep input design w nonlinear rotorcraft modeling [NASA-CE-159085] INSTRUMENT APPBOACH Increasing capacity at Paris airports [AIAF PAPER 61-0802] INSTRUMENT BEROBS Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTENS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at Paris airports [AIAF APER 61-0802] INTENGENTION AN/TPI-54 interrogator INVENTORY BANGEMENT Aircraft modification management evaluation [AD-A096458] IROM ISOTOPES Bearing wear detection using radioactive in tagging [ALE PEPEINT 81-AM-6A-3] ISOSTATIC PRESSORE</pre>	A81-32502 red A81-31126 A81-32490 with N81-22726 A£1-33890 Book A81-32401 A81-32694 mum A81-32697 A81-32697 A81-32833 ry A81-32695 A81-33890 A81-31131 N81-22974 con-55 A81-33868
<pre>IMPRABED SCAMBERS Applications of new technology in the infra Porward-looking infrared /PLIE/ sensor for autcnomous wehicles IMPOT INDES User's guide multistep input design w nonlinear rotorcraft wodeling [NASA-CE-159085] INSTRUMENT APPROACE Increasing capacity at Paris airports [AIAF PAPER 61-0602] INSTRUMENT BEROES Measurement of aircraft speed and altitude Accuracy of noise-modulated radio altimeter Orientation of measurement sensors for opti end-of-life performance A microprocessor based land navigator INSTRUMENT LANDING SISTEMS Application of endfire arrays at contempora glide-slope problem sites Increasing capacity at Paris airports [AIAF APER 61-0602] INTENMOGATION ANJTRI-54 interrogator INVENTORY MANAGEMENT Aircraft modification management evaluation [AD-A096458] INOM ISOTOPES Bearing wear detection using radioactive in tagging [ASLE PREPENT 81-AM-6A-3] ISOSTATIC PRESSURE The rejuvenation of properties in turbine e but section comments by bot iscretation</pre>	A81-32502         red         A81-31126         A81-32490         rith         N81-22726         A&1-33890         Book         A81-32401         A81-32694         NUM         A81-32697         A81-32697         A81-32695         A81-32695         A81-32695         A81-32695         A81-32695         A81-32695         A81-32695         A81-32695         A81-33890         A81-31131         B81-22974         con-55         A81-33868         ingipe         ressing

ISOTOPIC LABBLING Bearing wear detection using radioactive in	on-55
tagging	
[ASLE PREPRINT 81-AM-6A-3]	A81-33868
J	
J-65 BNGINB	
Location of faults in jet engines by calcul	ation
of component characteristics	
JRT ATROPART	N81-23012
Jet aircraft design	
[AIAA PAPEB 81-0912]	A81-32930
Energy modeling for aviation fuel efficienc	
JET AIBCEAPT HOISE	201 33003
Installation effects on propeller noise	
[AIAA FAPEE 80-0993] Noise characteristics of two parallel jets	A81-31369
unequal flow	with .
[AIAA PAPER 80-0168]	A61-31601
Contribution to the study of non stationary signals emitted by moving jet engine -	,
Application to special analysis and imagi	ng. I.
	<b>▲</b> 81-33288
Contribution to the study of non-stationary	
Application to spectral analysis and imag	ing. II
	A81-33294
The role of coherent structures in the gene	ration .
[NASA-CR-164214]	N81-22833
JET BEGIEB FOELS	
Future C.S. jet fuels - A refiner's viewpoi	.Dt 181-33876
Investigation of air solubility in jet A fu	el at
bigh pressures	
[NASA-CR-3422]	881-22130
Fuel/engine/airframe trade off study	
[AD-A097391]	881-23073
JET FLOW Nethod for predicting the int-induced sered	VDanice
of V/STOL configurations in transition	Juanca
[AD-A097356]	NE1-23043
JET BOZZLES	u i t h
unequal flow	
[AIAA PAPER 80-0168]	A81-31601
JET PROPULSION	cimil
and military applications	
	A81-32521
JET TEBUST Experimental investigation of oscillating s	utsonic
jets	
10 4 104 1007	A81-32777
JET JET FUEL Fuel/engine/airframe/trade_off_study	
[AD-A097391]	N81-23073
JP-8 JBT FOBL	
ruer/engine/airirame trade orr study [AD-A097391]	N81-23073
K	

DALDAD FILIDAD	
Dynamic errors of the Kalman filtering of	
trajectory parameters for radar track	ing of
aircraft maneuvers	
	A81-33687
DEEFIS user's guide: Discrete Extended Kal	aan
Filter/Smoother program for aircraft and	
rotorcraft data consistency	
[NASA-CB-159081]	881-22722
The reconstruction of flight paths from AID	)S data
with the aid of modern filtering methods	
kalman filters	
	881-23021
KBROSENE .	
Future U.S. jet fuels - A refiner's viewpoi	.nt .
[AIAA PAPEE 81-0770]	A81-33876
KEVLAB (TBADBHABK)	
Air Force Geophysics Laboratory aerodynamic	ally
tethered ballcon, 45,000 cubic feet	-
[AD-A096758]	881-22023
• •	

**∆**-21

KIBBBATIC BQUATIONS Kinematic properties of the helicopter in coordinated turns [NASA-TP-1773] N81-22039 Ĺ LAMINAB BOUNDARY LAYEE Oscillatory flows from shock induced separations cn biconver aerofoils of varying thickness in ventilated wind tunnels N81-23056 LANIBAR PLOW Transonic viscous-inviscid interaction over airfoils for separated laminar or turbulent flows 181-31612 A6 Topology of three-dimensional separated flows [NASA-TH-81294] NA: N81-23037 LANINATES Bonded laminated structures in aircraft manufacture -- Russian book 181-33700 LANDING AIDS Antenna design and development for the microwave subsystem experiments for the terminal configured vehicle project [NASA-CR-164220] N81-22 LANDING GBAR N81-22282 Test procedures used in determining aircraft suitability for STAN integral weight and balance system [SANE PAPER 1339] A81-31379 Design and testing of float landing gear systems for helicopters A81-32007 Crashworthiness design parameter sensitivity analysis [AD-1096550] N81-22041 LANDING LOADS operational responses to aft empty C.G. --- Center of Gravity location in Boeing 727-200 aircraft [SANE PAPER 1338] A81-31378 LANDING SITES Application of endfire arrays at contemporary glide-slope problem sites A81-32695 LARGE SCALE INTEGRATION A review of current and future components for electronic warfare receivers A81-32252 LASER APPLICATIONS Laser beacon collision avoidance systems N81-22009 LASER DOPPLER VELOCIMETERS Adaptive-wall wind-tunnel development for transonic testing A81-31367 Laser Doppler airspeed and altitude sensor [AD-A096980] LASEB TABGET DESIGNATORS N81-22049 A high performance TV camera for use in target acquisition and laser designator systems A81-31115 LEADIEG EDGE FLAPS Bffectiveness of leading-edge vortex flaps on 60 and 75 degree delta wings A81-31368 LEADING BDGBS Role of laminar separation bubbles in airfoil leading-edge stalls A81-31613 Leading-edge separation from a thick, conical slender wing at small angles of incidence A81-31687 LIFE CYCLE COSTS Implementing Aircraft Structural Life Management to reduce structural cost of ownership
[SAWE PAPER 1331]
The Modular Life Cycle Cost Model for advanced
aircraft systems - An overview
[SAWE PAPER 1351]
Digital Avionics Information System (DAIS). A81-31376 A81-31386 Volume 1: Impact of DAIS concept on life cycle cost [AD-A097339] N81-23083 Digital Avionics Informaticn System (DAIS). Volume 2: Impact of DAIS concept on life cycle cost. Supplement [AD-A097438] 881-230 N81-23084

SUBJECT INDEX

LIFT
Wing-body carryover at supersonic speeds with
Quiet propulsive-lift technology ready for civil
and military applications A01-32521
energetics and optimum motion of
[NASA-CB-165679] N81-23035
An asymptotic unsteady lifting-line theory with energetics and optimum motion of
thrust-producing lifting surfaces [NASA-CB-165679] N81-23035
LIFT DIAG HATLO The optimal lift-drag ratio of a civil aircraft [AAAP PAPER NT 80-35] A&1-33923
LIFT FANS A design analysis technique for evaluating size
and weight of V/STOL lift fans [SAWE PAPER 1386] A81-31402
LIPTING BODIES A theoretical treatment of lifting surface theory
of an elliptic wing A81-30653
Equilibrium spinning of a typical single-engine
LOW-Wing light aircraft A81-31598
Design of low powered aircraft, a philosophy for future personal sport aircraft
[AIAA FAPES 81-0905] A81-32926 Approvance caused by light aircraft poise
[NASA-TH-76533] B81-22589
SCI Identification (SCIDNT) program user's guide maximum likelihood method for linear
rotorcraft models [NASA-CB-159082] N81-22723 LIONTD CRYSPALS
Investigation of the use of liquid crystal thermography to study flow over turbomachinery
blades [BE-A097289] B81-23089
LIQUID PROPELLAST BOCKET ENGINES
liquid-propellant engines
LOAD TESTS
Modern techniques of conducting a flight loads
Bawk belicopter
LOADING MOMBHIS
Structural flight loads simulation capability, volume 1
[AD-A096572] N81-22044 Structure] flight loads cimulation capability
Volume 2: Structural analysis computer program
[AC-A096594] BE1-22045
IOGISTICS Weapons system support resources demand parameters
- logistics [AD-A097517] #61-23937
LOGISTICS HABAGBABBT Aircraft modification management evaluation
[AD-A096458] P-16 integrated logistics support: Still time tc
consider economical alternatives
NAVAIE Avionics Master Plan [AD-A097522] N81-23082
NAVAIB Avionics Master Plan [AC-A097522] N81-23082 Development of maintenance METBICS to forecast resource demands of weapon systems (parameter
NAVAIR Avionics Haster Plan [AC-A097522] N81-23082 Development of maintenance METRICS to forecast resource demands of weapon systems (parameter polarization), revision A [AD-A097692] N81-23325
[PB01=13/47]3       B01=23073         NAVAIR Avionics Haster Plan       881-23082         [AL-A097522]       881-23082         Development of maintenance METRICS to forecast       resource demands of weapon systems (parameter polarization), revision A         [AD-A097692]       N81-23325         IORAM C       Use of Loran-C for general aviation aircraft navigation
<pre>NAVAIR Avionics Haster Plan [AC-A097522] N81-23082 Development of maintenance METBICS to forecast resource demands of weapon systems (parameter polarization), revision A [AD-A097692] N81-23325 LORAN C Use of Loran-C for general aviation aircraft navigation N81-22002 An analysis of the adaptability of Loran-C tc air</pre>

## **BICROMINIATURIZATION**

A61-31132

Results of a Loran-C flight test using an a	bsolute
data reference whf monirance pawigati	on
cuctor and discrete address become cuctor	
system and discrete address beacon system	
	881-22006
Microcomputer processing for Loran-C	
	N81-22007
LOW ASPECT RATIO	
Coriolis effect on the wibration of flat ro	ntating
low aspect ratio captilever plates	, cuciny
iow aspect facto cantilevel places	
	A81-30914
LOW COST	
Design concepts for low-cost composite turk	ofan
engine frame	
[NASA-CB-165217]	N81-22053
LON PEROBERCIES	
Invefrequency radio navigation system	
funct-cach upo 15060 11	104 22026
[BASA-CASE-BPO-15204-1]	801-22030
LOW SFEED STABILITY	
Concerning Khristianovich's transformation	ofa
subsonic flow past an airfoil into a low-	speed
flow	-
	A81-31045
LON STRE ATREBART	
Revisive company of a typical cinclosed	aina
Equilibrium spinning of a typical single-er	igine
low-wing light allorait	
	¥81-31598
LUBRICATING OILS	
X-ray fluorescence spectrometric analysis of	of wear
metals in used lubricating oils	
[AD-A097552]	N81-23087
fas seriest	201 20001
<b>.</b> ' <b>.</b>	
M	
NITUGDULUCD ODITUTUC	
BALBIBABLA IBALBADA	

Aircraft modification management evaluation	0
[AD-A096458]	N81-22974
MAN MACHINE SYSTEMS	
A micronrocessor based land namigator	
a arcroprocessor based table havigator	481-12833
Which and making of the support of the st	A01-J20JJ
Flight evaluation of the concept of the sta	age A
Peripheral Vision Borizon Device (PVHD)	using
the CB 135 aircraft of 403 Squadron - CB	B Gagetown
[AD-A096870]	N81-22050
Application of computer colour raster disp.	lays in
the cockpit in research flight simulation	o -
[AD-A096542]	N81-22063
NANAGRARAT ARTHODS	
lircraft modification management evaluation	n
Cip_sAGE/EG3	N01_2207#
	861-22574
CARAGEOEST PLANSING	
BAVAIB Avionics Master Plan	
[AD-A097522]	N81-23082
MABUPACTOBIBG	
Increasing the strength properties of sheet	t parts
by explosive forming of them with optimiz	zaticn
of the production parameters	
or the production parameters	101-23174
NUDICTES (2017)	701-22114
HARAGING STRELS	
Tensile stress/strain characterization of	
pon-linear materials	
	A81-30915
MASS BALANCE	A81-30915
MASS BALANCE The 'light-weight' system - A novel concep	A81-30915
MASS BALANCB The 'light-weight' system A novel concep on-board weight and balance measurement	A81-30915 t for nsing
MASS BALANCB The 'light-weight' system A novel concep on-board weight and balance measurement ( fiber ontics	A81-30915 t for using
MASS BALANCE The 'light-weight' system A novel concep on-board weight and balance measurement   fiber optics (SAUP DADED 1336)	A81-30915 t for using A81-31377
HASS BALANCE The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE PAPEE 1336] The backdown and in determining circles	A81-30915 t for using A81-31377
MASS BALANCE The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE PAPER 1336] Test procedures used in determining aircra.	A81-30915 t for using A81-31377 ft
MASS BALANCE The 'light-weight' system A novel concep on-board weight and balance measurement fiber optics [SAWE PAPER 1336] Test procedures used in determining aircra suitability for STAN integral weight and	A81-30915 t for using A81-31377 ft balance
HASS BALANCE The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE PAPER 1336] Test procedures used in determining aircra suitability for STAN integral weight and system	A81-30915 t for using A81-31377 ft balance
<pre>HASS BALANCE The 'light-weight' system A novel concep on-board weight and balance measurement {     fiber optics     [SABE PAPEB 1336] Test procedures used in determining aircra:     suitability for STAN integral weight and     system     [SABE PAPEB 1339]</pre>	A81-30915 t for using A81-31377 ft balance A81-31379
MASS BALANCE The 'light-weight' system A novel concep on-board weight and balance measurement fiber optics [SABE PAPER 1336] Test procedures used in determining aircra suitability for STAN integral weight and system [SAWE PAPER 1339] Development and testing of a new technolog	A81-30915 t for using A81-31377 ft balance A81-31379 y weight
MASS BALANCE The 'light-weight' system - A novel concep- on-board weight and balance measurement of fiber optics [SAWE PAPER 1336] Test procedures used in determining aircra: suitability for STAN integral weight and system [SAWE PAPEE 1339] Develogment and testing of a new technolog and balance indicator	A81-30915 t for nsing A81-31377 ft balance A81-31379 y weight
HASS BALANCE The 'light-weight' system A novel concep- on-board weight and balance measurement i fiber optics [SAWE PAPEE 1336] Test procedures used in determining aircra: suitability for STAN integral weight and system [SAWE PAPEE 1339] Development and testing of a new technolog; and balance indicator [SAWE PAPEE 131]	A61-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381
MASS BALANCE The 'light-weight' system A novel concep- on-board weight and balance measurement i fiber optics [SABE PAPER 1336] Test procedures used in determining aircra: suitability for STAN integral weight and system [SAWE PAPER 1339] Development and testing of a new technolog; and balance indicator [SAWE PAPER 1341] MATRANATICAL MORES	A81-30915 t for using A81-31377 ft balance A81-31379 y veight A81-31381
<pre>MASS BALANCE The 'light-weight' system - A novel concep on-board weight and balance measurement i fiber optics [SAWE PAPER 1336] Test procedures used in determining aircra: suitability for STAN integral weight and system [SAWE PAPER 1339] Development and testing of a new technolog and balance indicator [SAWE PAPER 1341] HATHEMATICAL MODELS #sthematical medel of the linear unstandy</pre>	A81-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381
<pre>HASS BALANCE The 'light-weight' system A novel concep on-board weight and balance measurement i fiber optics (SAWE PAPEE 1336) Test procedures used in determining aircra: suitability for STAN integral weight and system (SAWE PAPEE 1339) Development and testing of a new technolog and balance indicator [SAWE PAPEE 1341] HATHERATICAL MODELS Hathematical model of the linear unsteady</pre>	A81-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381
<pre>MASS BALANCE The 'light-weight' system - A novel concep on-board weight and balance measurement fiber optics [SAWE PAPER 1336] Test procedures used in determining aircra: suitability for STAN integral weight and system [SAWE PAPER 1339] Develogment and testing of a new technolog and balance indicator [SAWE PAPER 1341] HATMENATICAL MODELS Mathematical model of the linear unsteady aerodynamics of the entire aircraft</pre>	A61-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381
<pre>MASS BALANCE The 'light-weight' system A novel concep on-board weight and balance measurement i fiber optics [SAWE PAPEN 1336] Test procedures used in determining aircra: suitability for STAN integral weight and system [SAWE PAPEN 1339] Development and testing of a new technolog, and balance indicator [SAWE PAPEN 1341] MATHEMATICAL MODELS Hathematical model of the linear unsteady aerodynamics of the entire aircraft</pre>	A81-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381 A81-31039
<ul> <li>HASS BALANCE</li> <li>The 'light-weight' system - A novel concepon-board weight and balance measurement fiber optics (SAWE PAPER 1336)</li> <li>Test procedures used in determining aircrament is suitability for STAN integral weight and system (SAWE PAPER 1339)</li> <li>Development and testing of a new technolog and balance indicator (SAWE PAPER 1341)</li> <li>HATHEMATICAL MODELS</li> <li>Mathematical model of the linear unsteady aerodynamics of the entire aircraft</li> <li>Application of an aerodynamic configuration</li> </ul>	A81-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381 A81-31039
<pre>MASS BALANCE The 'light-weight' system - A novel concep on-board weight and balance measurement i fiber optics [SAWE PAPEB 1336] Test procedures used in determining aircra: suitability for STAN integral weight and system [SAWE PAPEE 1339] Development and testing of a new technolog and balance indicator [SAWE PAPEB 1341] MATMENATICAL MODELS Mathematical model of the linear unsteady aerodynamics of the entire aircraft Application of an aerodynamic configuratio; modeling technique to the design and anaa;</pre>	A81-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381 A81-31039 n
<ul> <li>HASS BALANCE</li> <li>The 'light-weight' system - A novel concepon-board weight and balance measurement if the optics</li> <li>[SA BE PAPEE 1336]</li> <li>Test procedures used in determining aircrassuitability for STAN integral weight and system</li> <li>[SA BE PAPEE 1339]</li> <li>Development and testing of a new technolog and balance indicator</li> <li>[SA BE PAPEE 1341]</li> <li>HATHENATICAL MODELS</li> <li>Hathematical model of the linear unsteady aerodynamics of the entire aircraft</li> <li>Application of an aerodynamic configuratiom modeling technique to the design and analized in the set of th</li></ul>	A61-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381 A81-31039 u lysis of
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<ul> <li>HASS BALANCE</li> <li>The 'light-weight' system - A novel concepon-board weight and balance measurement if ther optics <ul> <li>[SA BE PAPER 1336]</li> </ul> </li> <li>Test procedures used in determining aircrassitability for STAN integral weight and system <ul> <li>[SA BE PAPER 1339]</li> </ul> </li> <li>Development and testing of a new technolog, and balance indicator <ul> <li>[SA BE PAPER 1341]</li> </ul> </li> <li>HATHERATICAL HODELS</li> <li>Mathematical model of the linear unsteady aerodynamics of the entire aircraft</li> <li>Application of an aerodynamic configuration modeling technique to the design and anal I-Wing aircraft and model wathematical model validation triated to the set of the</li></ul>	A81-30915 t for using A81-31377 ft balance A81-31379 y veight A81-31381 A81-31039 n lysis of A81-32013 als.
<ul> <li>MASS BALANCE</li> <li>The 'light-weight' system - A novel concepon-board weight and balance measurement fiber optics</li> <li>[SAWE PAPEB 1336]</li> <li>Test procedures used in determining aircrassitability for STAN integral weight and system</li> <li>[SAWE PAPEB 1339]</li> <li>Development and testing of a new technolog and balance indicator</li> <li>[SAWE PAPEB 1341]</li> <li>MATHENATICAL MODELS</li> <li>Hathematical model of the linear unsteady aerodynamics of the entire aircraft</li> <li>Application of an aerodynamic configuration modeling technique to the design and anal I-Wing aircraft configurations</li> <li>Sea King mathematical model validation triaged</li> </ul>	A81-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381 A81-31039 n lysis of A81-32013 als.
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<ul> <li>HASS BALANCE</li> <li>The 'light-weight' system - A novel concepon-board weight and balance measurement if ther optics <ul> <li>[SAWE PAPEN 1336]</li> </ul> </li> <li>Test procedures used in determining aircrassitability for STAN integral weight and system <ul> <li>[SAWE PAPEN 1339]</li> <li>Development and testing of a new technolog, and balance indicator <ul> <li>[SAWE PAPEN 1341]</li> </ul> </li> <li>HATHEMATICAL MODELS</li> <li>Hathematical model of the linear unsteady aerodynamics of the entire aircraft</li> <li>Application of an aerodynamic configuration modeling technique to the design and analities</li> <li>I-Wing aircraft configurations</li> <li>Sea King mathematical model validation triation <ul> <li>[AD-A096587]</li> </ul> </li> </ul></li></ul>	A81-30915 t for using A81-31377 ft balance A81-31379 y weight A81-31381 A81-31039 lysis of A81-32013 als. B81-22043
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881-22058

SCI model structure determination program (OSB) user's guide --- optimal subset regression [WASA-CB-159084] 861-881-22725 An evaluation of a simplified near field noise model for supersonic helical tip speed propellers [BASA-TH-81727] 81-22836 [JASA TH-80198] B01-220 [NASA-CE-165700] B81-2300 An airport community noise-impact assessment model [NASA-TH-80198] B81-237 881-23059 881-23713 MAXIMUM LIRBLINGOD ESTIMATES Maximum likelihood elevation angle estimates of radar targets using subapertures A81-32691 Maximum likelihood identification of aircraft lateral parameters with unsteady aerodynamic modelling N81-22057 SCI Identification (SCIDBT) program user's guide --- maximum likelihood method for linear rotorcraft models [H85A-CB-159082] N81-2 NLSCIDNT user's guide maximum likehood parameter identification computer program with nonlinear N81-22723 rotorcraft model [NASA-CB-159083] N81-22724 ABCHANICAL DRIVES High frequency drive mechanism for an active controls systems aircraft control surface N81-22400 BECHANICAL INPEDANCE Beduction of helicopter vibration through control of hub-impedance AE1-32009 MECHANICAL OSCILLATORS Non-linear oscillator models in bluff body aeroelasticity A81-30786 **AECHARICAL PROPERTIES** Patigue strength of gas turbine engine rotor blades in connection with structural changes in service A81-31673 MESOSCALE PHEBOMENA Investigative technical measurements of the planetary boundary layer made onboard an instrumented motorized glider [ BEFT-149] N81-22666 BETAL PATIGUE Patigue strength of gas turbine engine rotor blades in connection with structural changes in service A81-31673 Thermoplastic strengthening of a gas-turbine engine disk lock joint - Determination of the residual stresses 181-33169 ARTAL SEBRES Increasing the strength properties of sheet parts by explosive forming of them with optimization of the production parameters A81-33174 BETALS I-ray fluorescence spectrometric analysis of wear Betals in used lubricating oils [AD-A097552] BBTBOROLOGY NE1-23087 Electronic flight rules: An alternative separation assurance concept [AL-A097570] N81-23063 BETROLOGY Proceedings of the Seminar, Los Angeles, Calif., Froceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980 A81-32504 Aircraft quality assurance using close-range photogrammetry A61-32508 **HICROCOMPUTRES** Dead reckoner navigation project NE1-22010 A microcomputer-based signal data converter for runway visual range measurements [AD-A097568] BICBOBIBIATURISATION 881-23060 A new generation IPP - The AB/APX-100/V/ transponder

## **MICROFHONES**

Improvement of the imaging of moving acc	
	ustic
sources by the knowledge of their moti	00
NTCROPROCESSORS	A01-32334
A microprocessor based land navigator	
· · · · · ·	A81-32833
Microprocessor-based digital air data co	aputer for
ilight test	181-32959
A flight test real-time GW+CG computing	system
	A81-32860
The P/POD project: Programmable/Pilot O	riented
Display general aviation aircraft	
Microcomputer processing for Loran-C	NO1-22004
Hittoompacer proceeding for bords c	N81-22007
A microcomputer-based signal data conver	ter for
runway visual range measurements	
[AD-A09/568] Summary of transponder data Nay 1070 -	N81-23060
1979	WOAGHDET
[AD-A097569]	N81-23061
MICROSTELP TRADSMISSION LINES	
A 7.5-GHz microstrip phased array for	
	A81-30776
NICRODAVE AMPLIPIBRS	
An X-band power Gals PET amplifier for m	ilitary
avionics radar applications	104 24400
ATCROBATE CIRCUTES	A81-31122
A review of current and future commonent	s for
electronic warfare receivers	
	A81-32252
AICEONAVE LANDING SISTERS	10504380
subsystem experiments for the terminal	ICTORAGE
configured vehicle project	
[NASA-CR-164220]	881-22282
MLS: Airplane system modeling	891-23050
MILTARY AIRCRAFT	M01-23039
The variable-speed tail-chase aerial com	bat problem
	A81-31295
A review of current and future component	s for
electronic mature receivers	A81-32252
Quiet propulsive-lift technology ready f	or civil
and military applications	
_, , , , ,	AH1+32521
The rice of all and space	201 92321
The rise of all and space	A81-33718
The rise of all and space	A81-33718
The rise of all and space <b>HILITARY AVIATION</b> Army aviation - A perspective into the e	A81-33718 ighties
The rise of all and space <b>MILITARY AVIATION</b> Army aviation - A perspective into the e [AIAA PAPER 81-0931] MILITARY HENCODYRES	A81-33718 ighties A81-32935
The rise of all and space <b>MILITARY AVIATION</b> Army aviation - A perspective into the e [AIAA PAPER 81-0931] <b>MILITARY BELICOPTERS</b> Crashworthiness versus cost based on a s	A81-33718 ighties A81-32935 tudy of
The rise of all and space <b>MILITARY AVIATION</b> Army aviation - A perspective into the e [AIAA PAPER 81-0931] <b>MILITARY BELICOPTERS</b> Crashworthiness versus cost based on a s severe Army helicopter accidents during	A81-33718 ighties A81-32935 tudy of g 1970 and
The rise of all and space <b>HILITARY AVIATION</b> Army aviation - A perspective into the e [AIAN PAPER 81-0931] <b>HILITARY BELICOPTERS</b> Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971	A81-33718 ighties A81-32935 tudy of g 1970 and
The rise of all and space <b>HILITARY AVIATION</b> Army aviation - A perspective into the e [AIAN PAPER 81-0931] <b>HILITARY BELICOPTERS</b> Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the c	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties
The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY BELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPEB 81-0931]	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935
The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPER 81-0931] MILITARY HELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0951] MILITARY OPERATIONS	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935
The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPER 81-0931] MILITARY HELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0931] MILITARY OPERATIONS Aerodynamic trials with the linear motor	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven
The rise of all and space <b>MILITARY AVIATION</b> Army aviation - A perspective into the e [AIAA PAPER 81-0931] <b>MILITARY HELICOPTERS</b> Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0931] <b>MILITARY OPERATIONS</b> Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration
The rise of all and space <b>HILITARY AVIATION</b> Army aviation - A perspective into the e [AIAM PAPER 81-0931] <b>HILITARY HELICOPTERS</b> Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971 Army aviation - A perspective into the e [AIAM PAPER 81-0931] <b>HILITARY OPERATIONS</b> Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests	A&1-33718 ighties A&1-32935 tudy of g 1970 and A&1-32006 ighties A&1-32935 -driven sting Center leration
The rise of all and space <b>HILITARY AVIATION</b> Army aviation - A perspective into the e [AIAA PAPER 81-0931] <b>HILITARY BELICOPTERS</b> Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0931] <b>HILITARY OPERATIONS</b> Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAF PAPER 8T 80-41]	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943
The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY BELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAA PAPEB NT 80-41] MILITARY TECHDOLOGY	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943
The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY BELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAF PAPEB NT 80-41] MILITARY TECHBOLOGY The USAF Armament Division Structural Dy	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab B81-30689
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The rise of all and space HILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPER 81-0931] HILITARY HELICOPTERS Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0931] HILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAP PAPER NT 80-41] HILITARY TECHDOLOGY The USAF Armapent Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-30689 ilitary A81-31122
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The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY BELICOPTEBS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAP PAPEB NT 80-41] MILITARY TECHBOLOGY The USAP Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications MINICOMPOTEDS Weights information systems using minico [SAME PAPER 1347] MISS DISTANCE	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-30689 illitary A61-31122 mputers A81-31385
The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY BELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPEB 81-0931] MILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAF PAPEB BT 80-41] MILITARY TECHBOLOGY The USAF Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications MINICOMPOTERS Weights information systems using minico [SAWE PAPEB 1347] MISS DISTANCE Velocity tolerance of escape systems	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-33943 namics Lab A81-31943 namics Lab A81-3185 ilitary A81-31385
The rise of all and space HILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPEB 81-0931] HILITARY HELICOPTERS Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPEB 81-0931] HILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAF PAPEB NT 80-41] HILITARY TECHBOLOGY The USAF Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications HIMICOMPOTERS Weights information systems using minico [SAWE PAPEB 1347] HISS DISTANCE Velocity tolerance of escape systems [AD-A096881] HISSUE PREVENC	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-33943 namics Lab A81-31122 mputers A81-31385 N81-22035
The rise of all and space HILITARY AVIATION Army aviation - A perspective into the e [AIAM PAPER 81-0931] HILITARY HELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAM PAPER 81-0931] HILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAP PAPER NT 80-41] HILITARY TECHDOLOGY The USAF Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications HIBICOMPUTERS Weights information systems using minico [SAWE PAPER 1347] HISS DISTANCE Velocity tolerance of escape systems [AD-A096881] HISSILE TRACKIME Autoncamous target handoff from an airbor	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-30689 ilitary A81-31122 mputers A81-31385 B81-22035 me sensor
The rise of all and space HILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPER 81-0931] HILITARY HELICOPTERS Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0931] HILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAP PAPER NT 80-41] HILITARY TECHDOLOGY The USAF Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications HINICOMPUTERS Weights information systems using minico [SAWE PAPER 1347] HISS DISTANCE Velocity tolerance of escape systems [AD-096881] HISSILE TRACKING Autonemous target handoff from an airbor to a missile seeker	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-31122 mputers A81-31385 N81-22035 ne sensor
The rise of all and space HILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPER 81-0931] HILITARY BELICOPTERS Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0931] HILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAF PAPER NT 80-41] HILITARY TECHBOLOGY The USAF Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications HINICOMPUTERS Weights information systems using minico [SAWE PAPER 1347] HISS DISTANCE Velocity tolerance of escape systems [AD-A096881] HISSILE TEACKING Autoncaous target handoff from an airbor to a missile seeker	A81-33718 ighties A81-32935 A81-32935 A81-32006 ighties A81-32935 -driven Sting Center leration A81-33943 namics Lab A81-30689 ilitary A81-31122 mputers A81-31385 N81-22035 ne sensor A81-32498
The rise of all and space MILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPER 81-0931] MILITARY BELICOPTERS Crashworthiness versus cost based on a s severe Army helicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPER 81-0931] MILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAP PAPER NT 80-41] MILITARY TECHBOLOGY The USAP Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications MINICOMPOTERS Weights information systems using minico [SAWE PAPER 1347] MISSILE TRACKING Autonemous target handoff from an airbor to a missile seeker MINERS	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-31943 ilitary A81-31122 mputers A81-31385 B81-22035 ne sensor A81-32498 turbofan
The rise of all and space HILITARY AVIATION Army aviation - A perspective into the e [AIAA PAPEB 81-0931] HILITARY BELICOPTERS Crashworthiness versus cost based on a s severe Army belicopter accidents durin 1971 Army aviation - A perspective into the e [AIAA PAPEB 81-0931] HILITARY OPERATIONS Aerodynamic trials with the linear motor platform at the Toulouse Aeronautic Te for aircraft acceleration and dece tests [AAAF PAPEB NT 80-41] HILITARY TECHBOLOGY The USAF Armament Division Structural Dy An X-band power GaAs PET amplifier for m avionics radar applications HINICOMPUTERS Weights information systems using minico [SAWE PAPER 1347] HISS ISTANCE Velocity tolerance of escape systems [AD-A096881] HISSLE TRACKING Autonomous target handoff from an airbor to a missile seeker HIMES Factors which influence the behavior of forced mixer nozzles	A81-33718 ighties A81-32935 tudy of g 1970 and A81-32006 ighties A81-32935 -driven sting Center leration A81-33943 namics Lab A81-33943 namics Lab A81-31122 mputers A81-31122 mputers A81-31385 N81-22035 me sensor A81-32498 turbofan

## SUBJECT INDEX

Inflight aircraft vibration modes and the	eir effect
on aircraft radar cross section	
	A81-31370
A new method for modal identification	
	A81-33293
BODULATION	• ~ •
Accuracy of noise-modulated radio altime	101-3260#
NORODULSE BADAR	801-32034
Detection of target multiplicity using m	onopulse
guadrature angle	
	A81-32696
NOVING TABGET INDICATORS	
Moving target identification /MTI/ algor	ithm fcr
passive sensors	
	A81-32502
NI	
N	
BASA PROGRAMS	
An evaluation of NASA's program for adva	ncing
rotorcraft technology	

rotorcraft technology	
[ 5891-10/190]	N81-23078
TTO: HANDO	301 23070
according of laboratory personal termor	
A comparison of laboratory measured temper	acures
with predictions for a spar/skin type at	rerait
structure	
[NASA-TH-81359]	N81-23067
BAVIER-STORES EQUATION	
Analysis of turbulent flow about an isolat	€d
airfoil using a time dependent Navier-St	okes
procedure	
1	N81-23053
NAVICITIAN ATOS	
Sono decign and procedural accords of in-f	liaht
some design and procedural aspects of in-i	11guc
CONTRACTOR AVOIDANCE	101.22005
TATAA FAFEP 81-0800 ]	COSEC-10A
MIT Annotated Bibliography	
	861-22001
Use of Loran-C for general aviation aircra	ft
navigation	
•	881-22002
An analysis of the adaptability of Loran-C	to air
navidation	
1011902101	¥91-22003
Topostication of sin transportation tashna	1007 01
investigation of all clausportation techno	rogy at
Obio University, 1980 general aviati	00 .
aircraft and navigation aids	
	N81-22005
Low-frequency radio navigation system	
[NASA-CASE-NPO-15264-1]	N81-22036
Navaids calibration evaluation with a	
computer-controlled avionics data acquis	ition
system	
373100	
-	N81-23020
- Punctional tosting sitherne patiention ogn	NE1-23020
- Functional testing airborne navigation equ	N81-23020 ipment
Functional testing airborne navigation equ (AC-A097115)	N&1-23020 ipment N&1-23062
Functional testing airborne navigation equ (AC-A097115) BAVIGATION INSTRUMENTS	N81-23020 ipment N81-23062
Functional testing airborne navigation equ [Ar-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the	N81-23020 ipment N81-23062 presence
Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc	N&1-23020 ipment N&1-23062 presence raft
Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems	N&1-23020 ipment N&1-23062 presence raft
Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The Fehavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems	NE1-23020 ipment N81-23062 presence raft A81-31285
Functional testing airborne navigation equ (AC-A097115) BAVIGATION INSTRUMENTS The kebavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg	N@1-23020 ipment N&1-23062 presence raft A&1-31285 ed
Functional testing airborne navigation equ [AL-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book	N81-23020 ipment N81-23062 presence raft A81-31285 ed
Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Bussian book	N81-23020 ipment N81-23062 presence raft A81-31285 ed A81-31623
Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book Functional testing airborne pavigation com	N01-23020 ipment N01-23062 presence raft A01-31205 ed A01-31023 ipment
Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Bussian book Functional testing airborne navigation equ	NE1-23020 ipment NE1-23062 presence raft AE1-312E5 ed AE1-31E23 ipment NE1-23062
Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Bussian book Functional testing airborne navigation equ [AD-A097115]	N01-23020 ipment N01-23062 presence raft A01-31205 ed A01-31023 ipment N01-23062
<pre>Functional testing airborne navigation equ [AL-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book Functional testing airborne navigation equ [AD-A097115] EAVIGATORS</pre>	N@1-23020 ipment N&1-23062 presence raft A&1-31285 ed A&1-31@23 ipment B&1-23062
<ul> <li>Functional testing airborne navigation equ [AC-A097115]</li> <li>BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>BAVIGATORS A microprocessor based land navigator</li> </ul>	Ne1-23020 ipment Ne1-23062 presence raft Ae1-312e5 ed Ae1-31e23 ipment Ne1-23062
<pre>Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book Functional testing airborne navigation equ [AD-A097115] BAVIGATORS A microprocessor based land navigator</pre>	Ne1-23020 ipment Ne1-23062 presence raft Ae1-31285 ed Ae1-31223 ipment Ne1-23062 Ae1-32633
<ul> <li>Functional testing airborne navigation equ [AC-A097115]</li> <li>BAVIGATION INSTRUMENTS</li> <li>The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Russian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>BAVIGATORS A microprocessor based land navigator</li> <li>EAVSTAR SATELLITES</li> </ul>	N@1-23020 ipment N@1-23062 presence raft A@1-31285 ed A@1-31@23 ipment B@1-23062 A@1-32@33
<ul> <li>Functional testing airborne navigation equ [AC-A097115]</li> <li>BAVIGATION INSTRUMENTS</li> <li>The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>DAVIGATORS A microprocessor based land navigator</li> <li>BAVSTAR SATELLITES GFS Navstar, the universal positioning sys</li> </ul>	N@1-23020 ipment N@1-23062 presence raft A@1-312@5 ed A@1-31@25 B@1-23062 A@1-32@33 tem of
<pre>Functional testing airborne navigation equ [AD-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book Functional testing airborne navigation equ [AD-A097115] HAVIGATORS A microprocessor based land navigator EAVSTAN SATELLITES GPS Navstar, the universal positioning sys the future</pre>	N@1-23020 ipment N&1-23062 presence raft A&1-31285 ed A&1-31285 ipment N&1-23062 A&1-32833 tem of
<ul> <li>Functional testing airborne navigation equ [AC-A097115]</li> <li>BAVIGATION INSTRUMENTS</li> <li>The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>BAVIGATORS A microprocessor based land navigator</li> <li>BAVSTAB SATELLITES GPS Navstar, the universal positioning sys the future</li> </ul>	Ne1-23020 ipment Ne1-23062 presence raft Ae1-31285 ed Ae1-31223 ipment Ne1-23062 Ae1-32833 tem of Ae1-32975
<ul> <li>Functional testing airborne navigation equ [AI-A097115]</li> <li>BAVIGATION INSTRUMENTS</li> <li>The hebavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Russian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>BAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>BAVSTAB SATELLITES GPS Navstar, the universal positioning sys the future</li> </ul>	N01-23020 ipment N01-23062 presence raft A01-31205 ed A01-31223 ipment N01-23062 A01-32033 tem of A01-32975
<pre>Functional testing airborne navigation equ [AL-A097115] HAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Bussian book Functional testing airborne navigation equ [AD-A097115] HAVIGATORS A microprocessor based land navigator HAVSTAR SATELLITES GFS Wavstar, the universal positioning sys the future HAVI WAVALE Avionics Master Plan</pre>	NE1-23020 ipment NE1-23062 presence raft AE1-31285 ed AE1-31E23 ipment NE1-23062 AE1-32833 ten of AE1-3C975
<ul> <li>Functional testing airborne navigation equ (AC-A097115)</li> <li>BAVIGATION INSTRUMENTS</li> <li>The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ (AD-A097115)</li> <li>HAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>HAVSTAR SATELLITES GPS Wavstar, the universal positioning sys the future</li> <li>BAVI NAVAIR Avionics Baster Plan</li> </ul>	NE1-23020 ipment NE1-23062 presence raft AE1-312E5 ed AE1-312E3 ipment NE1-23062 AE1-32E33 tem of AE1-3C975
<pre>Functional testing airborne navigation equ [AD-A097115] BAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book Functional testing airborne navigation equ [AD-A097115] BAVIGATORS A microprocessor based land navigator HAVSTAB SATELLITES GPS Navstar, the universal positioning sys the future BAVY NAVAIB Avionics Baster Plan [AD-A097522]</pre>	Ne1-23020 ipment Ne1-23062 presence raft Ae1-31285 ed Ae1-31285 ipment Ne1-23062 Ae1-32833 ten of Ae1-3C975 Be81-23082
<ul> <li>Functional testing airborne navigation equ [AC-A097115]</li> <li>HAVIGATION INSTRUMENTS The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Russian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>HAVIGATORS A microprocessor based land navigator</li> <li>HAVSTAN SATELLITES GFS Navstar, the universal positioning sys the future</li> <li>HAVAIE Avionics Master Plan [AD-A097522]</li> <li>HEAB FIELDS</li> </ul>	N@1-23020 ipment N@1-23062 presence raft A@1-31285 ed A@1-31@23 ipment B@1-23062 A@1-32@33 tem of A@1-3C975 H@1-23082
<pre>Functional testing airborne navigation equ [AD-A097115] BAVIGATION INSTRUMENTS The hebavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book Functional testing airborne navigation equ [AD-A097115] BAVIGATORS A microprocessor based land navigator HAVSTAP SATELLITES GPS Navstar, the universal positioning sys the future BAVY NAVAIE Avionics Baster Plan [AD-A097522] BABP FIEDS An evaluation of a simplified near field n</pre>	N01-23020 ipment N01-23062 presence raft A01-31205 ed A01-31205 ed N01-31205 N01-23062 A01-32033 tem of A01-32033 tem of A01-32032 b01-230082 oise
<ul> <li>Functional testing airborne navigation equ (AC-A097115)</li> <li>HAVIGATION INSTRUMENTS</li> <li>The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>HAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>HAVSTAB SATELLITES GPS Navstar, the universal positioning sys the future</li> <li>HAVI NAVAIR Avionics Master Plan [AD-A097522]</li> <li>HEAB FIELDS An evaluation of a simplified near field n model for supersonic helical tip speed p</li> </ul>	N@1-23020 ipment N&1-23062 presence raft A&1-31285 ed A&1-31823 ipment N&1-23062 A&1-32833 tem of A&1-3C975 B&1-23082 oise rogellers
<ul> <li>Functional testing airborne navigation equ (AC-A097115)</li> <li>BAVIGATION INSTRUMENTS</li> <li>The tehavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ (AD-A097115)</li> <li>HAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>HAVSTAN SATELLITES GFS Wavstar, the universal positioning sys the future</li> <li>HAVYI MAVAIR Avionics Master Plan (AD-A097522)</li> <li>HEAB FIELDS</li> <li>An evaluation of a simplified near field n model for supersonic helical tip speed p [MASA-TM-81727]</li> </ul>	N01-23020 ipment N01-23062 presence raft A01-31205 ed A01-31205 ipment N01-23062 A01-32033 tem of A01-32033 tem of A01-32075 N01-23002 oise rogellers N01-22036
<pre>Functional testing airborne navigation equ [AC-A097115] BAVIGATION INSTRUMENTS The hebavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems Aircraft equipment /2nd revised and enlarg edition/ Russian book Functional testing airborne navigation equ [AD-A097115] DAVIGATORS A microprocessor based land navigator EAVSTAN SATELLITES GPS Navstar, the universal positioning sys the future EAVY NAVAIE Avionics Baster Plan [AD-A097522] HEAM FIELDS An evaluation of a simplified near field n model for supersonic helical tip speed p [NASA-TH-81727] EEAM WARES</pre>	N@1-23020 ipment N@1-23062 presence raft A@1-31285 ed A@1-31285 ed A@1-31283 ipment N@1-23062 A@1-32033 tem of A@1-3C975 B@1-23082 oise rofellers N@1-22836
<ul> <li>Functional testing airborne navigation equ (AC-A097115)</li> <li>BAVIGATION INSTRUMENTS</li> <li>The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ (AD-A097115)</li> <li>BAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>WAVSTAB SATELLITES GPS Navstar, the universal positioning sys the future</li> <li>HAVY</li> <li>MAVAIE Avionics Baster Plan (AD-A097522)</li> <li>HEAB FIELDS</li> <li>An evaluation of a simplified near field n model for supersonic helical tip speed p (NASA-TH-81727)</li> <li>BEAB WARES</li> <li>Hean-flow and turbulence measurements in t</li> </ul>	N@1-23020 ipment N&1-23062 presence raft A&1-31285 ed A&1-31285 ed A&1-32833 tem of A&1-32833 tem of A&1-32833 tem of A&1-32833 tem of A&1-32833 tem of A&1-32833 tem of A&1-32833 tem of A&1-32833 tem of A&1-32833 tem of A&1-23082 oise rogellers N&1-22836
<ul> <li>Functional testing airborne navigation equ (AC-A097115)</li> <li>BAVIGATION INSTRUMENTS</li> <li>The hebavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ (AD-A097115)</li> <li>BAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>EAVSTAR SATELLITES GPS Navstar, the universal positioning sys the future</li> <li>BAVYI NAVAIE Avionics Baster Plan (AD-A097522)</li> <li>BEAB FIELDS</li> <li>An evaluation of a simplified near field n model for supersonic helical tip speed p (NASA-TB-81727)</li> <li>BEAB VAEES</li> <li>Mean-flow and turbulence measurements in t vinity of the trailing edge of an BACA</li> </ul>	N01-23020 ipment N01-23062 presence raft A01-31205 ed A01-31205 H01-23002 A01-32033 tem of A01-32033 tem of A01-32032 tem of A01-23002 oise rogellers N01-22036
<ul> <li>Functional testing airborne navigation equ (AC-A097115)</li> <li>BAVIGATION INSTRUMENTS</li> <li>The behavior of guartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Russian book</li> <li>Functional testing airborne navigation equ [AD-A097115]</li> <li>HAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>HAVSTAB SATBLLITES GPS Navstar, the universal positioning sys the future</li> <li>HAVI NAVAIR Avionics Baster Plan [AD-A097522]</li> <li>HEAB FIELDS</li> <li>An evaluation of a simplified near field n model for supersonic helical tip speed p [NASA-TH-81727]</li> <li>HEAB WERS</li> <li>Hean-flow and turbulence measurements in t vicinity of the trailing edge of an BACA 1)-012 airfoil</li> </ul>	N@1-23020 ipment N@1-23062 presence raft A@1-31285 ed A@1-31823 ipment N@1-23062 A@1-32833 tem of A@1-32833 tem of A@1-3082 oise ropellers N@1-22836 be (63 sut
<ul> <li>Functional testing airborne navigation equ (AC-A097115)</li> <li>BAVIGATION INSTRUMENTS</li> <li>The tehavior of quartz oscillators in the of accelerations in missile and airc time-frequency navigation systems</li> <li>Aircraft equipment /2nd revised and enlarg edition/ Bussian book</li> <li>Functional testing airborne navigation equ (AD-A097115)</li> <li>HAVIGATORS</li> <li>A microprocessor based land navigator</li> <li>HAVSTAN SATBLLITES GFS Wavstar, the universal positioning sys the future</li> <li>HAVYI MAVAIR Avionics Baster Plan (AD-A097522)</li> <li>HEAB FIBLOS</li> <li>An evaluation of a simplified near field n model for supersonic helical tip speed p (MASA-TH-81727)</li> <li>HEAB WARES Hean-flow and turbulence measurements in t vicinity of the trailing edge of an MACA 1)-012 airfoil (MASA-TH-8471)</li> </ul>	N01-23020 ipment N01-23062 presence raft A01-31205 ed A01-31205 ipment N01-23062 A01-32033 tem of A01-32033 tem of A01-32032 coise rogellers N01-22036 be (63 sut N01-23410

NOISE SEASUREMENT Installation effects on propeller noise [AIAA PAFEE 80-0993] A81-Noise characteristics of two parallel jets with A81-31369 unequal flow [AIAA PAPEE 80-0168] A81-31601 Improvement of the imaging of moving acoustic sources by the knowledge of their motion [ONERA, TP MC. 1981-17] A&1-32534 Contribution to the study of non stationary signals emitted by moving jet engine -Application to special analysis and imaging. I. A&1-33288 Improvement of the imaging of moving acoustic Acoustic performance evaluation of an advanced OH-1 helicopter main rotor system [AHS PAPER 81-58] A81-33952 The role of coherent structures in the generation of noise for subsonic jets [NASA-CE-164214] N81-22833 evaluation of a simplified near field noise λn nodel for superschic helical tip speed propellers
[NASA-TH-81727] 881-2283 N81-22836 BOISE POLLATION The effect of airplane noise on the inhabitants of areas near Okecie Airport in Warsaw [NASA-TH-758791 N81-22593 An airport community noise-impact assessment model [NASA-TH-80198] NOISE PEBDICTION (AIRCRAFT) Transonic rotor noise - Theoretical and N81-23713 experimental comparisons A81-33049 The relationship between noise and annoyance around Orly [NASA-TH-76573] Nifframe noise of a small model transport aircraft N81-22594 and scaling effects --- Boeing 747 [NASA-TP-1858] N81-22832 Comparison of predicted engine core noise with proposed PAA belicopter noise certification requirements [NASA-TM-81739] N81-22839 HOISE PROPAGATION A study of the effect of terrain on helicopter noise propagation by acoustical modeling [AD-A097626] N81-23864 HOISE BEDUCTION Noise Characteristics of two parallel jets with unegual flow [AIAA PAPEE 80-0168] A81-31601 Pederal policies affecting airport noise compatibility programs [AIAA PAPEE 81-0829] A81-33879 Analysis of axial fan noise with the belp of the Lowson formalism [AAAF PAPES NT 80-541 A61-33948 BOISE SPECTEA Contribution to the study of non stationary signals emitted by moving jet engine.-Application to special analysis and imaging. I A81-33288 Contribution to the study of non-stationary Application to spectral analysis and imaging. II A81-33294 HOISE TOLEBANCE Annoyance caused by light aircraft noise [NASA-TH-76533] 881-22589 The annoyance caused by airplane noise in the vicinity of Orly Mirport and the reaction of neighboring residents [NASA-TH-76575] N81-22590 The relationship between noise and annoyance around Orly [NASA-TH-76573] 881-22594 BOBLINEAB BQUATIONS Non-linear oscillator models in bluff body aeroelasticity A81-30786 BOBLIBBAB SYSTEMS BLSCIDHT user's guide maximum likebood parameter identification computer program with nonlinear rotorcraft model [NASA-CE-159083] 881-22724 INDES User's guide multistep input design with nonlinear rotorcraft modeling [NASA-CB-159085] 881-22726 A nonlinear propulsion system simulation tehnique for piloted simulators [NASA-TH-82600] N81-23085 NOLLIMEARITY Study of the characteristics of a base-vented wing in nonlinear theory [AAAP PAPEB NT 80-40] A81-33927 NUMERICAL ANALYSIS Method for evaluating the resistance of gas-turbine installation disks to thermal cycling A81-33168 Application of holography to the study of helicopter rotor flow fields [NASA-CR-164293] N81-23433 O OMEGA MAVIGATION SYSTEM

Investigation of air transportation technology at Frinceton University, 1980 N81-22008 OBBOARD DATA PROCESSING Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles 181-32491 Airborne ground velocity determination by digital processing of electro-optical line sensor signals A81-32496 Airborne electronic disclays A81-32999 Relationships for a flight performance computer N81-23014 ONBOARD BOUIPHENT The 'light-weight' system - A novel concept for on-board weight and balance measurement using fiber optics [SAWE PAPEE 1336] A81-31377 An analysis of the adaptability of Loran-C tc air navigation N81-22003 The P/FOD project: Programmable/Pilot Oriented Display --- general aviation aircraft N81-22004 Investigation of air transportation technology at Ohio University, 1980 --- general aviation aircraft and navigation aids NE1-22005 OPERATIONAL PROBLEMS Operational responses to aft empty C.G. --- Center of Gravity location in Boeing 727-200 aircraft [ SAWE PAPER 1338] OPERATOR PERFORMANCE A81-31378 Application of signal detection theory to decision making in supervisory control - The effect of the operator's experience A81-31288 OPTICAL BOUIPHENT Optics in metrology and quality assurance; Proceedings of the Seminar, Los Angeles, Calif., Pebruary 6, 7, 1980 A81-32504 OPTICAL MEASUBBBBB Techniques for evaluation of aircraft windscreen optical distortion A81-32507 OPTICAL ABASURING INSTRUMENTS An opto-electronic method for wind tunnel mcdel alignment A81-32849 High frequency angular vibration measurements in Vebicles [AAS FAFBE 81-024] OPTICAL PROPERTIES A81-32886 Techniques for evaluation of aircraft windscreen optical distortion A81-32507 OPTICAL REFLECTION Apparatus for and method of compensating dynamic unbalance [ NASA-CASE-GSC-12550-1 ] N81-22358 OPTICAL SCABBERS Analysis, design and simulation of line scan aerial surveillance systems A81-32492 OPTIBAL CONTROL Energy modeling for aviation fuel efficiency [AIAA PAPER 81-0789] ãe1-33683

#### OPTINIZATION Airborne method to minimize fuel with fixed time-of-arrival constraints A81-31297 Increasing the strength properties of sheet parts by explosive forming of them with optimization of the production parameters A81-33174 Global optimization of a glider [AAAP PAPEB NT 80-36] A81-3 An analysis of opportunistic maintenance policy for the P100PW100 aircraft engine A81-33937 [AD-A097548] 881-23025 A cost function for an airframe, production program [AD-A097540] OSCILLATING PLON N81-23967 Non-linear oscillator models in bluff body aeroelasticity A81-30786 Unsteady aerodynamics of an aerofoil at high angle of incidence rerforming various linear oscillations in a uniform stream A81-32017 Experimental investigation of oscillating subscnic lets A81-32777 Oscillatory flows from shock induced separations on biconvex aerofoils of varying thickness in ventilated wind tunnels N81-23056

# Ρ

E-221 WELFCOLIDE	
Crashworthiness design parameter sensitivit	y
analysis	
[AD-A096550]	N81-22041
PAINTS	
Development of a water disclacing, touch-up	paint
[AD-A097125]	N81-23288
PANEL METHOD (FIGTD DYNAMICS)	
Computation of pressure distribution on the	PEVID
wing-hody model by the manel method	
(DBAIN-BD-00-00)	N01_22020
	801-22023
PARSED	
Benavior of continuous filament advanced co	uposite
isogrid structure	
	881-22095
PARABOLIC BEFLECTORS	
Apparatus for and method of compensating dy	namic
unbalance	
[NASA-CASE-GSC-12550-1]	N81-22358
PARALLEL FLOW	
Noise characteristics of two parallel jets	with
unequal flcw	
[AIAA PAPER 80-0168]	A81-31601
PARABETBEISATION	
Application of the parameter space method t	:0
aerospace vehicle digital control system	design
	A81-32642
PASSENGER AIRCRAPT	
Design considerations for future turboprop	
transports	
transports [SAUE DADDR 13403	481-31380
transports [SAWE PAPER 1340] Plethod - The universal transport airplane	A81-31380
transports [SAWE PAPEB 1340] Platbed - The universal transport airplane	A81-31380
transports [SAWE PAPEB 1340] Platbed - The universal transport airplane [SAWE PAPER 1343] Computer airplate decign	A81-31380 A81-31382
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPER 1343] Commuter aircraft design	A81-31380 A81-31382
transports [SAWE PAPEB 1340] Platbed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 81-0913]	A81-31380 A81-31382 A81-32931
transports [SAWE PAPEB 1340] Platbed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airc	A81-31380 A81-31382 A81-32931 Craft
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airc [AAAP PAPEB NT 80-35]	A81-31380 A81-31382 A81-32931 Craft A81-33923
transports [SAWE PAPEB 1340] Platbed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 61-0913] The optimal lift-drag ratio of a civil airc [AAAP PAPEB NT 80-35] PASSENGEES	A81-31380 A81-31382 A81-32931 Craft A81-33923
transports [SAWE PAPER 1340] Plathed - The universal transport airplane [SAWE PAPER 1343] Commuter aircraft design [AIAA PAPER 81-0913] The optimal lift-drag ratio of a civil airc [AAAP PAPER NT 80-35] PASSBWGERS Aircraft crash dynamics: Some major consid	A81-31380 A81-31382 A81-32931 Traft A81-33923 derations
transports [SAWE PAPEN 1340] Plathed - The universal transport airplane [SAWE PAPEN 1343] Commuter aircraft design [AIAA PAPEN 81-0913] The optimal lift-drag ratio of a civil airco [AAAP PAPEN NT 80-35] PASSBUGENS Aircraft crash dynamics: Some major consid	A81-31380 A81-31382 A81-32931 Traft A81-33923 derations N81-22437
transports [SAWE PAPEB 1340] Platbed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 61-0913] The optimal lift-drag ratio of a civil airc [AAAP PAPEB NT 80-35] PASSBUGEBS Aircraft crash dynamics: Some major consid PAVEBENTS	A81-31380 A81-31382 A81-32931 Craft A81-33923 Berations B81-22437
transports [SAWE PAPER 1340] Plathed - The universal transport airplane [SAWE PAPER 1343] Commuter aircraft design [AIAA PAPER 81-0913] The optimal lift-drag ratio of a civil aird [AAAP PAPER NT 80-35] PASSBWGEBS Aircraft crash dynamics: Some major consid PAVEBENTS National runway friction measurement program	A81-31380 A81-31382 A81-32931 Fraft A81-33923 Herations N81-22437
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airco [AAAP PAPEB NT 80-35] PASSBUGERS Aircraft crash dynamics: Some major consid PAVEBENTS National runway friction measurement progra [AD-A097334]	A81-31380 A81-31382 A81-32931 craft A81-33923 lerations N81-22437 M81-23097
transports [SAWE PAPEB 1340] Platbed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 61-0913] The optimal lift-drag ratio of a civil airc [AAAP PAPEB NT 80-35] PASSBGEBS Aircraft crash dynamics: Some major consid PAVEMENTS National runway friction measurement progra [AD-A097334] PAYLODS	A81-31380 A81-31382 A81-32931 craft A81-33923 Berations N81-22437 A8 N81-23097
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [ATAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airc [AAAP PAPEB NT 80-35] PASSBNGEBS Aircraft crash dynamics: Some major consid PAVEMENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil:	A81-31380 A81-31382 A81-32931 craft A81-33923 lerations N81-22437 M81-23097 ity,
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airco [AAAP PAPEB NT 80-35] PASSBUGERS Aircraft crash dynamics: Some major consid PAVEBENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil: volume 1	A81-31380 A81-32931 raft A81-32931 raft A81-33923 lerations N81-22437 M81-22097 ity,
transports [SAWE PAPER 1340] Platbed - The universal transport airplane [SAWE PAPER 1343] Commuter aircraft design [ATAP PAPER 81-0913] The optimal lift-drag ratio of a civil aird [AAAP PAPER 81-0913] PASSB@GBS Aircraft crash dynamics: Some major consid PAVEMENTS National runway friction measurement progra [AD-A097334] PATIOADS Structural flight loads simulation capabil: volume 1 [AD-A096572]	A81-31380 A81-31382 A81-32931 craft A81-33923 Berations N81-22437 M81-23097 ity, N81-22044
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [ATAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airco [AAAP PAPEB NT 80-35] PASSBNGEBS Aircraft crash dynamics: Some major consid PAVEMENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil:	A81-31380 A81-32931 craft A81-33923 derations N81-22437 N81-22097 ity, N81-22044 ity.
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airco [AAAP PAPEB NT 80-35] PASSBUGERS Aircraft crash dynamics: Some major consid PAVEMEENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil: Volume 2: Structural analysis computer 1	A81-31380 A81-32931 raft A81-32931 raft A81-33923 lerations N81-22437 ity, N81-23097 ity, N81-22044
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [ATAP PAPEB 61-0913] The optimal lift-drag ratio of a civil aird [ATAP PAPEB 81-0913] The optimal lift-drag ratio of a civil aird [ATAP PAPEB 81-0913] PASSBWGBS Aircraft crash dynamics: Some major consid PAVEBENTS National runway friction measurement progra [AD-A097334] PATIOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil: Volume 2: Structural analysis computer 1 USEP's manual	A81-31380 A81-31382 A81-32931 Craft A81-33923 Berations N81-22437 M81-23097 ity, N81-22044 ity, rogram
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [ATAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airco [AAAP PAPEB NT 80-35] PASSBNGEBS Aircraft crash dynamics: Some major consid PAVEBENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil: Volume 2: Structural analysis computer 1 USET's manual [AD-A096594]	A81-31380 A81-32931 raft A81-32931 raft A81-33923 derations N81-22437 ity, N81-22044 ity, N81-22044 ity, Program B81-22045
<pre>transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [AIAA PAPEB 81-0913] The optimal lift-drag ratio of a civil airce [AAAP PAPEB NT 80-35] PASSBGEBS Aircraft crash dynamics: Some major consid PAVEBENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil: volume 2: Structural analysis computer [ user's manual [AD-A096594] PEEPOGNANCE PEBDICTIOH</pre>	A81-31380 A81-32931 raft A81-33923 lerations N81-22437 ity, N81-23097 ity, N81-22044 ity, N81-22044 ity, N81-22044
transports [SAWE PAPEN 1340] Plathed - The universal transport airplane [SAWE PAPEN 1343] Commuter aircraft design [AIAA PAPEN 81-0913] The optimal lift-drag ratio of a civil airc [AAAP PAPEN NT 80-35] PASSBWGENS Aircraft crash dynamics: Some major consid PAVENENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil: Volume 2: Structural analysis computer j user's manual [AD-A096594] PENFORMANCE PENDICTION Accounting performance evaluation of an advant	A81-31380 A81-31382 A81-32931 rraft A81-33923 derations N81-22437 MB1-23097 ity, N81-22044 ity, Program N81-22045 nced
transports [SAWE PAPEB 1340] Plathed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [ATAP PAPEB 81-0913] The optimal lift-drag ratio of a civil airco [AAAP PAPEB NT 80-35] PASSBNGERS Aircraft crash dynamics: Some major consid PAVEBENTS National runway friction measurement progra [AD-A097334] PAYLOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil: Volume 2: Structoral analysis computer 1 USER'S manual [AD-A096594] PBEPOBMANCE PEBDICTION Acoustic performance evaluation of an advan DH-1 belicerter main rotor system	A81-31380 A81-32931 rraft A81-33923 derations N81-22437 ity, N81-22044 ity, N81-22044 ity, N81-22045 aced
<pre>transports [SAWE PAPEB 1340] Platbed - The universal transport airplane [SAWE PAPEB 1343] Commuter aircraft design [ATAP PAPEB 61-0913] The optimal lift-drag ratio of a civil aird [AAAP PAPEB NT 80-35] PASSB@GBS Aircraft crash dynamics: Some major consid PAVEMENTS National runway friction measurement progra [AD-A097334] PATIOADS Structural flight loads simulation capabil: volume 1 [AD-A096572] Structural flight loads simulation capabil: volume 2: Structural analysis computer j user's manual [AD-A096594] PBEPOBMARCE PEBDICTION Acoustic performance evaluation of an advas DH-1 helicopter main rotor system [AD PAPER A1-581]</pre>	A81-31380 A81-31382 A81-32931 raft A81-33923 lerations N81-22437 ity, N81-23097 ity, N81-22044 ity, N81-22044 ity, N81-22044 a81-33952

## SOBJECT INDEX

PERFORMANCE TESTS Helicopter rotor blade effects on mast-mounted sensor images A81-31114 Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [ SAWE FAPEE 1383] A81-31399 Functional analysis and operational assessment of an onboard glide path guidance system for visual approaches (visual approach monitor VAM) [ BSA-TT-655] N81-22038 Brosion resistant coatings [NASA-TH-75870] N81-22098 Functional testing airborne navigation equipment [AD-A097115] Functional testing airborne radars N81-23062 [AC-A097562] N81-23358 PERIPHEBAL VISION Flight evaluation of the concept of the stage A Peripheral Vision Horizon Device (PVHD) using the CH 135 aircraft of 403 Squadron - CEB Gagetown [AD-A096870] N81-22050 PERSONNEL NAMES FARMENT Development of maintenance metrics to forecast resource demands of weapon systems. Analysis and evaluation, revision A [AD-A096688] Development of maintenance metrics to forecast N81-22971 resource demands of weapon system. Maintenance metrics and weightings, revision A [AD-A096689] Development of maintenance metrics to forecast N81-22972 resource demands of weapon systems. Analysis and results of metrics and weightings, revision A [AD-A096690] N81-22973 PHASED ANDAYS A 7.5-GHz microstrip phased array for aircraft-to-satellite communication A81-3C776 An extremely lightweight fuselage-integrated phased array for airborne applications A81-3C779 PHOTOGRAMMETRY Aircraft quality assurance using close-range photogrammetry A81-32508 PILOT BEEOR A review of in-flight emergencies in the ASES data **t**ase SNASA-CE-1661661 N81-22031 PILOT PERFORMANCE Candidate CDTI procedures study [ MASA-CE-165673] PILOT TRAINING N81-22032 Operator training systems/simulators A81-31109 PITCHIEG BOBBETS Kinematic properties of the helicopter in coordinated turns [NASA-TP-1773] N81-22039 PLANETARY BOUNDARY LAYER Investigative technical measurements of the planetary boundary layer made onboard an instrumented motorized glider [EBFT-149] N81-22666 POLAND The effect of airplane noise on the inhabitants cf areas near Okecie Airport in Warsaw [NASA-TH-75879] N81-22593 FOLICIES DOD's use of remotely filoted vehicle technology offers opportunities for saving lives and dollars [AD-A097419] NE1-23074 POLLOTION NASA's aeronautics research and technology base [NASA-CE-164195] N81-22969 POLYBOBIALS Approximations and short cuts based on generalized functions A81-30730 POSTTION RRRORS Passive location finding with a multiwavelength two element interferometer A81-31125 Maximum likelihood elevation angle estimates of radar targets using subapertures A81-32691

BADAR BOUIPBENT

POSITION INDICATORS Passive location finding with a multiwavelength two element interferometer 181-31125 POWER AMFLIPIERS An X-band power GaAs FET amplifier for military avionics radar applications A81-31122 PREDICTION ANALYSIS TECHNIQUES The Modular Life Cycle Cost Model for advanced aircraft systems - An overview Comparison of theoretical predictions of orbiter airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TH-01358] N81-23 A81-31386 N81-23066 PRESSORE DISTRIBUTION Comparison of computed and measured unsteady pressure fields on a supercritical wing [ONEBA, TP NO. 1981-12] A01-3254 Pressure distribution computation on a non-lifting A81-32541 symmetrical helicopter blade in forward flight 181-33291 Computation of pressure distribution on the DFVLB wing-body model by the panel method [DPVLB-PB-80-02] N81-22029 Two-dimensional aerodynamic characteristics of the NACA 0012 airfoil in the Langley 8 foot transonic pressure tunnel [NASA-TH-81927] N81-23036 PRRSSORR MRASDRRARHES Centralized in-place pressure calibration system for multiple turbine engine aerodynamic pressure measurement systems 481-32847 PRESSURE OSCILLATIONS Analysis of total and static pressure fluctuations in an air intake at bigh incidence TAAAF PAPES NT 80-611 A81-33950 PRESSURE BEDUCTION Thermal and flow analysis of a convection air-cooled ceramic coated porous metal concept for turbine vanes [NASA-TH-81749] 881-22056 PROC EDORES Punctional testing airborne radars [AD-A097562] N81-23358 PROC OBBRENT Preliminary design study of advanced composite blade and hub and nonnechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CE-152336-2] 881-23065 PRODUCT DEVELOPMENT Development of a water displacing, touch-up paint [AD+A097125] N81-23 N81-23288 PROGRAM VERIFICATION (COMPUTERS) A simulator to test compressor research facility control system software A81-31110 PROJECT FLAMMING Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CR-152336-2] N81-23065 PROPRILER BLADES Propellers for economic flight at high speeds [AAAF PAPES NT 80-34] A81-33936 An evaluation of a simplified near field noise 881-22836 PROPELLES SPPICIENCY Propellers for economic flight at high speeds [AAAF PAPES NT 80-34] A81-33936 PROPELLER SLIPSTREAMS Installation effects on propeller noise [AIAA PAPEE 80-0993] A81-31369 PROPELLESS The propeller tip vortex. A possible contributor to aircraft cabin noise [BASA-TH-81768] 881-22838 Pull-scale aerodynamic characteristics of a propellar installed on a small twin-engine aircraft wing panel [MASA-TM-81285] B 881-23039

PROPULSION SYSTEM CONFIGURATIONS Study of a propulsive system --- aerodynamic characteristics of proposed model A81-33673 Application of ion implantation for the improvement of localized corrosion resistance cf H50 steel bearings [AD-A097230] PROPULSION SYSTEM PREFORMANCE N81-23466 Improvement of the energy efficiency of helicopters [AAAF PAPER NI 80-33] A81-33 Energy efficient engine flight propulsion system: A81-33933 Aircraft/engine integration evaluation [NASA-CB-159584] N81-22051 Component research for future propulsion systems [NASA-TH-82613] 881-22055 A nonlinear propulsion system simulation tebnique for piloted simulators [ NASA-TH-82600] 881-23085 Performance deterioration based on simulated aerodynamic loads test, JT9D jet engine diagnostics program [NASA-CE-165297] PROPULSIVE BPPICIENCY N81-23086 Improvement of the energy efficiency of helicopters [AAAP PAPEE NT 80-33] PROTECTIVE CONTINGS A81-33933 Mechanical properties of aluminum coatings on heat-resistant steels Erosion resistant coatings [NASA-TH-75870] B81-22098 Development of a water displacing, touch-up paint N81-23268 A81-31668 PROVING Sea King mathematical model validation trials. Flight data channel calibration [AD-A096587] N81-22043 PSYCHOACOUSTICS Appoyance caused by light aircraft noise [NASA-TH-76533] N81-22589 The annoyance caused by airplane noise in the vicinity of Orly Airport and the reaction of neighboring residents [NASA-TH-76575] 881-22590 The effect of airplane noise on the inhabitants of areas near Okecie Airport in Warsaw [NASA-TH-75879] N81-225 881-22593 The relationship between noise and annoyance around Orly [NASA-TH-76573] N81-22594 PUBSUIT TRACKING The variable-speed tail-chase aerial combat problem

# Q

QUALITY CONTROL Optics in metrology and guality assurance; Proceedings of the Seminar, Los Angeles, Calif., Pebruary 6, 7, 1980 Aircraft guality assurance using close-range photogrammetry A&1-3250& CUANTS CHISTALS The Lebavior of guartz oscillators in the presence of accelerations -- in missile and aircraft time-frequency navigation systems

A81-31285

A81-31295

# R

BADAR CEOSS SECTIONS Inflight aircraft vibration modes and their effect on aircraft radar cross section A81-31370 Detection of target multiplicity using monopulse guadrature angle A81-32696 BADAR DETECTION Detection of target multiplicity using monopulse guadrature angle A81-32696 BADAR BQUIPRENT Functional testing airborne radars [AD-A097562] BE1-23358

## RADAS BESOLUTION

RADAB RESOLUTION Detection of target multiplicity using monopulse guadrature angle A81-32696 RADAE TARGETS Maximum likelihood elevation angle estimates of radar targets using subapertures A81-32691 BADAS TEACKING . Maximum likelihood elevation angle estimates of radar targets using subarertures A81-32691 pynamic errors of the Kalman filtering of trajectory parameters --- for radar tracking of aircraft maneuvers A81-33687 RADIAL PLON The role of coherent structures in the generation of noise for subsonic jets [NASA-CB-164214] N81-22833 BADIO ALTIMETERS Accuracy of noise-modulated radio altimeter A81-32694 RADIO DIBECTION FINDERS passive location finding with a multiwavelength two element interferometer A81-31125 RADIO BQUIPHENT Aircraft equipment /2nd revised and enlarged edition/ --- Russian book A81-31823 RADIO INTERFEROMETERS passive location finding with a multiwavelength two element interferometer A81-31125 BADIO BAVIGATION GFS Navstar, the universal positioning system of the future A81-30975 RADIO BECEIVEES A review of current and future components for electronic warfare receivers A81-32252 RADIO TRABSMITTERS AN/TPX-54 interrogator A81-31131 Low-frequency radio navigation system [NASA-CASE-NPO-15264-1] N81-22036 RADIOACTIVE ISOTOPES Bearing wear detection using radioactive iron-55 tagging [ASLE PEPPEINT 81-AM-6A-3] RANJET ENGINES A81-33868 Multiple-scale turbulence modeling of boundary layer flows for scramjet applications [NASA-CR-3433] N81-23411 RANJET BISSILES O.N.B.B.A. ramjet test facilities A81-33285 RANDON BOISE Accuracy of noise-modulated radio altimeter 181-32694 Contribution to the study of non stationary ntribution to the study of non according signals emitted by moving jet engine -Application to special analysis and imaging. I. A81-33288 Contribution to the study of non-stationary signals emitted by moving jet engines -Application to spectral analysis and imaging. II **▲**81-33294 REAL TIME OPBRATION A flight test real-time GW-CG computing system A81-32860 A study of real-time computer graphic display technology for aeronautical applications [NASA-CR-164221] N81-22727 RECEPTION DIVERSITY New technology applied to an IPF diversity transponder A81-31133 Antenna design and development for the microwave subsystem experiments for the terminal configured vehicle project [NASA-CR-164220] NA1-22282 BECOBBAISSANCE AIBCRAFT Crashworthiness design parameter sensitivity analysis [AD-A096550] N81-22041

#### SUBJECT INDEX

REGRESSION ANALYSIS SCI model structure determination program (OSB) user's guide --- optimal subset regression [NASA-CE-159084] N81-22725 BEGULATIONS Pederal policies affecting airport noise compatibility programs [AIAA FAPBB 81-0829] **▲81-33879** BELIABILITY ANALYSIS Efficiency of the methods and algorithms used for estimating the reliability in aviation techniques 181-33173 BEGA16 - Computer program for analysis and extrapolation of stress-rupture data [NASA-TF-1809] N81-23486 BELIABILITY BNGINBBBING New technology applied to an IPF diversity transponder A81-31133 An analysis of the adaptability of Loran-C tc air **Davigation** N81-22003 BENCTE SENSORS Helicopter rotor blade effects on mast-mounted sensor images A81-31114 Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles A81-32491 Airborne ground velocity determination by digital processing of electro-optical line sensor signals A81-32496 Autonomous target handoff from an airborne sensor to a missile seeker A81-32498 Advanced target tracking by dynamic scene analysis Adv-32499 Moving target identification /MTI/ algorithm for passive sensors A81-32502 BEBOTELY PILOTED VEHICLES An extremely lightweight fuselage-integrated phased array for airborne applications A81-30779 A high performance TV camera for use in target acquisition and laser designator systems A81-31115 Forward-looking infrared /FLIR/ sensor for autonomous vehicles A81-32490 Technology growth in mini-RPV systems [AIAA PAPES 81-0936] 181-32937 Analytical study of the cruise performance of a class of remotely riloted, microwave-powered, high-altitude airplane platforms [NASA-T8-81969] N81-22040 NASA's aeronautics research and technology base N81-22969 [ NASA-CR-1641951 DOD's use of remotely piloted vehicle technology offers opportunities for saving lives and dollars [ AD-A097419] N81-23074 BESBARCH AIRCHAPT Quiet propulsive-lift technology ready for civil and military applications A81-32521 RESEARCH AND DEVELOPMENT An aircraft manufacturer's view of airport B&D needs [AIAA PAPER 81-0793] BESBARCE FACILITIES A81-33687 A simulator to test compressor research facility control system software A81-31110 Structural flight loads simulation capability, volume 1 [AD-A096572] N81-22044 RESIDUAL STERSS Thermoplastic strengthening of a gas-turbine engine disk lock joint - Determination of the residual stresses A81-33169 **BEVISIONS** Aircraft modification management evaluation [AD-A096458] REYBOLDS BUABBB 881-22974 Experimental flutter at high subsonic speeds and its theoretical prediction, taking into account wing thickness and Reynolds number N81-23052 .

BOT	OBS
-----	-----

BRANULDS CABBESC,	
Mean-flow and turbulence measurements in th	1e
vicinity of the trailing edge of an NACA	(63 sub
1)-012 airfoil	-
[NASA-TP-1845]	N81-23410
RIGID BOTORS	
A GALEININ CYPE LIBITE ELEMENT BETRON IOF	forward
flight	.or ward
	A81-33050
BIGID WINGS	
The development of the secondary wing struc	ture:
for a rigid wing hang glider sandwick	1
(BB-251)	881-22046
ROCKET BIGINES	301 22040
Velocity tolerance of escape systems	
[AD-A096881]	N81-22035
ROCKET TEST PACILITIES	
U.N.E.B.A. ramjet test facilities	101-33305
ROCKET THRUST	401-33263
Velocity tolerance of escare systems	
[AD-A096881]	881-22035
BOLL	
Allematic properties of the helicopter in	
ENDIGIDATED LUIUS	N81-22020
ROLLEE BEABINGS	551-22033
Bearing wear detection using radioactive in	con-55
tagging	
[ASLE PEEPEINT 81-AM-6A-3]	A81-33868
Application of log implantation for the	
M50 steel bearings	ance or
[AD-A097230]	N81-23466
BOTABY STABILITY	
Equilibrium spinning of a typical single-en	ngine
low-wing light aircraft	
inparatus for and method of compensating du	A01-31598
unbalance	Labic
[NASA-CASE-GSC-12550-1]	N81-22358
ROTARY HING AIRCRAPT	
DEKFIS user's guide: Discrete Extended Kal	lman
DBKFIS user's guide: Discrete Extended Kaj Filter/Smoother program for aircraft and	luan
DEKFIS user's guide: Discrete Extended Kaj Pilter/Smother program for aircraft and rotorcraft data consistency [Nat-CP-159081]	N81-22722
DEKFIS user's guide: Discrete Extended Kaj Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081] SCI Identification (SCIDNT) program user's	luan N81-22722 quide
DEKFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081] SCI Identification (SCIDNT) program user's maximum likelihood method for linear	lman N81-22722 guide
DBKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081] SCI Identification (SCIDNT) program user's maximum likelihood method for linear rotorcraft models	N81-22722 guide
DBKPIS user's guide: Discrete Extended Kaj Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081] SCI Identification (SCIDNT) program user's maximum likelihood method for linear rotorcraft models [NASA-CR-159082]	N81-22722 guide N81-22723
<ul> <li>DEKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood pare identification</li> </ul>	Man N81-22722 guide N81-22723 Meter
<ul> <li>DERFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model</li> </ul>	N81-22722 guide N81-22723 Neter Linear
DERFIS user's guide: Discrete Extended Kal Pilter/Smoother program for aircraft and rotorcraft data consistency [NASA-CR-159081] SCI Identification (SCIDNT) program user's maximum likelihood method for linear rotorcraft models [NASA-CR-159082] NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]	N81-22722 guide N81-22723 Neter Linear N81-22724
<ul> <li>DBKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program</li> </ul>	<pre>N81-22722 guide N81-22723 Neter linear N81-22724 (05B)</pre>
<ul> <li>DBKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression</li> </ul>	N81-22722 guide N81-22723 meter linear N81-22724 (05B)
<ul> <li>DEKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non: rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> </ul>	N81-22722 guide N81-22723 Neter Linear N81-22724 (OSB) N N81-22725
<ul> <li>DEKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non: rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design to nonlinear rotorcraft modeling</li> </ul>	N81-22722 guide N81-22723 Neter Linear N81-22724 (OSB) N N81-22725 vith
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelhood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood pare identification computer program with non: rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design to nonlinear rotorcraft modeling [NASA-CR-159085]</li> </ul>	N81-22722 guide N81-22723 N81-22723 Neter linear N81-22724 (OSB) N81-22725 N81-22726
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguires</li> </ul>	<pre>N81-22722 guide N81-22723 weter linear N81-22724 (OSB) N N81-22725 with B81-22726 aents:</pre>
<ul> <li>DBKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multistep input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Botorcraft aviation icing research requires Research review and recommendations</li> </ul>	N81-22722 guide N81-22723 Neter N81-22724 (OSB) N81-22725 with N81-22726 nets:
<ul> <li>DBKPIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguires Research review and recommendations [NASA-CR-165344]</li> </ul>	N81-22722 guide N81-22723 Meter Linear N81-22724 (05B) N81-22725 With N81-22726 Ments: N81-23070
<ul> <li>DERFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research requires [NASA-CR-165304]</li> <li>MASA-CR-165304]</li> <li>An evaluation of NASA's program for advance rotorcraft technology</li> </ul>	N81-22722 guide N81-22723 Neter linear N81-22724 (OSB) N81-22725 N81-22725 N81-22726 nets: N81-23070 ing
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Botorcraft aviation icing research reguires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [EB1-1441801</li> </ul>	<pre>NB1-22722 guide NB1-22723 Weter linear NB1-22724 (OSB) NB1-22725 With NB1-22726 aents: NB1-23070 ing NB1-23078</pre>
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Botorcraft aviation icing research requires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTABY WINGS</li> </ul>	<pre>N81-22722 guide N81-22723 weter inear N81-22724 (OSB) N N81-22725 with N81-22726 N81-22726 N81-23070 ing N81-23078</pre>
<ul> <li>DBKFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Botorcraft aviation icing research reguires Research review and recommendations [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advanc: rotorcraft technology [FB81-144180]</li> <li>BOTABY WINGS</li> </ul>	N81-22722 guide N81-22723 Neter N81-22724 (05B) N81-22725 W81-22726 N81-22726 N81-23070 N81-23078
<ul> <li>DERFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft models [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguirer Research review and recommendations [NASA-CR-165334]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTARY WINGS</li> <li>The bearingless main rotor</li> </ul>	N81-22722 guide N81-22723 Neter linear N81-22724 (05B) N81-22725 With N81-22726 N81-22726 N81-23070 N81-23078 N81-32008
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelhood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood pare identification computer program with non: rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research requires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advanc: rotorcraft technology [FB81-1444180]</li> <li>BOTABY HINGS</li> <li>The bearingless main rotor</li> </ul>	N81-22722 guide N81-22723 Weter linear N81-22724 (OSB) N81-22725 With N81-22726 Ments: N81-23070 M81-23078 N81-23078 A81-32008 control
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguires [NASA-CR-159084]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTABY WINGS The bearingless main rotor</li> <li>Reduction of heliccpter vibration through of hub-impedance</li> </ul>	<pre>NB1-22722 guide NB1-22723 Weter linear NB1-22724 (OSB) NB1-22725 With NB1-22726 ments: NB1-23070 Ing NB1-23078 AB1-23078 AB1-32008 control AB1-32009</pre>
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research required Besearch review and recommendations [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTABY UINGS The bearingless main rotor</li> <li>Beduction of helicopter vibration through of of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor</li> </ul>	N81-22722         guide         N81-22723         Imeter         Imeter         Imeter         N81-22724         (OSB)         N81-22725         With         N81-22726         Imeter:         N81-23070         Img         N81-23078         A81-32008         Control
<ul> <li>DBKFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft models [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguires Research review and recommendations [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [EB81-144180]</li> <li>BOTABY WINGS</li> <li>The bearingless main rotor</li> <li>Reduction of heliccpter vitration through of of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> </ul>	N81-22722 guide N81-22723 Deter N81-22724 (OSB) N81-22725 W81-22726 Detts: N81-22726 N81-22726 N81-23070 N81-23078 A81-32008 A81-32009
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelhood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood pare identification computer program with non: rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159085]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [E881-144180]</li> <li>BOTABY UNGS The bearingless main rotor</li> <li>Beduction of helicopter vibration through of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> </ul>	N81-22722 guide N81-22723 Neter linear N81-22724 (OSB) N81-22725 N81-22725 N81-22726 N81-22726 N81-23070 N81-23070 N81-23078 N81-23008 control A81-32009 A81-32010
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood part identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regressiv [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-1444180]</li> <li>BOTABY WINGS The bearingless main rotor</li> <li>Reduction of helicopter vitration through of of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> </ul>	<pre>NB1-22722 guide NB1-22723 Neter linear NB1-22724 (OSB) NB1-22725 Nith NB1-22726 ents: NB1-23070 NB1-23070 NB1-23078 AB1-32008 control AB1-32009 AB1-32009 AB1-32010 gb angle</pre>
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research requires [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research requires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTABY HINGS The bearingless main rotor</li> <li>Reduction of helicopter vibration through of bub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> <li>Unsteady aerodynamics of an aerofoil at his of incidence performing various linear oscillations in a wriferm externer</li> </ul>	<pre>Nan Nan Nan Nan Nan Nan Nan Nan Nan Nan</pre>
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Botorcraft aviation icing research required Besearch review and recommendations [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTABY UINGS</li> <li>The bearingless main rotor</li> <li>Beduction of helicopter vibration through of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> <li>Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> </ul>	N81-22722         guide         N81-22723         Imeter         N81-22724         (OSB)         N81-22725         with         N81-22726         N81-22726         N81-23070         M81-23078         A81-32008         A81-32010         Jb angle         A81-32017
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelhood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood pare identification computer program with non: rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design to nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research requires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [EB81-144180]</li> <li>BOTABY UBMGS</li> <li>The bearingless main rotor</li> <li>Beduction of helicopter vibration through of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> <li>Unsteady aerodynamics of an aerofoil at his of incidence petforming various linear oscillations in a uniform stream</li> </ul>	N81-22722         guide         N81-22723         Weter         linear         N81-22724         (OSB)         N81-22725         with         N81-22726         metts:         N81-23070         M81-23078         A81-32008         control         A81-32010         A81-32017         Copter
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelhood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood pare identification computer program with noni rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research required Besearch review and recommendations [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advanc: rotorcraft technology [FB81-1444180]</li> <li>BOTABY HINGS</li> <li>The bearingless main rotor</li> <li>Reduction of helicopter vibration through of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> <li>Unsteady aerodynamics of an aerofoil at his of incidence performing various linear oscillations in a uniform stream</li> <li>Comparison of calculated and measured helid rotor lateral flapping angles</li> </ul>	N81-22722 guide N81-22723 Weter linear N81-22724 (OSB) N81-22724 N81-22725 Weth-22725 Weth-22725 N81-22726 Ments: N81-22726 Ments: N81-22070 A81-32078 A81-32009 A81-32010 gb angle A81-32017 copter
<ul> <li>DERFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  marimum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood part identification computer program with non- rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research reguires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-1444186]</li> <li>BOTABY WINGS The bearingless main rotor</li> <li>Reduction of helicopter vitration through of nultipage ance user of aultiblade sensors for on-line rotor tip-path plane estimation</li> <li>Unsteady aerodynamics of an aerofoil at his of incidence performing various linear oscillations in a uniform stream</li> <li>Comparison of calculated and measured helic rotor lateral flapping angles</li> </ul>	N81-22722         guide         N81-22723         Weter         Inear         N81-22724         (OSB)         N81-22725         with         N81-22726         ents:         N81-23070         ing         N81-23078         A81-32008         control         A81-32010         bangle         A81-32017         copter         A81-32018
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research requires [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Rotorcraft aviation icing research requires [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTABY WINGS</li> <li>The bearingless main rotor</li> <li>Reduction of helicopter vibration through of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> <li>Unsteady aerodynamics of an aerofoil at his of incidence performing various linear oscillations in a uniform stream</li> <li>Comparison of calculated and measured helic rotor lateral flapping angles</li> <li>Pluid mechanics mechanisms in the stall pro- pation of rotorcraft flapping</li> </ul>	<pre>NB1-22722 guide NB1-22723 NB1-22724 (05B) NB1-22724 (05B) NB1-22725 NB1-22726 NB1-22726 NB1-23070 NB1-23070 NB1-23078 AB1-32008 Control AB1-32009 AB1-32010 NB1-32010 AB1-32017 Copter AB1-32018 Coss of</pre>
<ul> <li>DBRFIS user's guide: Discrete Extended Kal Pilter/Smocther program for aircraft and rotorcraft data consistency [NASA-CR-159081]</li> <li>SCI Identification (SCIDNT) program user's  maximum likelihood method for linear rotorcraft models [NASA-CR-159082]</li> <li>NLSCIDNT user's guide maximum likehood para identification computer program with non rotorcraft model [NASA-CR-159083]</li> <li>SCI model structure determination program user's guide optimal subset regression [NASA-CR-159084]</li> <li>INDES User's guide multister input design in nonlinear rotorcraft modeling [NASA-CR-159085]</li> <li>Botorcraft aviation icing research required Besearch review and recommendations [NASA-CR-165344]</li> <li>An evaluation of NASA's program for advance rotorcraft technology [FB81-144180]</li> <li>BOTABY UINGS</li> <li>The bearingless main rotor</li> <li>Beduction of helicopter vibration through of hub-impedance</li> <li>Use of multiblade sensors for on-line rotor tip-path plane estimation</li> <li>Unsteady aerodynamics of an aerofoil at his of incidence performing various linear oscillations in a uniform stream</li> <li>Comparison of Calculated and measured helic rotor lateral flapping angles</li> <li>Fluid mechanics mechanisms in the stall pro- airfoils for helicopters</li> </ul>	N81-22722         guide         N81-22723         Imeter         N81-22724         (OSB)         N81-22725         with         N81-22726         N81-22726         N81-22726         N81-23070         M81-23078         A81-32008         A81-32009         A81-32010         Jb angle         A81-32017         Copter         A81-32018         Cess of         A81-32779

Transonic rotor noise Theoretical and	
experimental comparisons	▲81-33049
A Galerkin type finite element method for rotary-wing aeroelasticity in hover and	forward
flight	x81-33050
Pressure distribution computation on a non	-lifting
symmetrical belicopter blade in forward	111gbt 181-33291
Propeller and wing Russian book	A81-33696
Analysis of axial fan noise with the help	of the
LOWSON FORMALISM [AAAF PAPER NT 80-54]	A81-33948
Broadband helicopter rotor noise	X81-33949
Acoustic performance evaluation of an adva	DCED
[AHS PAPER 81-58]	A81-33952
Preliminary design study of advanced compo- blade and bub and nonnechanical control	site system
for the tilt-rotor aircraft. Volume 1:	-1
[NASA-CB-152336-1]	<b>B81-2306</b> 4
Preliminary design study of advanced compo blade and hub and nonmechanical control	site system
for the tilt-rotor aircraft. Volume 2:	Froject
[NASA-CB-152336-2]	N81-23065
Application of holography to the study of helicopter rotor flow fields	
[NASA-CE-164293]	N81-23433
Coriolis effect on the vibration of flat r	otating
low aspect ratio cantilewer plates	A81-30914
Apparatus for and method of compensating d	ynamic
(NASA-CASE-GSC-12550-1)	N81-22358
Use of multiblade sensors for on-line roto	r
tip-path plane estimation	A81-32010
Comparison of calculated and measured beli	copter
Lotor lateral flapping angles	A81-32018
A Galerkin type finite element method for rotary-wing aeroelasticity in hover and	forward
flight	181-33050
Pressure distribution computation on a non	-lifting
symmetrical helicopter blade in forward	111gbt 181-33291
Prop-Fan technical progress leading to tec readiness	hnology
[AIAA PAPEB 81-0810]	A81-33878
Helicopter rotor blade effects on mast-mou	inted
sebsor images	AE1-31114
Use of multiplade sensors for on-line roto	) <b>r</b>
rth-harm highe estimation	<b>▲</b> 81-32010
BOTOB BLADES (TOBBOMACHINERY) Patique strength of gas turbine engine rot	OL
blades in connection with structural cha	nges in
	▲81-31673
Study of the secondary flow in the downstr noving blade row in an axial flow fan	ean of a
ROTOR SPRED	181-31767
Transonic rotor noise - Theoretical and	
experimental comparisons	A81-33049
BOTOBS Preliminary design study of advanced compo	osite
blade and hub and nonmechanical control	system
for the tilt-rotor aircraft. Volume 1: Bugineering studies	
[NASA-CE-152336-1] Preliminary design study of advanced compo	N81-23064 site
blade and hub and nonsechanical control	
	system
planning data	system Project

BUD TINE (CONPUTERS)	
A time marching finite volume method for	
<pre>tlade-to-blade flows using a body-fitted</pre>	
curvilinear mesh	
	A81-30717
RUNNAY CONDITIONS	
National runway friction measurement progra	an
[AD-A097334]	N81-23097
RUEBATS	
Airport capacity enhancement by innovative	use of
runway geometry	
CALAA PAPER 81-08011	181-33891
Candidate CDII procedures study	
[NASA-CB-165673]	N81-22032
A microcomputer-based signal data converter	r for
runway visual range measurements	
[AD-A097568]	N81+23060
National renway friction measurement progra	aci 23000
[AD=A007334]	NG1-23097
Ten Teningel	BU1-23037

# S

SAFRTY DEVICES Aircraft equipment /2nd revised and enlarged edition/ --- Bussian book A81-31823 SAPRTY MANAGRARAT Is it safe - The safety assessment of aircraft | systems. IV - Methods, techniques, and organisation A81-33789 Aircraft crash dynamics: Some major considerations N81-22437 SAINT VENANT PRINCIPLE On St. Venant flexure and torsion problem for symmetrical airfoil sections A81-33245 SABDRICH STRUCTURES Bonded laminated structures in aircraft manufacture --- Russian book A81-33700 The development of the secondary wing structure for a rigid wing hang glider --- sandwich structure techniques [ 80-251 ] 881-22046 SATELLITE NAVIGATION SYSTEMS GPS Navstar, the universal positioning system of the future A81-30975 SCALE EPPECT Airframe noise of a small model transport aircraft and scaling effects --- Eceing 747 [NASA-TP-1858] N81-22832 Experimental studies of scale effects on oscillating airfoils at transonic speeds 881-23054 SCALE BODBLS Equilibrium spinning of a typical single-engine low-wing light aircraft A81-31598 Description of 0.186-scale model of high-speed duct of Dational transonic facility [NASA-TH-81949] N81-22061 SCREE ABALYSIS Advanced target tracking by dynamic scene analysis A81-32499 Moving target identification /MTI/ algorithm for passive sensors A81-32502 SCHEDULING An analysis of opportunistic maintenance policy for the F100Pm100 aircraft engine [AD-A097548] N81-2 N81-23025 SCRAP Silver recovery from aircraft scrap [PB81-150021] N81-23269 SBATS Study to develop improved fire resistant aircraft passenger seat materials [NASA-CR-152408] N81-23058 SECOBDARY PLON Study of the secondary flow in the downstream of a moving blade row in an axial flow fan A81-31767 SECORDARY RADAR Discrete Address Beacon System A81-31134

#### SUBJECT INDEX

SELF ALIGNMENT An opto-electronic sethod for wind tunnel model alignment A81-32849 SEBICOBDUCTOB DEVICES Procedure for pressure contact on high-power semiconductor devices free of thermal fatigue [ NASA-TH-75733] NE1-22054 SEPABATED FLOW Leading-edge separation from a thick, conical, slender wing at small angles of incidence A81-31687 Byperimental study of the separation at the trailing edge of an axisymmetrical contoured after-body A81-33281 Topology of three-dimensional separated flows [ NASA-TH-81294 ] NE1-23037 SERVICE LIFE Numerical methods for studying the stress-strain state and service life of aircraft gas-turbine engine disks A61-31258 Implementing Aircraft Structural Life Management to reduce structural cost of ownership (SAWE FAPES 1331) A81-31 Patigue strength of gas turbine engine rotor blades in connection with structural changes in A81-31376 service A81-31673 Orientation of measurement sensors for optimum end-cf-life performance A81-32697 Service evaluation of aluminum-brazed titanium (AETi) --- aircraft structures [NASA-CB-3418] N81-22129 An analysis of opportunistic maintenance policy for the P100PW100 aircraft engine [AC-A097548] N81-23025 SH-3 BELICOPTER An analysis of thermal balance in the cooled cabin An analysis of the main balance in the could of a Sea King Helicopter [AD-A097199] SHAPTS (HACHINE BLEBERTS) Full-scale aerodynamic characteristics of a N81-23077 propellar installed on a small twin-engine aircraft wing panel [NASA-IN-81285] N81-23039 SEBAR STRENGTE Air Force Geophysics Laboratory aerodynamically tethered balloon, 45,000 cubic feet [AD-A096758] 881-N81-22023 SHEAR STRESS Developments in the analysis and repair of cracked and uncracked structures **A81-31561** SHOCK BAVES Oscillatory flows from shock induced separations on biconvex aerofoils of varying thickness in ventilated wind tunnels N81-23056 SHORT HAUL AIRCEAPT Bolls-Boyce BB 211-535 power plant [AIAA FAREE 81-0807] A81-33886 SHORT TAKBOFF AIBCRAPT Application of variable structure system theory to aircraft flight control --- AV-8A and the Auguentor Wing Jet STOL Besearch Aircraft [WSA-CE-164321] 881-230 N81-23093 SIDESLIF Rinematic properties of the helicopter in coordinated turns [NASA-TP-1773] N81-22039 SIGNAL DETECTION Application of signal detection theory to decisicn making in superviscry control - The effect of the operator's experience 181-31288 SIGNAL PADIEG Antenna design and development for the microwave subsystem experiments for the terminal configured vehicle project [NASA-CE-164220] N81-22282 SIGNAL PROCESSING AN/TEI-54 interrogator A81-31131 Improvement of the imaging of moving acoustic sources by the knowledge of their motion [ONBBA, TP NO. 1981-17] A8 A81-32534 .

STRESS INTENSITY FACTORS

Maximum likelihood elevation angle estimate	s of
lauar cargees using subapercures	A81-32691
Contribution to the study of non-stationary	
Application to spectral analysis and imag	ing. II
	A81-33294
Microcomputer processing for Loran-C	N81-22007
A microcomputer-based signal data converter	for
runway visual range measurements	801-72060
SILVBR	101-23000
Silver recovery from aircraft scrap	
[FB81-150021] SIMULATORS	N81-23269
Design, development, and evaluation of ligh	tweight
hydraulic system, phase 1 A-7 aircraf	t N91-22075
SINGULAR INTEGRAL EQUATIONS	801-23073
Approximations and short cuts based on gene	ralized
IUNCTIONS	A81-30730
SIZE DETERMINATION	
A design analysis technique for evaluating and weight of V/STOL lift fans	size
[SAWE PAPER 1386]	A81-31402
SKIN (STRUCTURAL MEMBIR) Structural design of REPP matches for Mirag	e winc
repair	e wing .
[AD-A097195]	N81-23024
with predictions for a scar/skin type air	craft
structure	
[NASA-TH-81359] SKIN PRICTION	881-23067
Topology of three-dimensional separated flo	¥S
(NASA-TH-81294) SIRNDRR HTNCS	N81-23037
Leading-edge separation from a thick, conic	al,
slender wing at small angles of incidence	191 24607
Vortex-flow aerodynamics - An emerging desi	A01-3100/
capability	-
Experimental flutter at high subsonic speed	A81-33717 s and
its theoretical prediction, taking into a	ccount
wing thickness and Reynolds number	N81-23052
SHALL PERTORBATION FLOW	
Experimental flutter at high subschic speed its theoretical crediction, taking into a	s and ccount
wing thickness and Reynolds number	
500T DH \$0T \$14\$5	N81-23052
Combustion system processes leading to corr	osive
deposits (NASA-TH-81752)	N81-23243
SOLAB CBLLS	101 23243
Sun powered aircraft design	101-20020
SOLAB GEBERATORS	AUI-32332
Sun powered aircraft design	101-33030
SOLID ROCKET FROPELLARTS	au - 32932
Tensile stress/strain characterization of	
non-libear materials	<b>A81-30915</b>
SOLID STATE DEVICES	
AB/TPI-54 interrogator	A81-31131
New technology applied to an IFF diversity	
transponder	481-31133
SOLUBILITY	
Investigation of air solubility in jet A fu	el at
[BASA-CR-3422]	N81-22130
SOUND PIBLDS	
signals emitted by moving iet engine ~	
Application to special analysis and imagi	ng. I.
Contribution to the study of non-stationary	481-33288
signals emitted by moving jet engines -	
application to spectral analysis and imag	10g. II A81-33294

SPACE SHOTTLE OEBITER 101	
Comparison of theoretical predictions of or	cbiter .
airloads with wind tunnel and flight test	2
ESULTS IOL & BACH HUMBEL OF V.52	N81-23066
SPACECEAPT	801-23000
The rise of air and scace	
	A81-33718
SPACECRAFT COBBUSICATION	
A 7.5-GHz microstrip phased array for	
aircraft-to-satellite communication	
	A81-30776
SPECIFICATIONS	
fuel/engine/airrame trade orr study	N61-22072
SDRCADON ANALYSTS	801-23013
Contribution to the study of non-stationar	4
signals emitted by moving jet engines -	
Application to spectral analysis and image	ging. II
	A81-33294
SPBED INDICATORS	
Beasurement of alterait speed and altitude	Book
CDTN GDCSC	A01-32401
Ranilibrium spinning of a typical single-en	naine
low-wing light aircraft	- ,
	A81-31598
STAGEATION PRESSURE	
Description of recent changes in the Langle	ey 6- by
28-inch transonic tunnel	NO1 03000
[NASA-TE-81947]	181-23096
Bydrodynamic modelling of the starting pro-	ress in
liguid-propellant engines	
	181-31287
STATIC LOADS	
Structural flight loads simulation capabil:	ity,
volume 1	N04-00000
[AU-AU303/2] Structural flight loads simulation canabil	801-22044 itv.
Volume 2: Structural analysis computer	DICGIAE
user's Danual	
[AD-A096594]	N81-22045
STATIC PRESSURE	
in an air intake at high incidence	LUALIONS
(AAAF PAPEE NT 80-61)	A81-33950
STATIC STABILITY	
Steady flow and static stability of airfoi	ls in
extreme ground effect	101-21606
STATISTICAL ANALYSIS	¥91-21990
Efficiency of the methods and algorithms up	sed for
estimating the reliability in aviation t	echnigues
· · · · · · · · · · · · · · · · · · ·	AE1-33173
Engine parameter trend analysis with LEADS	200: €limba
Possibilities and libitations using a	Eligat
recorder data	N81-23010
STEADY FLOW	
Steady flow and static stability of airfoi	ls in
extreme ground effect	104 24606
CADDIC	¥01-31000
Mechanical properties of aluminum coatings	OD
heat-resistant steels	
	A81-31668
STIFFUESS	
Behavior of continuous filament advanced c	omposite
isogila scieccule	N81-22095
STRAIN HARDENING	
Thermoplastic strengthening of a gas-turbi	ne
engine disk lock joint - Determination o	f the
residual stresses	381-33169
STRRNGTH	201-33103
Behavior of continuous filament advanced c	omposite
isogrid structure	-
	881-22095
NECLIG - Computer program for analysis and	
extrapolation of stress-rubture data	
[NASA-TP-1809]	B81-23486
STRESS INTENSITY PACTORS	
Experimental determination of the stress i	otensity
INCLOSE THE CLACKS WITH A CULATINGAL LLO	
complex marts /mas turbine blades/	
complex parts /gas turbine blades/	481-31264

STRESS BRASUREMENT Measuring dynamic stresses on helicopter transmission gear teeth utilizing telemetry AE1-32859 Development of a noninterference compressor blade stress measurement system A81-32874 STRESS-STRAID RELATIONSHIPS Tensile stress/strain characterization of non-linear materials A81-30915 Numerical methods for studying the stress-strain state and service life of aircraft gas-turbine engine disks A81-31258 STRUCTORAL ANALYSIS Structural flight loads simulation capability. Volume 2: Structural analysis computer program user's manual [ AD-A0965941 N81-22045 STRUCTUBAL DESIGN Principles of aircraft structural design /2nd revised and enlarged edition/ --- Russian bock A81-31800 Past and future trends in structures and dynamics --- of aircraft [AIAA PAPER 81-0896] STRUCTURAL DESIGN CEITERIA A81-32921 Concepts for improving the damage tolerance of composite compression panels A81-32825 Structural optimization - Past, present and future [AIAA PAPEE 81-0897] A01-32 Designing for aircraft structural crashworthiness [AIAA PAPEE 81-0803] A81-33 A81-32922 A81-33882 Aircraft crash dynamics: Some major considerations N81-22437 Aircraft wing weight build-up methodology with modification for materials and construction techniques [NASA-CE-166173] N81-23068 STRUCTURAL PAILURE Developments in the analysis and repair of cracked and uncracked structures A81-31561 STRUCTURAL BELIABILITY Implementing Aircraft Structural Life Management to reduce structural cost of ownership [SAWE PAPER 1331] A81-31 STRUCTURAL STABILITY A81-31376 A Galerkin type finite element method for rotary-wing aeroelasticity in hover and forward flight A81-33050 STRUCTURAL VIBRATION Inflight aircraft vibration modes and their effect on aircraft radar cross section 181-31370 High frequency angular vibration measurements in vehicles [AAS PAPER 81-024] 181-32886 Helicopter vibration control - A survey 181-33047 A new method for modal identification A81-33293 Pinite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane A81-33736 STRUCTURAL WEIGHT The 'light-weight' system - A novel concept for on-board weight and balance measurement using fiber optics [SARE PAPER 1336] A81-31377 rest procedures used in determining aircraft suitability for STAN integral weight and balance svstem [SAWE PAPER 1339] A81-31379 Development and testing of a new technology weight and balance indicator [SAWE PAPEE 1341] & &81-313 A81-31381 An Interactive Weight Accounting Frogram /IWAP/ [SAWE PAPER 1345] &81-181-31383 [SAWE PAPER 1345] A81-37 Computer aided technology interface with weights engineering --- aircraft design [SAWE PAPER 1346] A81-37 The structural weight fraction - Revisited for fighter/attack type aircraft [SAWE PAPER 1365] A81-37 A81-31384 A81-31387

## SUBJECT INDEX

Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-Aircraft wing weight build-up methodology with modification for materials and construction A81-31399 technigues [NASA-CE-166173] N81-23068 SUBSOILC AIRCRAFT V/STOL advanced technology rewards and risk --aircraft design [SAWE PAPER 1385] AE1-31401 SUBSOBIC FLOR Subsonic gas flow past a wing profile A81-31034 Concerning Khristianovich's transformation of a subsonic flow past an airfoil into a low-speed flow A81-31045 Subsonic and transonic flow on a wing at different sweep angles. I A81-31249 Subscnic and transonic flow on a wing at different sweep angles. II A81-31250 Experimental investigation of oscillating subsonic iets A81-32777 Some remarks on the unsteady airloads on oscillating control surfaces in subsonic flow N81-23055 lechnical evaluation report on the Pluid Dynamic Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics [AGABD-AB-146] N81-23431 SUBSONIC FLUTTER Measurement of the aerodynamic forces acting on a harmonically oscillating wing at high subsonic speeds A81-31042 Experimental flutter at high subsonic speeds and ving thickness and Reynolds number N81-23052 SUPBRCAVITATING FLOW Study of the characteristics of a base-vented wing in nonlinear theory [AAF FAFER NT 80-40] SUPBECRITICAL FLOW On the design of modern airfoil sections by A81-33927 numerical methods A81-30705 Pressure and force data for a flat wing and a warped conical wing having a shockless recomparession at Mach 1.62 [NASA-TE-1759] SUPBRCBITICAL WINGS NE1-22016 Comparison of computed and measured unsteady pressure fields on a supercritical wing [ONBBA, TP NO. 1981-12] Experimental studies of scale effects on A81-32541 oscillating airfoils at transonic speeds N81-23054 SUPERSONIC AIRCRAFT Transonic rotor noise - Theoretical and experimental comparisons A81-33049 Propellers for economic flight at high speeds [AAAF FAPEE HT 80-34] SUPBESONIC CONDUSTION A81-33936 Bultiple-scale turbulence modeling of boundary layer flows for scramjet applications [NASA-CB-3433] N81 NE1-23411 SUPBRSONIC CONBUSTION BANJET BUGINES C.N.E.E.A. ramjet test facilities A81-33265 SUPERSONIC COMMERCIAL AIR TRANSPORT Transonic flutter study of a wind-tunnel model of an arrow-wing superschic transport --- SCAT-15E model test in the Langley Transonic Dynamics Tunnel [NASA-TH-81962] N81-23071 SUPERSONIC SPEEDS Bing-body carryover at supersonic speeds with finite afterbodies A81-31622 An evaluation of a simplified near field noise model for supersonic helical tip speed propellers [ BASA-TH-81727 ] N81-22836

#### TEMPERATORS MEASORBOINT

SUPPORT SYSTEMS P-16 integrated logistics support: Still time to consider economical alternatives [PB81-137473] SUBFACE ACOUSTIC WAVE DEVICES N81-23079 AN/TPX-54 interrogator 181-31131 The behavior of guartz oscillators in the presence of accelerations --- in missile and aircraft time-frequency navigation systems A81-31285 SURPACE BANTGATION A microprocessor based land navigator A81-32833 SUBPACE FROPERTIES Procedure for pressure contact on high-power semiconductor devices free of thermal fatigue [NASA-TM-75733] N81-22054 Application of ion implantation for the improvement of localized corrosion resistance of M50 steel bearings [AD-A097230] 181-23466 SURFACE BOUGHNESS National runway friction measurement program [AD-A097334] N81-23097 SUBVRILLANCE Analysis, design and simulation of line scan aerial surveillance systems A81-32492 SURVEILLANCE BADAR Discrete Address Beacon System A81-31134 SURVRIS General Aviation Activity and Avionics Survey [AD-A097604] 181-23081 SURPTRACK BINGS Investigation of aerodynamic characteristics of wings having vortex flow using different numerical codes [NASA-CR-165706] N81-23034 SYSTEM EFFECTIVENESS A high performance TV camera for use in target acquisition and laser designator systems A81-31115 SYSTEM FAILURES Is it safe - The safety assessment of aircraft systems. IV - Methods, techniques, and organisation A81-33789 Detection and location of faults in onboard aircraft systems with the aid of the Automatic Fault Identification System (AFIS) N81-23022 SYSTEMS BEGINEBEING The Modular Life Cycle Cost Bodel for advanced aircraft systems - An overview [SAWE PAPER 1351] A81-31386 Design, development, and evaluation of lightweight hydraulic system, phase 1 --- A-7 aircraft [AD-A097505] N81-23075 SYSTERS INTEGRATION Rapport tactical self protection systems design 181-31113 A new generation IFF - The AN/API-100/V/ transponder 181-31132 Airborne electronic displays A81-32999 Demonstration Advanced Avionics System (DAAS) functional description --- Cessna 402B aircraft [NASA-CR-152405] N81-23080 SYSTERS SINULATION A digital-analog hybrid system and its application to the automatic flight control system simulation research [NASA-TH-76457] 881-22060 MLS: Airplane system modeling [NASA-CE-165700] N81-23059 for piloted simulators [NASA-TH-82600] 881-23085 Т

## TABGET ACQUISITION

A high performance TV camera for use in target acquisition and laser designator systems A81-31115

Autonomous target handoff from an airborne sensor to a missile seeker A81-32498 Advanced target tracking by dynamic scene analysis A81-32499 Technology growth in mini-RPV systems [AIAA FAPES 81-0936] TABGET BECOGRITION AE1-32937 Detection of target multiplicity using monorulse guadrature angle A81-32696 TECHNOLOGICAL FORECASTING Past and future trends in structures and dynamics --- of aircraft [AIAA FAPES 81-0896] A81-32921 Structural optimization - Past, present and future [AIAA PAPEE 81-0897] A&1-32922 The art of designing experimental aircraft - An overview [AIAA FAPES 81-0944] A81-32939 Maintenance tomorrow and the day after --- of wide-bodied transport aircraft 181-33790 Puture U.S. jet fuels - A refiner's viewpoint [AIAA PAPEB 81-0770] A8 TECENOLOGI ASSESSENT 181-33876 V/STOL advanced technology rewards and risk --aircraft design [SAWE PAPEE 1385] A81-31401 Airships - Transport of the future 181-31699 Structural optimization - Past, present and future [AIAA PAPES 81-0897] A61-329. AE1-32922 Army aviation - A perspective into the eighties [AIAA FAPE5 81-0931] 181-32935 Technology growth in mini-BPV systems [AIAA PAPBE 81-0936] 181-32937 Is s it safe - The safety assessment of aircraft systems. IV - Methods, techniques, and organisation A81-33789 Prop-Fan technical progress leading to technology readiness [AIAA FAFEE 81-0810] A&1-3. Rotorcraft aviation icing research requirements: 181-33878 Besearch review and recommendations [HASA-CB-165344] B£1-2307 DOD's use of remotely riloted vehicle technology offers opportunities for saving lives and dcllars NE1-23070 [AD-A097419] N81-23074 An evaluation of NASA's program for advancing rotorcraft technolcgy
[FB81-144180] N81-23078 TECHNOLOGY UTILIZATION Applications of new technology in the infrared AE1-31126 New technology applied to an IFF diversity transponder A81-31133 Advanced composites - Evolution of manufacturing technology [AIAA PAPES 81-0895] A81-32920 An evaluation of WASA's program for advancing rotorcraft technology [ FB8 1- 144180 ] 881-23078 TELEBETRY Measuring dynamic stresses on helicopter transmission gear teeth utilizing telemetry A81-32859 TELEVISION CAMERAS A high performance TV camera for use in target acquisition and laser designator systems AE1-31115 TESPERATURE DISTRIBUTION Computation of wall temperature and heat flux distributions of the film cooled walls A81-30802 TEAPEBATORE SPFECTS Factors which influence the behavior of turbcfan forced mixer nozzles [AIAA FAPEE 81-0274] A81-32549 TEMPERATORE ABASUBEMENT Investigation of the use of liquid crystal thermography to study flow over turbomachinery blades [AD-A097289] N81-23C89 Heat generation in aircraft tires under free rolling conditions

[NASA-CR-164273]

N81-23461

TEBSILE TESTS Tensile stress/strain characterization of non-linear materials A81-30915 TERMINAL CONFIGURED VIHICLE PROGRAM Antenna design and development for the microwave subsystem experiments for the terminal configured vehicle project [NASA-CR-164220] N81-22282 TEBRINAL PACILITIES An aircraft manufacturer's view of airport B6D needs [AIAA PAPER 81-0793] A81-33887 TERRAIN POLLOWING AIRCHAPT A study of the effect of terrain on helicopter noise propagation by acoustical modeling [AD-A097626] N81-23864 TEST PACILITIES The USAF Armament Division Structural Dynamics Lab A81-30689 Aerodynamic trials with the linear motor-driven platform at the Toulcuse Aeronautic Testing Center --- for aircraft acceleration and deceleration tests [AAAF PAPEE NT 80-41] A81-33943 TETHEBED BALLOOES Air Force Geophysics Laboratory aerodynamically tethered balloon, 45,000 cubic feet [AD-A096758] N81-2 N81-22023 THERBAL CICLING TESTS Method for evaluating the resistance of gas-turbine installation disks to thermal cycling A81-33168 THERMAL PATIGUE gas-turbine installation disks to thermal cycling A81-33168 Procedure for pressure contact on high-power semiconductor devices free of thermal fatigue [NASA-TM-75733] N81-22054 THERMAL RESISTANCE Method for evaluating the resistance of gas-turbine installation disks to thermal cycling A81-33168 THER MODY PANIC PROPERTIES Investigation of air solubility in jet A fuel at high pressures [NĂSA-CR-3422] THERBOPLASTIC RESINS N81-22130 Advanced fiber reinforced thermoplastic structures [AD-A096759] ¥81-22106 THERMOPLASTICITY Thermoplastic strengthening of a gas-turbine engine disk lock joint - Determination of the residual stresses A81-33169 THIN AIRFOILS Influence of hinge line gap on aerodynamic forces acting on a harmonically oscillating thin profile in an incompressible flow. 1, II A81-30956 Steady flow and static stability of airfoils in extreme ground effect A81-31686 THREE DIBERSICHAL PLON Topology of three-dimensional separated flows [NASA-TH-81294] N8 N81-23037 THRUST Full-scale aerodynamic characteristics of a propellar installed on a small twin-engine aircraft wing panel [NASA-TM-81285] TILT BOTOB BESEARCH AIBCRAPT FROGBAM N81-23039 V/STOLAND digital avionics system for XV-15 tilt rotor [NASA-CR+152320] N81-22047 TIBE DEPENDENCE Airborne method to minimize fuel with fixed time-of-arrival constraints A81-31297 Analysis of turbulent flow about an isolated airfoil using a time dependent Navier-Stokes procedure N81-23053 TIP SPRED Use of multiblade sensors for on-line rotor tip-path plane estimation A81-32010

#### SUBJECT INDEX

TITABION ALLOYS Aircraft applications of titanium - A review of the past and potential for the future [AIAA PAPEE 81-0893] A81-Service evaluation of aluminum-brazed titanium A81-32918 Service evaluation of aluminum-brazed (ABTi) --- aircraft structures [NASA-CE-3418] TOLREABCES (MECHABICS) Velocity tolerance of escape systems [AD-A096681] 581-22129 N81-22035 TOPOLOGY Topology of three-dimensional separated flows [NASA-TM-81294] BE NE1-23037 TOROUR Full-scale aerodynamic characteristics of a propellar installed on a small twin-engine aircraft wing panel [NASA-TH-81285] N81-23039 TOBSIONAL STRESS On St. Venant flexure and torsion problem for symmetrical airfoil sections A81-33245 TORSIONAL VIBRATION Coriolis effect on the vibration of flat rotating low aspect ratio cantilever plates A81-30914 TRACKING PILTERS Advanced target tracking by dynamic scene analysis A81-32499 Dynamic errors of the Kalman filtering of trajectory parameters --- for radar tracking of aircraft maneuvers A81-33687 TRAILING EDGES A computer code for the calculation of aircraft trailing vortices A81-30710 The displacement-thickness theory of trailing edge noise A81-30785 Steady flow and static stability of airfoils in extreme ground effect 181-31686 Experimental study of the separation at the trailing edge of an axisymmetrical contoured after-body A81-33281 Mean-flow and turbulence measurements in the vicinity of the trailing edge of an NACA (63 sub 1)-012 airfoil [NASA-TP-1845] N81-23410 TRAINING EVALUATION Application of signal detection theory to decision making in supervisory control - The effect of the operator's experience A81-31288 TRAIBING SINULATORS Operator training systems/simulators A81-31109 A simulator to test compressor research facility control system software A81-31110 SINCAT - A modular air traffic control simulator A81-33149 TRAJECTORY ABALYSIS Dynamic errors of the Kalman filtering of trajectory parameters --- for radar tracking of aircraft maneuvers A81-33687 TRANSISTOR AMPLIPIERS An X-band power GaAs PET amplifier for military avionics radar applications A81-31122 TRANSITION METALS Procedure for pressure contact on high-power semiconductor devices free of thermal fatigue [ NASA-TH-75733 ] ¥81-22054 TRANSMISSIONS (MACHINE ELEMENTS) Drive system technology advancements ---transmissions for CH-47D helicopter A81-32015 Beasuring dynamic stresses on helicopter transmission gear teeth utilizing telemetry A81-32859 TRAESOBIC PLON Subsonic and transonic flow on a wing at different sweep angles. I A81-31249

TUBBOPBOP ENGINES

Subsonic and transonic flow on a wing at different sweep angles. II 181-31250 Transonic viscous-inviscid interaction over airfoils for separated laminar or turbulent flows 181-31612 Technical evaluation report on the Pluid Dynamic Panel Symposium on Subsonic/Transonic Configuration/Aerodynamics TAGAED-AR-1461 N81-23431 TRANSOBIC FLUTTER Transonic flutter study of a wind-tunnel model of an arrow-wing supersonic transport --- SCAT-15P model test in the Langley Transonic Dynamics lunnel [NASA-TH-81962] N81-23071 Transonic flutter and gust-response tests and analyses of a wind-tunnel model of a torsion free wing airplane [NASA-TH-81961] N81-23072 TRANSONIC SPERD Transonic rotor noise - Theoretical and experimental comparisons A81-33049 Propellers for economic flight at high speeds [AAP PAPER NT 80-34] Experimental studies of scale effects on A81-33936 oscillating airfoils at transonic speeds N81-23054 TRANSONIC WIND TUNNELS Adaptive-wall wind-tunnel development for transonic testing A81-31367 Description of 0.186-scale model of high-speed duct of national transonic facility [NASA-TM-81949] N81-22061 High frequency drive mechanism for an active controls systems aircraft control surface N81-22400 Description of recent changes in the Langley 6- by 28-inch transonic tunnel [NASA-TH-81947] N81-23096 TRANSPONDERS A new generation IFF - The AN/APX-100/V/ transponder A81-31132 New technology applied to an IPP diversity transponder A81-31133 Summary of transponder data, May 1979. - November 1979 [AD-A097569] N81-23061 TRANSPORT AIBCRAFT Airborne method to minimize fuel with fixed time-of-arrival constraints A81-31297 Design considerations for future turboprop transports transports [SAWB PAPEB 1340] -53E combat survivability assessment and survivability enhancement program [SAWE PAPEB 1384] A81-31380 СН 181-31400 Airships - Transport of the future 181-31699 Comparison of computed and measured unsteady pressure fields on a supercritical wing [ONERA, TP BO. 1981-12] A81-32541 European approaches to transport aircraft design [AIAA PAPEB 81-0926] A81-32934 Maintenance tomorrow and the day after --- of wide-bodied transport aircraft 181-33790 Designing for aircraft structural crashworthiness [AIAA PAPEB 81-0603] A81-33 A81-33882 Generalized active control - Its potential and directions of research [AAAP PAPER NT 80-29] A81-33928 [AMAF FARES BI GU-29] Design considerations for composite fuselage structure of commercial transport aircraft [ BASA-CR-159296 ] 881-22419 TUMBLING SOTION Aircraft body-axis rotation measurement system [MASA-CASE-FRC-11043-1] B81 881-22048 TUBBINE BLADES A time marching finite volume method for tlade-to-blade flows using a body-fitted curvilinear mesh A81-30717

Experimental determination of the stress intensity factor for cracks with a curvilinear front in complex parts /gas turbine blades/ AE1-31264 Mechanical properties of aluminum coatings on beat-resistant steels A81-31668 Thermal and flow analysis of a convection air-cooled ceramic coated porous metal concept for turbine vanes [ BASA-TH-81749] N81-22056 TOBBINE BIGINES Combustion system processes leading to corrosive deposits [NASA-TH-81752] 881-23243 TUBBIEB INSTRUMENTS Centralized in-place pressure calibration system for multiple turbine engine aerodynamic pressure measurement systems A81-32847 Development of a noninterference compressor blade stress measurement system A81-32674 TURBINE WHERLS Bumerical methods for studying the stress-strain state and service life of aircraft gas-turbine engine disks A81-31258 Bethod for evaluating the resistance of gas-turbine installation disks to thermal cycling A81-33168 Thermoplastic strengthening of a gas-turbine engine disk lock joint - Determination of the residual stresses A81-33169 TURBINES Component research for future propulsion systems [NASA-TH-82613] N81-22055 TURBOCOMPBESSORS Study of the secondary flow in the downstream of a moving blade row in an axial flow fan A81-31767 TURBOPAN AIRCRAFT Frop-Fan technical progress leading to technology readiness [AIAA PAPER 81-0810] A81-33878 TUBBOPAN BIGINBS Quiet propulsive-lift technology ready for civil and military applications AE1-32521 Rolls-Boyce BB 211-535 power plant [AIAA FAPEE 81-0807] A81-3. CFM56-3 high by-pass technology for single aisle A81-33886 twins [AIAA FAPES 81-0808] A81-33689 Buergy efficient engine flight propulsion system: Aircraft/engine integration evaluation [NASA-CE-159584] 881-22051 Quiet Clean General Aviation Turbofan (QCGAT) technology study, volume 1 [NASA-CE-164222] N81-22052 Design concepts for low-cost composite turbofan engine frame [NASA-CB-165217] ¥81-22053 TUBBOPADS Pactors which influence the behavior of turbofan forced mixer nozzles [AIAA PAPEB 81-0274] A81-32549 TURBOJET BEGINES Investigations into local fault detection on turbojet engines --- monitoring instruments N81~23011 TURBORACHINBRY NASA's aeronautics research and technology hase [NASA-CB-164195] 881-22969 Classification of operating conditions of turbomachines from solid borne sound NE1-23015 TUBBOPEOP AIECEAPT Prop-Pan technical progress leading to technology readiness [AIAA PAPER 81-0810] AE1-33878 TURBOPBOP BEGINES Design considerations for future turboprop transports [ SAWE PAPER 1340 ] A81-31380

## TURBULBECE BPFECTS

SUBJECT INDEX

TURBULBBCE BPFBCTS Pactors which influence the behavior of turbofan forced mixer nozzles [AIAA PAPES 81-0274] A81-32549 TURBULENT BOUNDARY LAYER The displacement-thickness theory of trailing edge noise A81-30785 Role of laminar separation bubbles in airfoil leading-edge stalls A81-31613 Mean-flow and turbulence measurements in the vicinity of the trailing edge of an NACA (63 sub 1)-012 airfoil NASA-TP-1845] N81-23410 TURBULRNT PLOS Transonic viscous-inviscid interaction over airfoils for separated laminar or turbulent flows A81-31612 Analysis of total and static pressure fluctuations in an air intake at high incidence [AAAP PAPEB NT 80-61] A81-33950 Analysis of turbulent flow about an isolated airfoil using a time dependent Navier-Stokes procedure ¥81-23053 Hultiple-scale turbulence modeling of boundary layer flows for scranjet applications [NASA-CB-3433] 881 N81-23411 TORBOLENT JETS Experimental investigation of oscillating subscnic jets A81-32777 TURBULENT BIXING Hultiple-scale turbulence modeling of boundary layer flows for scramjet applications [NASA-CR-3433] N81 N81-23411 TURBULERT WAKES The propeller tip vortex. A possible contributor to aircraft cabin noise [NASA-TH-81768] N81-22838 TWO DIBENSIONAL PLON Adaptive-wall wind-tunnel development for transonic testing A81-31367

# U

UH-1 HELICOPTER	
Acoustic performance evaluation of an advan	ced
OH-1 helicopter main rotor system	
TAHS PAPER 81-581	A81-33952
UH-60A HELICOPTER	
Modern techniques of conducting a flight lo	ads
survey based on experience gained on the	Black
Bawk helicopter	
•	A81-32014
ULTRASONIC FLAW DETECTION	
In-flight fatigue crack monitoring using ac	oustic
emission	
	A81-32857
UNSTRADY FLOW	
Unsteady aerodynamics of an aerofoil at high	jh angle
cf incidence performing various linear	
oscillations in a uniform stream	
	A81-32017
Comparison of computed and measured unstead	ly
pressure fields on a supercritical wing	
[ONEBA, IP NC. 1981-12]	A81-32541
UPPBE SUBPACE BLOWING	
Quiet propulsive-lift technology ready for	civil
and military applications	
	A81-32521
UBSTEANES	
Erosion resistant coatings	
[NASA-TH-75870]	N81-22098
USER MANUALS (CONPUTER PROGRAMS)	
Structural flight loads simulation capabili	ity.
Volume 2: Structural analysis computer p	rogram
user's manual	
[AD-A096594]	N81-22045
User's manual for flight Simulator Display	System
(PSDS)	
[NASA-CE-164295]	N81-23095

## V

V/STOL AIRCRAFT V/STOL advanced technology rewards and risk --aircraft design [SAWE PAPER 1385] A81-31401 A design analysis technique for evaluating size and weight of V/STOL lift fans [ SAWE PAPEE 1386 ] A81-31402 V/STOLAND digital avionics system for XV-15 tilt rotor [NASA-CB-152320] N81-22047 Analysis of wind tunnel test results for a Analysis of wind tonnel test festils for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Study overview --- aerodynamic characteristics [NSA-CE-152391-VOL-1] B Analysis of wind tunnel test results for a 9.39-per cent centor performed N81-23030 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Evaluation of prediction methodologies [NASA-CR-152391-VOL-2] N81-23031 Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effects of configuration variations from baseline [NASA-CR-152391-VOL-3] N81-23032 Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 4: BALS B104 aerodynamic characteristics and comparisons with B205 configuration aercdynamic characteristics [NASA-CE-152391-VOL-4] NE1-2: NE1-23033 Method for predicting the jet-induced aerodynamics of V/STOL configurations in transition [AC-A097356] VARIABLE GROWEREW STRUCTOBES N81-23043 Experimental determination of the stress intensity factor for cracks with a curvilinear front in complex parts /gas turbine blades/ A81-31264 VARIABLE SEEEP SINGS Subsonic and transonic flow on a wing at different sweep angles. I A81-31249 Subsonic and transonic flow on a wing at different sweep angles. II A81-31250 VECTOR ABALYSIS A study of real-time computer graphic display technology for aeronautical applications [NASA-CB-164221] N81-22727 VELOCITY MEASUBBABBT Airborne ground velocity determination by digital processing of electro-optical line sensor signals A81-32496 VHP CHNIBABGE BAVIGATION Besults of a Loran-C flight test using an absolute data reference --- whf monirange navigation system and discrete address beacon system N81-22006 VIBRATION DAMPING Test procedures used in determining aircraft suitability for STAN integral weight and balance system [SAWE PAPER 1339] A81-31379 Reduction of helicopter vibration through control of hub-impedance A81-32009 Helicopter vibration control - A survey A81-33047 A new method for modal identification A81-33293 The development of a theoretical and experimental model for the study of active suppression of wing flutter N81-22058 VIBRATICE ISOLATORS Floor and fuel vibration isolation systems for the Boeing Vertol commercial Chinook A81-32016 Helicopter vibration control - A survey A81-33047 VIBRATICE MEASUREMENT High frequency angular vibration measurements in vebicles [AAS PAPER 81-024] A81-32886

BIBD TOBBEL TESTS

VIBRATION MODE	
Inflight aircraft vibration modes and their	effect
on aircraft radar cross section	
	181-31370
A new method for modal identification	201 01010
I Det Betrad for Bodar Idenetitodeton	181-33293
VIDRO COMMUNICATION	401 33233
Interna design and development for the mice	OVATO
subsystem experients for the terminal	
configured Rebicle project	
(NASA-CR-1642201	NG 1-22292
VISCORS PLON	501 22202
New interpretations in the theory of wisco	1C
incompressible fluid flow mast airfeil m	refiler
incompleasing tide field file base differi b	191-31000
Analysis of turbulant flow about an isolate	A01-31044
airfoil neine a time dependent Nation-Ch.	eu
arrivit using a time dependent savier-st	JKES
Frocedure	101-22052
Proprimental studies of scale officets on	801-23033
occillating simfoils at transcopic speeds	
oscillating allights at transpute speeus	801-33650
	861-23054
VISUAL PERCEPTION	
A MICLOCOMPULET-DASED SIGNAL DATA CONVERTER	E TOL
Langa visual range measurements	804 330/0
	N81-23060
Personal of locking adds member flow	
and 76 degree delte wines	01 60
and vo degree derta wings	101 31360
	801-31308
Computer code for the calculation of sim	
A computer code for the calculation of allo	Start
clatting vortices	101 20710
Rectance which influence the behavior of the	A81-30/10
Factors which influence the cenavior of tu	cooran
LOLCEU BIREL MOZZIES	101-33500
LAIAA PAPED 81-02/4	A81-32549
vortex-riow aerodynamics - An emerging des:	ign
capability	101 33343
The preveller the sector is section to	A81-33/1/
The properiet tip vortex. A possible conti	cibutor
LU GILCEGIL CADIB BOISE	801 22020
[BASATINTOING]	881-22838
inco boring matter flow main a different	S 01
wings having vorter flow using different	
numerical codes	
[ BASA-CH-105/06 ]	NB1-23034

W

Wendimonoional consideration abaranteristica	
Two-dimensional aerodynamic characteristics	or the
MACA UUIZ alfroll in the langley 8 foot	
transonic pressure tunnel	
[NASA-TH-81927]	N81-23036
VALL TEMPERATURE	
Computation of wall temperature and heat fl	u x u
distributions of the film cooled walls	
	A81-30802
WAR GAMES	
The variable-speed tail-chase aerial combat	problem
•	A81-31295
WARNING SYSTEMS	
Rapport tactical self protection systems de	sian
	A81-31113
Detection and location of faults in onboard	
aircraft Systems with the aid of the Auto	natic
Pault Identification System (APIS)	
ident identification plates (allo)	N81-73022
#1545 N4TIT914TAN	801-23022
Silver recever from sizesit cores	
CDB01-1600283	¥91 333/0
	801-23209
Balian and tothing of floot londing over th	
Design and testing of float landing gear sy	Stems
for helicofters	
	A81-32007
VEAPOR SISTER RANAGEBEET	
Development of maintenance metrics to forec	ast
resource demands of weapon systems. Anal	ysis
and evaluation, revision A	
[AD-A096688]	81-22971
Development of maintenance metrics to forec	ast
resource demands of weapon system. Maint	enance
metrics and weightings, revision A	
[AD-A096689]	N81-22972
Development of maintenance metrics to forec	ast
resource demands of weapon systems. Anal	VSIE
and results of metrics and weightings, re	vision A
[AD-A096690]	881-22973
[]	551 22375

- 100150105
[AD-A097517] #81-23937
BEAPON SYSTEMS
The USAF Armament Division Structural Dynamics Lab
Development of maintenance metrics to forecast
resource demands of weapon systems. Analysis
and evaluation, revision A [AD-A096688] N81-22971
Development of maintenance metrics to forecast
resource demands of weapon system. Maintenance
Detrics and weightings, revision A [AD-A096689] NP1-20972
Development of maintenance metrics to forecast
resource demands of wearon systems. Analysis
and results of metrics and weightings, revision A ran-A0966901 N81-22973
Development of maintenance METBICS to forecast
resource demands of weapon systems (parameter
polarization), revision A (An-A0976921 N81-23325
WEAR STOLEY
X-ray fluorescence spectrometric analysis of wear
Detais 1D used lubricating oils [AD+A097552] N81-23087
WEAR TESTS
Bearing wear detection using radioactive iron-55
tagging FASLE FREFTNE 81+IM-61+31 A81-33868
WEATHER RECORDALISSANCE ALECEAPT
Investigative technical measurements of the
planetary boundary layer made obboard an instrumented motorized glider
[BEPT-149] B81-22666
VEIGHT (BASS)
bydraulic system, phase 1 A-7 aircraft
[AD-A097505] N81-23075
WEIGHT AWALYSIS
engineering aircraft design
[SAVE FAPEE 1346] A81-31384
A design analysis technique for evaluating size
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system A81-32860
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [MASA-CE-166173] N81-23068
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [MASA-CE-166173] WEIGHT MEMSUREMENT Design, fabrication, calibration, application, and
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [MASA-CE-166173] WEIGHT MEMSUREMENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [NSA-CE-166173] N81-23068 WEIGHT MEASUREMENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-31399 WEIGHT OF MEASUREMENT
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [MSA-CE-166173] N81-23068 WEIGHT MEASUREMENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAVE PAPER 1383] A81-31399 WEIGHT BEDOCTION An extremely lightweight fuselage-integrated
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [NSA-CE-166173] N81-23068 WEIGHT MEASUBERENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPEE 1383] A81-31399 WEIGHT BEDOCTION An extremely lightweight fuselage-integrated phased array for airbcrne applications
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [WASA-CE-166173] N81-23068 WEIGHT MEASUREMENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-31399 WEIGHT BEDOCTION An extremely lightweight fuselage-integrated phased array for airbcrne applications A81-30779 The structural weight fraction = Periotited for
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [WASA-CB-166173] N81-23068 WBIGHT MEASUREMENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-31399 WBIGHT BEDOCTION An extremely lightweight fuselage-integrated phased array for airbcrne applications A81-30779 The structural weight fraction - Revisited for fighter,attack type aircraft
<pre>A flight test real-time GW-CG computing system</pre>
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [WASA-CB-166173] N81-23068 WEIGHT MEASOBERENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-31399 WEIGHT BEDUCTION An extremely lightweight fuselage-integrated phased array for airbcrne applications A81-30779 The structural weight fraction - Bevisited for fighter/attack type aircraft [SAWE FAPEE 1365] A81-31387 FABAM - A new weight sizing routine cost-effective computerized design for aircraft
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [NASA-CE-166173] N81-23068 WEIGHT MEASUBERENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPEN 1303] A81-31399 WEIGHT BEDUCTION An extremely lightweight fuselage-integrated phased array for airborne applications A81-30779 The structural weight fraction - Bevisited for fighter/attack type aircraft [SAWE FAPEN 1365] A81-31387 FABAM - A new weight sizing routine cost-effective computerized design for aircraft [SAWE FAPEN 1367] A81-31389
A flight test real-time GW-CG computing system A81-32860 Aircraft wing weight build-up methodology with modification for materials and construction techniques [NASA-CB-166173] N81-23068 WEIGHT MEASUBERENT Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAVE PAPEN 1383] A81-31399 WEIGHT BEDUCTION An extremely lightweight fuselage-integrated phased array for airborne applications A81-30779 The structural weight fraction - Bevisited for fighter/attack type aircraft [SAVE FAPEN 1365] A81-31387 FABAM - A new weight sizing routine cost-effective computerized design for aircraft [SAVE FAPEN 1367] A81-31389
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system
A flight test real-time GW-CG computing system

SUBJECT INDEX

Two-dimensional aerodynamic characteristics of the NACA 0012 airfoil in the Langley 8 foot transonic pressure tunnel [NASA-TM-81927] N81-23036 Full-scale aerodynamic characteristics of a propellar installed on a small twin-engine aircraft wing panel [WASA-TH-81285] B81-2. Oscillatory flows from shock induced separations on biconver aerofoils of varying thickness in N81-23039 ventilated wind tunnels N81-23056 Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CE-152336-2] N81-23065 Comparison of theoretical predictions of orbiter airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TH-81358] N81-23( Transonic flutter study of a wind-tunnel model of N81-23066 an arrow-wing supersonic transport --- SCAT-15F model test in the Langley Transonic Dynamics Тиллеі [NASA-TM-81962] N81-23071 WIND TUNBEL WALLS Adaptive-wall wind-tunnel development for transonic testing A81-31367 WIED TUNNELS Description of 0.186-scale model of high-speed duct of national transonic facility [NASA-TH-81949] N81-22061 WINDSHIBLDS Techniques for evaluation of aircraft windscreen optical distortion A81-32507 WING FLOW METHOD TESTS Calculation of the flow pattern behind an aircraft wing A81-31041 NIEG LOADING Concepts for improving the damage tolerance of composite compression panels A81-32825 Comparison of theoretical predictions of orbiter airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TH-81358] N81-23066 WING OSCILLATIONS Influence of hinge line gap on aerodynamic forces acting on a harmcnically oscillating thin profile in an incompressible flow. I, II A81-30956 Measurement of the aerodynamic forces acting on a harmonically oscillating wing at high subsonic speeds A81-31042 Comparison of computed and measured unsteady pressure fields on a supercritical wing [ONEEA, TP NO. 1981-12] A new method of airfoil flutter control A81-32541 A81-33844 An asymptotic unsteady lifting-line theory with energetics and optimum metion of thrust-producing lifting surfaces [NASA-CB-165679] N81-23035 Experimental studies of scale effects on oscillating airfoils at transonic speeds N81-23054 Some remarks on the unsteady airloads on oscillating control surfaces in subsonic flow N81-23055 WING PLANFORMS Study of the characteristics of a base-vented wing in nonlinear theory [AAAP PAPER NT 80-40] WING PROFILES 181-33927 A theoretical treatment of lifting surface theory of an elliptic wing 181-30653 Subsonic gas flow past a wing profile A81-31034 Study of a propulsive system --- aerodynamic characteristics of proposed model A81-33673

Vortex-flow aerodynamics - An emerging design capability A81-33717 Experimental flutter at high subsonic speeds and its theoretical prediction, taking into account wing thickness and Reynolds number 881-23052 BINGS Structural flight loads simulation capability, volume 1 [AD-A096572] 881-22044 Structural flight loads simulation capability. Volume 2: Structural analysis computer program user's manual [AD-A096594] N81-22045 The development of a theoretical and experimental model for the study of active suppression of wing flutter N81-22058 An asymptotic unsteady lifting-line theory with energetics and optimum motion of thrust-producing lifting surfaces [NASA-CR-165679] N81-23035 Aircraft wing weight build-up methodology with modification for materials and construction techniques [NASA-CR-166173] N81-23068 FORK EABDENING Increasing the strength properties of sheet parts by explosive forming of them with optimization of the production parameters A81-33174 X

I BAY FLUCEBSCENCE X-ray fluorescence spectrometric analysis of wear metals in used lubricating oils [AD-A097552] B81-23087 I BAY SFECTBOSCOPY X-ray fluorescence spectrometric analysis of wear metals in used lubricating oils [AD-A097552] N81-23087 I DING ROTORS Application of an aerodynamic configuration modeling technique to the design and analysis of X-Wing aircraft configurations A81-32013 XV-15 AIRCRAPT V/STOLAND digital avionics system for XV-15 tilt ICTOL [NASA-CE-152320] N81-22047 Preliminary design study of advanced composite blade and hub and nonmechanical control system Volume 1: for the tilt-rotor aircraft. Bngineering studies
[NASA-CB-152336-1] 881-23064 Preliminary design study of advanced composite blade and bub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data [NASA-CE-152336-2] B81-23065

# PERSONAL AUTHOR INDEX

## AERONAUTICAL ENGINEERING / A Continuing Bibliography (Suppl. 138)

## AUGUST 1981

## **Typical Personal Author Index Listing**



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The accession number is located beneath and to the right of the title, e.g. N81-11043. Under any one author's name the accession numbers are arranged in sequence with the *IAA* accession numbers appearing first.

Α ABBINK, P. J. Navaids calibration evaluation with a computer-controlled avionics data acquisition system N81-23020 ABBAHAM, M. Analysis, design and simulation of line scan aerial surveillance systems A81-32492 ABBAIMOV, D. V. Mechanical properties of aluminum coatings on heat-resistant steels A81-31668 ACE, R. R. Candidate CDTI procedures study [NASA-CR-165673] N81-22032 ADACHÌ, T. Study of the secondary flow in the downstream of a moving blade row in an axial flow fan A81-31767 ADAMSOB, W. M. Prop-Pan technical progress leading to technology readiness [AIAA PAPEE 81-0810] A81-33878 ABNADI, A. B. An asymptotic unsteady lifting-line theory with energetics and optimum action of thrust-producing lifting surfaces [NASA-CE-165679] B81-2 881-23035 ABBED, S. R. Computation of pressure distribution on the DFVLR ving-body model by the panel method [DFVLR-FB-80-02] N81-22029 ALBEBCHT, C. Drive system technology advancements A81-32015 ALCEDO, A. H. Design and testing of float landing gear systems for helicopters A81-32007 ALCOBTA, J. A. Bearing wear detection using radioactive iron-55 tagging [ASLE PREPRINT 81-AM-6A-3] 181-33868 ALEXANDER, H. E. Preliminary design study of advanced composite blade and bub and nonnechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] 881-23064

ANDERSON, B. H.	
Pactors which influence the behavior of tu	rbofan
forced mixer bozzles [AINA PAPER 81-0274]	<b>≥</b> 81-32549
ANDERSON, W. J.	
Inflight aircraft vibration modes and thei on aircraft radar cross section	r effect
	181-31370
ANDREWS, J. W. Plectronic flight rules: An alternative	
separation assurance concept	
(AD-A097570)	N81-23063
Comparison of computed and measured unstea	dy
pressure fields on a supercritical wing	-
{ONERA, TP NO. 1981-12] ARLAN, L.	A81-32541
A high performance TV camera for use in ta	rget
acquisition and laser designator systems	481-31115
ABLAZOBOV, M.	201 01110
Propeller and wing	101-21606
ASCH, A. B.	¥01~33030
Forward-looking infrared /PLIR/ sensor for	
autobomous Vehicles	A81-32490
ASSEO, S. J.	
Detection of target multiplicity using mon quadrature angle	opulse
30002-0120	A81-32696
В	
A mobile emissions laboratory for on-line	analysis
of combustion products from gas turbine	engines 181-32872
BADER, B. S. Past and future trends in structures and d	vnamics
[AIAA PAPEB 81-0896]	A81-32921
BAGANOPP, D.	
helicopter rotor flow fields	
[NASA-CB-164293]	N81-23433
Aircraft modification management evaluatio	D
[AD-A096458]	N81-22974
Development of a noninterference compresso	r blade
stress measurement system	
BANDA, S. S.	A01-J2074
Maximum likelihood identification of aircr	aft
lateral parameters with unsteady aerodyn modelling	auic
	₩81-22057
BARAN, B. A. Digital Avionics Information System (DAIS)	-
Volume 1: Impact of DAIS concept on lif	e cycle
cost ( hp_h0973391	NA1-23083
Digital Avionics Information System (DAIS)	
Volume 2: Impact of DAIS concept on lif	e cycle
	N81-23084
BABLON, P. B.	
ruil-scale aerodynamic Characteristics of propellar installed on a small twin-engi	a De
aircraft wing panel	NO4 00000
[BASA-TM-81285] BABSCEDORF, D.	881-23039
Classification of operating conditions of	
torhomachines from solid borne sound	
	N81-23015

BATRIN, L. B. Thermoplastic strengthening of a gas-turbine engine disk lock joint - Determination of the residual stresses 181-33169 BRAUSSIER, J. The behavior of quartz oscillators in the presence of accelerations A81-31285 BECHER, J. Antenna design and development for the microwave subsystem experiments for the terminal configured vehicle project [NASA-CB-164220] N81-22282 BRUECER, W. The reconstruction of flight paths from AIDS data with the aid of modern filtering methods N81-23021 BEBAK, P. New interpretations in the theory of viscous incompressible fluid flow past airfoil profiles A81-31044 BERTON, P. O.N.B.R.A. ramjet test facilities A81-33285 BETBILLE, R. H. European approaches to transport aircraft design [AIAA PAPER 81-0926] A81-32934 BEVAN, A. Rotorcraft aviation icing research requirements: Research review and recommendations [NASA-CE-165344] N81-2 N81-23070 BHAT, W., V. Noise characteristics of two parallel jets with unequal flow [AIAA PAPER 80-0168] A81-31601 BISHOP, H. B. The bearingless main rotor A81-32008 BISSEBET, A Application of signal detection theory to decision making in supervisory control - The effect of the operator's experience A81-31288 BLACKNAN, C. P. The development of the secondary wing structure for a rigid wing hang glider [80-251] N81-22046 BLASECZYE, J. Finite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane A81-33736 BOGNER, P. K. Structural flight loads simulation capability, volume [AD-A096572] 881-22044 Structural flight loads simulation capability. Volume 2: Structural analysis computer program user's manual [AD-A096594] N81-22045 BORISBVICH. V. K. Increasing the strength properties of sheet parts by explosive forming of them with optimization of the production parameters A81-33174 BOUCHARD. H. P. Structural flight loads simulation capability. Volume 2: Structural analysis computer program user's manual [AD-A096594] N81-22045 BOURIOT, M. Analysis of total and static pressure fluctuations in an air intake at high incidence [AAAF PAPES NT 80-61] A81-33950 BOUSQUET, J.- H. Propellers for economic flight at high speeds [AAAF PAPER NT 80-34] A81-33936 BREAKWELL, J. V. The variable-speed tail-chase aerial combat problem A81-31295 BRENECE, B. L Investigation of the use of liquid crystal thermography to study flow over turbomachinery hlades [AD-A097289] 181-23089 BRIDBLANCE, J. P. Analysis of axial fan noise with the help of the Lowson formalism [AAAF PAPER NT 80-54] A81-33948

#### PERSONAL AUTHOR INDEX

BRISTOL. H. A.

Digital Avionics Information System (DAIS).	
Volume 1: Impact of DAIS concept on life	e cycle
cost	
[AD-A097339]	N81-23083
Digital Avionics Information System (DAIS).	
Volume 2: Impact of DAIS concept on life	e cycre
cost. Supplement	No.4 0 300.
	881-23084
Controlized in-place processo calibration (	anct on
for multiple turbine engine serodynamic	SYSLE#
moastrement systems	ressure
readerence officer	A81-32847
BROCKNAN, D. N.	
A flight test real-time GH-CG computing sys	stem
	A81-32860
BROOME, K. B.	
An X-band power GaAs PET amplifier for mil:	itary
avionics radar applications	
	<b>▲81-31122</b>
BROWN, E. R.	
Fuel/engine/airframe trade off study	
[AD-A097391]	N81-23073
BROWNSTRIN, Bo	
A simulator to test compressor research iad	cility
control system sortware	301-21110
RPOR V	ACI-SIIIO
Concerning Khristianovich's transformation	of a
subsonic flow past an airfoil into a low-	speed
flow	
	A81-31045
BRUNBR, T. S.	
Structural flight loads simulation capabil:	ity.
Volume 2: Structural analysis computer p	program
user's manual	
[AD-A096594]	881-22045
BURKE, J. D.	
Sun powered allerait design	101-22022
LALAS PAPES OF-USIO	A01-32332
Ruel (ongine /airframe trade off study	
[AD-A097391]	N81-23073
BURRIN, R. H.	201 200.0
Installation effects on propeller noise	
[AIAA PAPEE 80-0993]	A81-31369
BYERS, B. H.	
A simulator to test compressor research fa	cility
control cuctor cofture	-
control system soltante	
CONTROL SISTEM SOLU-ALE	- A81-31110

# C

CAIAFA, C. Designing for aircraft structural crashworthiness [AIAA PAPER 81-0803] A81-338 CALISE, A. J. Application of variable structure system theory to A81-33882 aircraft flight control [NASA-CB-164321] N81-23093 CALLINAN, B. J. Developments in the analysis and repair of cracked and uncracked structures A81-31561 Structural design of BPRP patches for Mirage wing repair [AD-A097195] N81-23024 CAMARBEDO, B. A time marching finite volume method for blade-to-blade flows using a body-fitted curvilinear mesh A81-30717 CAMPBELL, J. P. Vortex-flow aerodynamics - An emerging design capability A81-33717 CANTEBLL, B. B. Maxinum likelihood elevation angle estimates of radar targets using subapertures A81-32691 CARTER, A. L. Comparison of theoretical predictions of orbiter airloads with wind tunnel and flight test results for a Mach number of 0.52 [NASA-TH-81358] ₩81-23066 CHAMBEBS, D. H. Silver recovery from aircraft scrap [PB81-150021] N81-23269

CHATTOT, JJ. Pressure distribution computation on a non symmetrical helicopter blade in forward	a-lifting flight A81-33291
CHEN, B. T. N. Kinematic properties of the belicopter in	
coordinated turns	
[NASA-TP-1773] CHENC P. M. H.	N81-22039
The 'light-weight' system - A novel concept on-board weight and balance measurement	t for using
[SAWE PAPER 1336] CHEBNIARV, B. P.	A81-31377
Method for evaluating the resistance of	
gas-turbine installation disks to therma	A81-33168
CHERNIAVSKII, O. P. Mothod for evaluating the resistance of	
gas-turbine installation disks to there	Al cycling A81-33168
Technology growth in mini-BPV systems	
[AIAA PAPEB 81-0936]	A81-32937
Hodern techniques of conducting a flight :	loads
survey based on experience gained on the	e Black
Hawk helicopter	A81-32014
CIPOLLA, F. B.	
A 7.5-GHZ BICFOSTFIP phased array for aircraft-to-satellite compunication	
	A81-30776
CLARE, D. E.	מר
modeling technique to the design and and	alysis of
<b>X-Wi</b> ng aircraft configurations	181-32013
CLARE, S. K.	201 32013
Heat generation in aircraft tires under fi	ree
[NASA-CB-164273]	N81-23461
CLAYTON, C. R. Application of ion implantation for the	
improvement of localized corrosion resis	stance of
M50 steel bearings [ND-N097230]	NB1-23466
COCREANE, J. A.	
Quiet propulsive-lift technology ready for and military applications	r civil
CORR. N	A01-32521
Antenna design and development for the hid subsystem experiments for the terminal	crowawe
configured vehicle project	NO.4 00000
COLLARD, #-	NO 1-22282
Global optimization of a glider	104 22022
COLLINGS, D- J-	A01-33937
Experimental investigation of oscillating	subscnic
	A81-32777
CULLIBS, B. P. Energy modeling for aviation fuel efficient	IC V
[AIAA PAPER 81-0789]	A81-33883
COLLINS, J. H. A review of current and future components	for
electronic warfare receivers	
CONNER. D. A.	A81-32252
Acoustic performance evaluation of an adva	anced
UH-1 DELICOPTER main rotor system [AHS PAPER 81-58]	A81-33952
COBREA, S. M.	
Inflight alforatt vibration modes and the on gircraft radar cross section	LI ellect
CORSIGLIA, V. E.	A81-31370
Pull-scale aerodynamic characteristics of	a ·
propertat installed on a swall twin-eng: aircraft wing panel	Lue
[HASA-TH-81285]	NØ1-23039
CUSTOLLOE, 5. P. Patione life variability in aluminum allow	1
aircraft structures	
(10-10-10-10-10-10-10-10-10-10-10-10-10-1	N81-23249

COUCHET, G.	
Study of a propulsive system	101-17472
COUPRY G.	¥01-33013
A new method for modal identification	
	A81-33293
COUSTOR, R.	
Comparison of computed and measured unstead	a y
pressure fields on a supercritical wing	
[ONBEA, TP NO. 1981-12]	<b>∆81-32541</b>
CONDIN, K. T.	
Aircraft body-axis rotation measurement sys	STED NO1 220000
[NASA-CASE-FEC-11043-1]	801-22048
The impact of the all Electric Airplane on	
production engineering	
LATAA PAPER 81-08481	181-12909
CROSS, B. J., JE.	
An experimental investigation of the aerod	ynamics
and cooling of a horizontally-opposed air	c-cooled
aircraft engine installation	
[ NA SA-CB-3405 ]	81-22015
[NASA-CE-3405] CROSSLEY, P. A.	N81-22015
[NASA-CE-3405] CEOSSLEY, P. A. Aircraft applications of titanium - A revie	₿81-22015 e¥ of
[ MASA-CE-3405] CBOSSLBI, F. A. Aircraft applications of titanium - A revio the past and potential for the future	981-22015
[ MASA-CE-3405] CROSSLEY, F. A. Aircraft applications of titanium - A revi the past and potential for the future [AIAA PAPEB 81-0893]	881-22015 ew of A81-32918
[ HASA-CE-3405] CROSSLEY, F. A. Aircraft applications of titanium - A revia the past and potential for the future [AIAA PAPER 81-0893] CUBRY, A. L. PAPER DEST design loads pro-	981-22015 ev of A81-32918
[ HASA-CE-3405] CROSSLRI, F. A. Aircraft applications of titanium - A revie the past and potential for the future [AIAA PAPEB 81-0893] CUBRY, A. L. BAPIDLOADS - A preliminary design loads pro- technique for aircraft	981-22015 ew of A81-32918 ediction
[ MASA-CE-3405] CBOSSLBI, F. A. Aircraft applications of titanium - A revia the past and potential for the future [AIAA PAPER 81-0893] CUBBY, A. L. BAPIDLOADS - A preliminary design loads pro- technique for aircraft [ SARP PAPER 13661	981-22015 ew of A81-32918 ediction A81-31388
[ MASA-CE-3405] CROSSLEY, F. A. Aircraft applications of titanium - A revio the past and potential for the future [AIAA PAPER 81-0893] CUBEY, A. L. BAFIDLOADS - A preliminary design loads pro- technique for aircraft [SAWE PAPER 1366] CUBETS. H.	981-22015 ev of A81-32918 ediction A81-31388
[ HASA-CE-3405] CROSSLEY, F. A. Aircraft applications of titanium - A revie the past and potential for the future [AIAA PAPEB 81~0693] CUBER, A. L. BAFIDLOADS - A preliminary design loads pro- technique for aircraft [ SAWE PAPEE 1366] CUBTIS, H. General aviation airplane fuel economy systeming General aviation fuel economy systeming General aviation airplane fuel economy systeming General aviation airplane fuel economy systeming General aviation fuel economy syst	881-22015 ev of A81-32918 ediction A81-31388 tem model
[ MASA-CE-3405] CBOSSLBI, F. A. Aircraft applications of titanium - A revie the past and potential for the future [AIAA PAPBE 81-0893] CUBBI, A. L. BAPIDLOADS - A preliminary design loads pro- technique for aircraft [ SAWE PAPBE 1366] CUBMIS, H. General aviation airplane fuel economy system	<pre>&gt;81-22015 ev of A81-32918 ediction A81-31388 tem model &gt;81-22011</pre>
[ MASA-CE-3405] CBOSSLBI, F. A. Aircraft applications of titanium - A revia the past and potential for the future [AIAA PAPER 81-0893] CUBRI, A. L. BAPIDLOADS - A preliminary design loads pro- technique for aircraft [SAWE PAPER 1366] CUBRIS, H. General aviation airplane fuel economy syst CUSHIBI, A.	<pre>&gt;81-22015 ev of</pre>
<pre>[ MASA-CE-3405] CBOSSLBY, F. A. Aircraft applications of titanium - A revio the past and potential for the future [AIAA PAPER 81-0893] CUBEY, A. L. BAFIDLOADS - A preliminary design loads pro technique for aircraft [ SAWE PAPER 1366] CUBETIS, B. General aviation airplane fuel economy syst CUSHINI, A. Erosion resistant coatings</pre>	881-22015 ev of A81-32918 ediction A81-31388 tem model B81-22011
[ MASA-CE-3405] CROSSLEY, F. A. Aircraft applications of titanium - A revie the past and potential for the future [AIAN PAPEB 81~0893] CUBEY, A. L. BAPTDLOADS - A preliminary design loads pro- technique for aircraft [ SAWE PAPEE 1366] CUBTIS, H. General aviation airplane fuel economy syst CUSHIMI, A. Erosion resistant coatings [ MASA-TH-75870]	N81-22015 ev of A81-32916 ediction A81-31388 tem model N81-22011 N81-22098

# D

DADOBE, L.

Rotorcraft aviation icing research requirem	ents:
Research review and recommendations	
[NASA-CH-165344]	N81-23070
DAEL, G.	
Location of faults in jet engines by calcul of component characteristics	ation.
•••••	N81-23012
Reduction of measured data and possibilitie	s for
early detection of sensor break-down	
carry account of perper preak down	NO1-22016
5) KOTODOB 1	801-23010
Broadhand helicopter rotor holse	
[AAAF PAPER NT 80-58]	A81-33949
DANIBLSON, G. L.	
Aircraft guality assurance using close-rang	e
photogrammetry	
	A81-32508
DABO, J. H.	
AN/TPX-54 interrogator	
<b>,</b> · · · - <b>,</b> · · · · · · · · · · · · · · · · · · ·	A81-31131
DASECUED, D. B.	
The development of a theoretical and experi	mental
model for the study of active suppression	of
wing flatter	UL
wind indecer	101-22050
	801-22030
UAVID, 6. W.	
Design considerations for composite fuselag	e
structure of connercial transport aircraft	t
[NASA-CB-159296]	81-22419
DAVIS, S.	
Adaptive-wall wind-tunnel development for	
transonic testing	
•	181-31367
DAVIS, S. S.	
Experimental studies of scale effects on	
oscillating airfoils at transonic speeds	
obciliating directio as dimbourto precas	881-23054
	801 23034
In sirport community poico-impact according	+ =====
An althour community noise-impact assessmen	201-22212
[ 8454-10-00190 ]	801-23/13
DRFAIFFR' 1-	
Analysis of total and static pressure fluct	uations
in an air intake at high incidence	
[AAAF PAPEE ST 80-61]	A81-33950
DEBABCHI, J. H.	
Design, development, and evaluation of ligh	tveight
hydraulic system, phase 1	-
[AD-A097505]	881-221

#### DEMIANUSHKO, L. V.

DEMIANUSHRO, L. V. Numerical methods for studying the stress-strain state and service life of aircraft gas-turbine engine disks A81-31258 DEBANCE, G. SINCAT - A modular air traffic control simulator A81-33149 DESJARDIES, R. A. Ploor and fuel vibration isolation systems for the Boeing Vertol commercial Chinook A81-32016 DITTEAR, J. H. An evaluation of a simplified near field noise model for supersonic helical tip speed propellers [NASA-TH-81727] N81-22836 N81-22836 The propeller tip vortex. A possible contributor to aircraft\_cabin noise to alcoratt capin holse [NASA-TH-81768] N81-2: DIXON, P. G. Preliminary design study of advanced composite hlade and hub and nonmechanical control system N81-22838 for the tilt-rotor aircraft. Volume 1: Engineering studies [NÁSA-CR-152336-1] N81-23064 DIXON, P. G. C. The bearingless main rotor A81-32008 DODGE, B. B. Heat generation in aircraft tires under free rolling conditions [NASA-CB-164273] N81-23461 DOBDOSHABSKII, V. K. Method for evaluating the resistance of gas-turbine installation disks to thermal cycling 181-33168 DOWBLL, B. H. Non-linear oscillator models in bluff body aercelasticity A81-30786 DRAPER, C. S. Control, navigation, and guidance [AIAA PAPER 81-0859] DREADIN, W. O. A81-32910 The USAF Armament Division Structural Dynamics Lab A81-30689 DREVER, J. E. Fuel/engine/airframe trade off study [AD-A097391] N81-23073 DU VAL, B. W. Use of multiblade sensors for on-line rotor tip-path plane estimation A81-32010 DUKE, D. B. Applications of new technology in the infrared A81-31126 DONNING, B. W., JR. Silver recovery from aircraft scrap [PB81-150021] N81-23269 DUPUY, C. The SYDAS flight data processing system N81-23018 DUBBEY, G. P. Air Porce Geophysics Laboratory aerodynamically tethered balloon, 45,000 cubic feet [AD-A096758] N81-22023 DUSKIN, P. E. Study to develop improved fire resistant aircraft passenger seat materials [NASA-CR-152408] DZYGADLO, 3. Pinite element analysis of asymmetric, lateral natural vibrations of a deformable aeroplane A81-33736

# Ε

BDELMAN, B. B. Multiple-scale turbulence modeling of boundary layer flows for scramjet applications [NASA-CE-3433] N81-23411 EGERDAHL, C. C. User's manual for flight Simulator Display System (PSDS) [NASA-CE-164295] N81-23095 EGGLESTOB, B. On the design of modern airfoil sections by numerical methods A81-30705

## PERSONAL AUTHOR INDEX

BL-DOKAHY, I. H.	
Accuracy of noise-modulated radio altimeter	A81-32694
Accuracy of noise-modulated radio altimeter	A81-32694
BLLIS, B. Dead reckoner navigation project	
ELROD, S. D.	N81-22010
Service evaluation of aluminum-brazed titan (ARTi)	ium
[NASA-CB-3418]	81-22129
MSIGN, C. R. MEGA16 - Computer program for analysis and	
extrapolation of stress-rupture data	N81-23486
BPSTRIN, N.	
twins	a1816
[AIAA PAPER 81-0808] BRDHANN, J. B.	A81-33889
National runway friction measurement progra	9 191-03007
BRHOULT, H.	801-23097
Contribution to the study of non stationary signals emitted by moving let engine -	
Application to special analysis and imagi	ng. I.
Contribution to the study of non-stationary	801-33280
signals emitted by moving jet engines - Application to spectral analysis and imag	ing. IT
	A81-33294
Jet aircraft design	
[AIAA PAPEB 81-0912]	<b>▲81-32930</b>
F	
• '	
PABRIS, G.	
PABBIS, G. Bultiple-scale turbulence modeling of bound	ary
PABRIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CE-3433]	ary 181-23411
PABRIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNEL, J. L. Analytical testing	ary N81-23411
PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNET, J. A. Analytical testing [NASA-CR-3429]	ary N81-23411 N81-23487
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CE-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CE-3429]</li> <li>PAETH, G. M. Investigation of air solubility in jet A fu</li> </ul>	ary N81-23411 N81-23487 el at
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CE-3433]</li> <li>PABUNNI, J. A. Analytical testing [NASA-CE-3429]</li> <li>PAETE, G. N. Investigation of air solubility in jet A fu high pressures [NASA-CE-3422]</li> </ul>	ary N81-23411 N81-23487 el at N81-22130
<pre>PABRIS, G. Buttiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNNEL, J. L. Analytical testing [NASA-CR-3429] PAETH, G. L. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422] PALCO, L.</pre>	ary N81-23411 N81-23487 el at N81-22130
<pre>PABRIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNEI, J. L. Analytical testing [NASA-CR-3429] PAETH, G. H. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422] PALCO, L. Erosion resistant coatings [NASA-TH-75070]</pre>	ary N81-23411 N81-23487 el at N81-22130 N81-22098
<pre>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNGI, J. A. Analytical testing [NASA-CR-3429] PABTE, G. N. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422] PALCO, L. Erosion resistant coatings [NASA-TH-75670] PAERELL, T. G. Structural Integrity Recording System (SIR)</pre>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for
<pre>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNGI, J. L. Analytical testing [NASA-CR-3429] PAETH, G. H. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422] PALCO, L. Erosion resistant coatings [NASA-TH-75070] PARRELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-1G Helicopters [NASA-TH-76201]</pre>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for
<pre>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNGI, J. A. Analytical testing [NASA-CR-3429] PAETH, G. B. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422] PALCO, L. Erosion resistant coatings [NASA-TH-75670] PARRELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-1G Helicopters [AD-A097263] PAVIER, D. J.</pre>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CB-3429]</li> <li>PAETH, G. B. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422]</li> <li>PALCO. L. Erosion resistant coatings [NASA-TR-75070]</li> <li>PABRELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AM-1G Helicopters [AD-A097203]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 b angle
<pre>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNBI, J. A. Analytical testing [NASA-CR-3429] PAETH, G. B. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422] PALCO. L. Erosion resistant coatings [NASA-CR-3422] PARCRLL, T. G. Structural Integrity Becording System (SIR) U.S. Army AB-16 Helicopters [AD-A097283] PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</pre>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CR-3429]</li> <li>PAETH, G. M. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422]</li> <li>PALCO. L. Brosion resistant coatings [NASA-TH-75670]</li> <li>PARERLL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-16 Helicopters [AD-A097283]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PBERGUSON, D. R.</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle A81-32017
<pre>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433] PABUNGI, J. A. Analytical testing [NASA-CR-3429] PAETH, G. M. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422] PALCO, L. Erosion resistant coatings [NASA-TA-75670] PARBELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-1G Helicopters [AD-A097263] PAVIEB, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream PBEGUSON, D. E. Fuel conservation integrated into airline e [ATAA PAPEB 81-0831]</pre>	ary N81-23487 el at N81-22130 N81-22098 for N81-23438 b angle A81-32017 conomics A81-33884
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CR-3429]</li> <li>PAETH, G. B. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422]</li> <li>PALCO, L. Brosion resistant coatings [NASA-TR-75070]</li> <li>PABRELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-1G Helicopters [AD-A097263]</li> <li>PAVIEB, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PREGUSON, D. B. Puel conservation integrated into airline e [AIAA PAPEB 81-0831]</li> <li>PILLIPROWSEI, S. Influence of hinge line gap on aerodynamic</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle A81-32017 conomics A81-33884 forces
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CB-3429]</li> <li>PAETH, G. B. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422]</li> <li>PALCO, L. Erosion resistant coatings [NASA-CR-3422]</li> <li>PALCO, L. Erosion resistant coatings [NASA-TH-75070]</li> <li>PAERBELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-1G Helicopters [AD-A097263]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PERGUSON, D. B. Puel conservation integrated into airline e [AIAA PAPEB 81-0831]</li> <li>PILIPROSEI, S. Influence of hinge line gap on aerodynamic acting on a harmonically oscillating thin profile in an incompressible flow J. J.</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 b angle A81-32017 conomics A81-33884 forces
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CR-3429]</li> <li>PAETH, G. M. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422]</li> <li>PALCO. L. Erosion resistant coatings [NASA-TM-75670]</li> <li>PARERLL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-16 Helicopters [AD-A097263]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PBEGUSON, D. E. Fuel conservation integrated into airline e [AIAA PAPEB 61-0831]</li> <li>PILIPROVEKI, S. Influence of hinge line gap on aerodynamic acting on a harmonically oscillating thin profile in an incompressible flow. I, II</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle A81-32017 conomics A81-33884 forces A81-30956
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CR-3429]</li> <li>PAETH, G. M. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422]</li> <li>PALCO, L. Erosion resistant coatings [NASA-TM-75670]</li> <li>PARERLL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-16 Helicopters [AD-A097283]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PBEGUSON, D. E. Fuel conservation integrated into airline e [ATA PAPER 81-0831]</li> <li>PILIPROVEKI, S. Influence of hinge line gap on aerodynamic acting on a harmonically oscillating thin profile in an incompressible flow. I, II</li> <li>PIRSCHEIN, O. Airborne ground velocity determination by d</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle A81-32017 conomics A81-33884 forces A81-30956 igital
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNEI, J. A. Analytical testing [NASA-CR-3429]</li> <li>PAETH, G. B. Investigation of air solubility in jet A fu high pressures [NASA-CR-3422]</li> <li>PALCO, L. Erosion resistant coatings [NASA-TH-75670]</li> <li>PARERLL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-16 Helicopters [AD-A097283]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PBEGUSON, D. E. Fuel conservation integrated into airline e [ATAA PAPER 81-0831]</li> <li>PILIPEOWSEI, S. Influence of hinge line gap on aerodynamic acting on a harmonically oscillating thin profile in an incompressible flow. I, II</li> <li>PIBSCHEIN, O. Airborne ground velocity determination by d processing of electro-optical line sensor</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle A81-32017 conomics A81-33884 forces A81-30956 igital signals A81-3496
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNBI, J. A. Analytical testing [NASA-CR-3429]</li> <li>PAETH, G. M. Investigation of air solubility in jet A funity pressures [NASA-CR-3422]</li> <li>PALCO, L. Erosion resistant coatings [NASA-TH-75670]</li> <li>PAERELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-16 Helicopters [AD-A097283]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PBEGUSON, D. R. Fuel conservation integrated into airline e [ATAA PAPER 81-0831]</li> <li>PILIPROWSKI, S. Influence of hinge line gap on aerodynamic acting on a harmonically oscillating thim profile in an incompressible flow. I, II</li> <li>PIRSCHER, D. L.</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle A81-32017 conomics A81-33884 forces A81-30956 igital signals A81-32496
<ul> <li>PABBIS, G. Bultiple-scale turbulence modeling of bound layer flows for scramjet applications [NASA-CR-3433]</li> <li>PABUNEI, J. A. Analytical testing [NASA-CR-3429]</li> <li>PAETH, G. M. Investigation of air solubility in jet A funity pressures [NASA-CR-3422]</li> <li>PALCO, L. Erosion resistant coatings [NASA-TH-75670]</li> <li>PAERELL, T. G. Structural Integrity Recording System (SIR) U.S. Army AH-16 Helicopters [AD-A097283]</li> <li>PAVIER, D. J. Unsteady aerodynamics of an aerofoil at hig of incidence performing various linear oscillations in a uniform stream</li> <li>PBEGUSON, D. R. Fuel conservation integrated into airline e [ATAA PAPER 81-0831]</li> <li>PILIPROWSKI, S. Influence of hinge line gap on aerodynamic acting on a harmonically oscillating thin profile in an incompressible flow. I, II</li> <li>PIRSCHER, D. L. Calibration of an arial fan at various powe settings for use on a duarter scale VC-RA</li> </ul>	ary N81-23411 N81-23487 el at N81-22130 N81-22098 for N81-23438 h angle A81-32017 conomics A81-33884 forces A81-30956 igital signals A81-32496 rair

[AD-A097043] N81-22042 FISCBBR, J. P. Results of a Loran-C flight test using an absolute data reference N81-22006

FISCBBR, R. W. AN/TFX-54 interrogator FLANDELLY, W. G. Analytical testing [NASA-CR-3429] N81-23487

GREEBBBRG, N.

PLOYD, P. H.	
The reinvenation of properties in turbine engine	
hot section components by hot isostatic tressing	
(AD-A097551) N81-23088	
POBRSCHING, H.	
Some remarks on the unsteady airloads on	
Oscillating control surfaces in subsonic flow	
N81-23055	
POKTR. V. C.	
Thermonlactic strengthening of a gas-turbine	
engine disk lock joint - Determination of the	
Tacidnal strasses	
181-33160	
PORTAK, H.	
Investigative technical measurements of the	
Dianetary houndary layer made onboard an	
instrumented notorized alider	
( RPDT-14Q1 N91-22666	
PRANCOTS J.	
The approvance caused by airplane noise in the	
Ficinity of Orly hirrort and the reaction of	
Deighboring residents	
The relationship between noise and annovance	
around Orly	
A Calerkin type finite element method for	
A odierkin type thatte erement method for	
flight	
11190L NO1-22050	
Didital Avianics Information System (DATS)	
Volume 1. Impact of DNIS concept on life cucle	
Cost	
COSC NO1-2202 NO1-2202	
[AU-AV9/339] NOI-23003 Digital brianics Information Sector (D)TS)	
Digital Aviouics information System (DAIS).	
volume 2: impact of DAIS concept on file cycle	
COSC. Supprement No1-3308	
Decemination of 0 196-seels model of high-speed	
duct of notional transmis facility	
TWICE OF HATTONAL TEANSONIC RECITLY	
In arteonaly lightweight functions integrated	
AP EXCLUDELY LIGHTWEIGHT IUSELAGE-INTEGRATED	
hasen array for gleborne abbrications	
E4//UE=188	

G

GALLOT, J.

Improvement of the energy efficiency of helicopters [AAAF PAPER BT 80-33] A81-3393. A81-33933 GARAS, B. Accuracy of noise-modulated radio altimeter A81-32694 GARDBER, D. G. A mobile emissions laboratory for on-line analysis of combustion products from gas turbine engines A81-32872 GARNES, E. C. Experimental flutter at high subsonic speeds and its theoretical prediction, taking into account wing thickness and Reynolds number N81-23052 GATZES, B. S. Prop-Fan technical progress leading to technology readiness [AIAA PAPER 81-0810] A81-33878 GEBABA, J. G. Structural flight loads simulation capability. Volume 2: Structural analysis computer program user's manual [AD-A096594] N81-22045 GETRY, C. L., JE. Description of 0.186-scale model of high-speed duct of mational transonic facility [ NASA-TH-8 1949 ] 881-22061 GETSON, L. B. Method for evaluating the resistance of gas-turbine installation disks to thermal cycling 181-33168 GIBBLING, H. J. Analysis of turbulent flow about an isolated airfoil using a time dependent Bavier-Stokes Frocedure 881-23053 GINHBLFARB, A. L. Principles of aircraft structural design /2nd revised and enlarged edition/ A81-31800 GINZBURG, A. E. Method for evaluating the resistance of gas-turbine installation disks to thermal cycling A81-33168 GLASIER, J. H. Digital Avionics Information System (DAIS). Volume 1: Impact of DAIS concept on life cycle [AD-A097339] N81-23083 Digital Avionics Information System (DAIS). Volume 2: Impact of DAIS concept on life cycle cost. Supple [AD-A097438] Supplement N81-23084 GOCLOWSKI, J. C. Digital Avionics Information System (DAIS). Volume 1: Impact of DAIS concept on life cycle cost [AD-A097339] Digital Avionics Information System (DAIS). N81-23083 Volume 2: Impact of DAIS concept on life cycle cost. Supplement [AD-A097438] N81-23084 GODSEY, J. D. Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-31399 CORSCE, We He Past and future trends in structures and dynamics [AIAA PAPEE 81-0896] A81-32921 GOGLIÀ, G. L. Investigation of aerodynamic characteristics of wings having vortex flow using different numerical codes [NASA-CB-165706] N81-23034 GOLDSHITH, D. J. Airliner maintenance for fuel efficiency [AIAA PAPER 81-0787] 181-33877 CORDON, B. Transonic viscous-inviscid interaction over airfoils for separated laminar or turbulent flows A81-31612 GOBDON, W. B. Maximum likelihood elevation angle estimates of radar targets using subapertures A81-32691 GOSSETT, C. B. Application of ion implantation for the improvement of localized corrosion resistance of M50 steel bearings [AD-A097230] N81-23466 GRACEY, R. Measurement of aircraft speed and altitude AE1-32401 GBAGG, C. D. Velocity tolerance of escape systems [AD-A096881] N81-22035 GBABT, I. The development of the secondary wing structure for a rigid wing hang glider [BU-251] 881-22046 GBANT, J. R. Fuel/engine/airframe trade off study [AD-A097391] ¥81-23073 GRANT, P. N. A review of current and future components for electronic warfare receivers A81-32252 GBAY, T. D. Implementing Aircraft Structural Life Management to reduce structural cost of ownership [SANE PAPES 1331] 181-31376 GRAYSON, B. L. Potential effects of the introduction of the discrete address beacon system data link on air/ground information transfer problems [ BASA-CE-166165] 881-22037 GREEN, B. A. Maintenance tomorrow and the day after A81-33790 GREENBERG, M. Summary of transponder data, May 1979 - Hovember 1979 [AD-A097569] N81-23061

GRIAZNOV, B. A. Patigue strength of gas turbine engine roto blades in connection with structural char service	or Iges in
	A81-31673
GRIPPITHS, P. J.	
Applications of new technology in the infra	red
	A81-31126
GROBSBECE, D.	
Comparison of predicted engine core noise w	lith
proposed PAA helicopter noise certificati	ion
requirements	
[NASA-TM-81739]	N81-22839
GROMARSE, D. J.	
Jet aircraft design	
[AIAA PAPEB 81-0912]	A81-32930
GROTH, W. P.	
Modern techniques of conducting a flight lo	bads
survey based on experience gained on the Hawk belicopter	Black
	A81-32014
GULLEDGE, T. B.	
A cost function for an airframe production	DFOGTAR
[AD-A097540]	N81-23967
GOTMAN, G. H.	
Thermoclastic strengthening of a gas-turbin	e
engine disk lock joint - Determination of	the
residual stresses	
	A81-33169

# Н

BAIDES, A. L.	
Increasing capacity at Paris airports	
[AIAA PAPER 81-0802]	A81-33890
Airport capacity enhancement by innovative	use of
runway geometry	
[AIAA PAPER 81-0801]	A81-33891
HALEY, J. L.	
Crashworthiness versus cost based on a stud	y or
1071	970 and
1371	A81-32006
BALLICH, B. P.	
The rise of air and space	
•	A81-33718
HAMM, B. S.	
V/STOL advanced technology rewards and risk	
[SAWE PAPER 1385]	A81-31401
HABIBG, B. K.	
Design, development, and evaluation of high	tweight
nyaraunic system, phase i ran-angrensi	N81-23075
HARDING. K. G.	201 23015
Techniques for evaluation of aircraft winds	creen
optical distortion	
•	A81-32507
HABRIS, C. D.	
Two-dimensional aerodynamic characteristics	; of the
NACA 0012 airfoil in the Langley 8 foot	
transonic pressure tunnel	
LADDIG J C	881-23036
Techniques for evaluation of aircraft winds	CLOCD
optical distortion	JULCEN
opologi diboligi	A81-32507
HARRIS, B. M.	
Increasing capacity at Paris airports	
[AIAA PAPEE 81-0802]	A81-33890
HARSCE, B.	
Experiences with a Flight Data Recording Sy	sten
(PDES) in a German Alfronce fighter bombe	er wing
after field trials	NO1-22000
HADSHA D #	001-23009
Multiple-scale turbulence modeling of bound	larv
laver flows for scramiet applications	
[ NASA-CB-3433 ]	N81-23411
HARTAAN, N. A.	•
The use of aircraft integrated data system	at KLM
	N81-23019
HARTHANN, G. L.	<b></b>
r-sc adaptive control law refinement and sc	DITWATE
CAST CD T T T T T T T T T T T T T T T T T T	NO1-22050
[4838-02-103033]	801-22039

#### PERSONAL AUTHOR INDEX

BANKINS, B. J. Test procedures used in determining aircraft suitability for STAN integral weight and balance system [ SAWE PAPER 1339] 181-31379 BAY, Ĵ. Improvement of the imaging of moving acoustic sources by the knowledge of their motion [ONERA, TP NO. 1981-17] A8 A81-32534 Contribution to the study of non stationary signals emitted by moving jet engine -Application to special analysis and imaging. I. A81-33288 Contribution to the study of non-stationary signals emitted by noving jet engines -Application to spectral analysis and imaging. II A81-33294 BECET, M. J. Structural flight loads simulation capability. Volume 2: Structural analysis computer program user's manual [ AD-A096594 ] N81-22045 EEGEDUS, C. B. Development of a water displacing, touch-up paint [AD-A097125] N81-23288 ERINEAND, B. B. Aircraft design then and now [AIAA PAPBE 81-0917] A81-32933 BENNIG, H. Puel/engine/airframe trade off study [AD-A0973911 881-23073 BERRIN, J. R. Puel/engine/airframe trade off study [AD-A097391] N81-23073 BICKS, J. B. Crashworthiness versus cost based on a study of severe Army helicopter accidents during 1970 and 1971 A81-32006 HILDEBRANDT, F. Detection and location of faults in onboard aircraft systems with the aid of the Automatic Pault Identification System (APIS) N81-23022 BINDES, D. K. Development of maintenance metrics to forecast resource demands of weapon systems. Analysis and evaluation, revision A [AD-A096688] B81-Development of maintenance metrics to forecast 881-22971 resource demands of weapon system. Maintenance metrics and weightings, revision A [AD-A096689] 881-Development of maintenance metrics to forecast N81-22972 resource demands of weapon systems. Analysis and results of metrics and weightings, revision [AD-A096690] N81-Development of maintenance METRICS to forecast N81-22973 resource demands of weapon systems (parameter polarization), revision A [AD-A097692] N81-23325 BIBVONEN, J. K. Application of ion implantation for the improvement of localized corrosion resistance of M50 steel bearings [AD-A097230] N81-23466 HOAD, D. E. Acoustic performance evaluation of an advanced OH-1 helicopter main rotor system [AHS PAPER 81-58] A81-33952 BOPPHAN, E. Processing of AIDS flight recorder data for a quick look with the aid of a hybrid computer system N81-23023 EOGGATT, J. 1. Advanced fiber reinforced thermoplastic structures [AD-A096759] B&1-2210 NE1-22106 HOLBER, B. D. Hoving target identification /HTI/ algorithm for passive sensors A81-32502 BOLLISTER, R. M Electronic flight rules: An alternative separation assurance concept [AD-A097570] N81-23063

HOBTOB, G. J.	
A microcomputer-based signal data converter	for
runway visual range measurements	
[AD-A097568]	N81-23060
HOURIGAN, D. T.	
Sea King mathematical model validation tria	als.
Plight data channel calibration	
[AD-A096587]	881-22043
HOUSE, E. E.	
Advanced fiber reinforced thermoplastic st	Cuctures
	881-22106
Mon dignlagement thickness theory of trails	
nico	rud eade
torse	101-20705
HOY, B. R.	201 30703
An aircraft manufacturer's view of airport	R&D needs
LAIAA PAPER 81-07931	A81-33887
HRASTAR, J. A., SE.	
Apparatus for and method of compensating dy	vnamic
unbalance	-
[NASA-CASE-GSC-12550-1]	N81-22358
HUBLER, G. K.	
. Application of ion implantation for the	
improvement of localized corrosion resist	tance of
M50 steel bearings	
[AD-A097230]	881-23466
HONT, G. H.	
Alfborne electronic displays	
	A81-32999
Averago, as The reconstruction of flight maths from MT	ne data
with the sid of modern filtering methods	və uala
with the did of wodgen fiftering wethous	N81-23021

HUTTON, P. H. In-flight fatigue crack monitoring using acoustic emission A81-32857

## 

- IABEO, A. K. Bfficiency of the methods and algorithms used for estimating the reliability in aviation techniques A81-33173 IGOE, M. B. Description of 0.186-scale model of high-speed duct of national transonic facility
- [NASA-TH-81949] B81-22061 ILLANKOV, A. L. Principles of aircraft-engine assembly A81-31799 IMMABIGBON, J. P. A.
- The rejuvenation of properties in turbine engine hot section components by hot isostatic pressing [AD-A097551] N81-23088 INGEGRERI, J. A microprocessor based land navigator A81-32833
- ISABBKO, V. I. Increasing the strength properties of sheet parts by explosive forming of them with optimization of the production parameters

J

- JAIN, B. K. COmputation of pressure distribution on the DPVLE wing-body model by the panel method (DPVLB-PB-80-02) JAMES, D. S. An I-band power GaAs PET amplifier for military avionics radar applications A81-31122 JANUEL, BE. Aerodynamic trials with the linear motor-driven platform at the Toulouse Aeronautic Testing Center (AAF PAPERE MT 80-41) JABHARE, B. S. A. The variable-speed tail-chase aerial combat problem A81-31225 JBWKINS, J. H. A comparison of laboratory measured temperatures with predictions for a spar/skin type aircraft
  - structure [BASA-TM-81359] B81-23067

JBBACKI, B. J.	
The propeller tip vortex. A possible contr	ibutor
to aircraft cabin noise	
	801-22020
[ 8838-18-61/06 ]	801-22030
JESEE, J. A.	
Rinematic properties of the helicopter in	
coordinated turns	
[ HASA-TE-1773]	N81-22039
3244 C B	
the optimation of the for wind Annual t	
We obto-electronic method for wind funder a	IOGET
alignment	
	A81-32849
JOENSON, R. B.	
Structural Integrity Recording System (SIR)	for
R S Aray 18-16 Weliconters	
f an_a0072023	801-22/20
	801-23430
JUHISON, N.	
Comparison of calculated and measured helic	copter
rotor lateral flapping angles	
	A81-32018
JONRS, D. J.	
On the decise of medern sinfail continue h	
on the design of modern arriver sections by	
numerical methods	
	A81-30705
JONES, B.	
Developments in the analysis and repair of	cracked
and uncracked structures	
	181-31561
Chevelynes] Junion of DEDD satelos for Wines	
Structural design of prar patches for allag	le arnà
repair	
repair [AD-A097195]	B81-23024
repair [AD-A097195] JOSBPBSOW, P. D.	881-23024
repair [AD-A097195] JOSBPHSON, P. D. National runway friction measurement progra	B81-23024
repair [AD-A097195] JOSEPBSON, P. D. National runway friction measurement progra [AD-A097334]	B81-23024
repair [AD-A097195] JOSBB5050, P. D. National runway friction measurement progra [AD-A097334] JOST c. s.	1-23024 1-23097
repair [AD-A097195] JOSBPHSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S.	881-23024 881-23097
repair [AD-A097195] JOSBPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy	981-23024 981-23097
repair [AD-A097195] JOSBPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures	881-23024 881-23097
repair [AD-A097195] JOSRPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198]	881-23024 881-23097 881-23249
repair [AD-A097195] JOSBB500, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T.	¥81-23024 NB1-23097 ¥81-23249
repair [AD-A097195] JOSBPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a	¥81-23024 N81-23097 ¥81-23249
repair [AD-A097195] JOSBPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL	¥81-23024 Na ¥81-23097 ¥81-23249
repair [AD-A097195] JOSB#500, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fibtor strate to a prograft Volume 1. Stra	881-23024 881-23097 881-23249
repair [AD-A097195] JOSRPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud	881-23024 881-23097 881-23249 881-23249
repair [AD-A097195] JOSBB500, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview	881-23024 881-23097 881-23249 881-23249
repair [AD-A097195] JOSRPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CE-152391-VOL-1]	881-23024 881-23097 881-23249 881-23249 881-23030
repair [AD-A097195] JOSBPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CR-152391-VOL-1] Analysis of wind tunnel test results for a	881-23024 881-23097 881-23249 881-23030
repair [AD-A097195] JOSBBBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [HASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL	881-23024 881-23097 881-23249 881-23249 881-23030
repair [AD-A097195] JOSRPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [MASA-CR-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval	881-23024 881-23097 881-23249 89 89 881-23030
<pre>repair [AD-A097195] JOSBB500, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of neddetion methodologies</pre>	881-23024 881-23097 881-23249 89 881-23030 881-23030
<pre>repair [AD-A097195] JOSRPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stat overview [NA3-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [WS1-CE-152391-VOL-3]</pre>	881-23024 881-23097 881-23249 19 881-23030 Luation
<pre>repair [AD-A097195] JOSEPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CR-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [NASA-CE-152391-VOL-2]</pre>	<pre>B81-23024 B81-23097 B81-23249 B81-23030 Luation B81-23031</pre>
<pre>repair [AD-A097195] JOSRPBSOW, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [BASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a</pre>	881-23024 18 1881-23097 19 19 19 19 19 19 19 10 10 10 10 10 10 10 10 10 10
<pre>repair [AD-A097195] JOSEPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [WASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [WASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL</pre>	881-23024 881-23097 881-23249 87 881-23030 Luation 881-23031
<pre>repair [AD-A097195] JOSBPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud of prediction methodologies [MSA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [MSA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [MSA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effet </pre>	B81-23024 B81-23097 B81-23249 B81-23030 Luation B81-23031 ects of
<pre>repair [AD-A097195] JOSRPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NA3-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [NASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline</pre>	<pre>B81-23024 B81-23097 B81-23097 B81-23030 Luation N81-23031 ects of</pre>
<pre>repair [AD-A097195] JOSEPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CR-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [NASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline [NASA-CE-152391-VOL-3]</pre>	<pre>B81-23024 B81-23097 B81-2304 B81-23030 Luation N81-23031 acts of B81-23032</pre>
<pre>repair [AD-A097195] JOSRPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stat overview [NASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [NASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction wethodologies [NASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline [NASA-CE-152391-VOL-3] Analysis of wind tunnel test results for a</pre>	<pre>B81-23024 B81-23097 N81-23030 N81-23030 Luation N81-23031 acts of B81-23032</pre>
<pre>repair [AD-A097195] JOSEPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [NASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline [NASA-CE-152391-VOL-3] Analysis of wind tunnel test results for a</pre>	<pre>B81-23024 B81-23097 B81-23030 B81-23030 Luation B81-23031 ects of B81-23032</pre>
<pre>repair [AD-A097195] JOSEPBSOB, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [BASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline [NASA-CE-152391-VOL-3] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL</pre>	B81-23024 B81-23097 B81-23249 B81-23030 Luation B81-23031 ects of B81-23032
<pre>repair [AD-A097195] JOSRPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [HASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effe configuration variations from baseline [NASA-CE-152391-VOL-3] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effe configuration variations from baseline [NASA-CE-152391-VOL-3] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL</pre>	<pre>B81-23024 B81-23097 B81-23030 Luation N81-23031 ects of N81-23032 5 B104</pre>
<pre>repair [AD-A097195] JOSEPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOICE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CR-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [NASA-CB-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline [NASA-CB-152391-VOL-3] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline [NASA-CB-152391-VOL-3] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 4: RAL aerodynamic characteristics and comparison articles and comparison and state characteristics and comparison articles and comparison and state characteristics and comparison and state characteristics and comparison articles articles and comparison articles articles and comparison articles articles and comparison articles articles articles and comparison articles articles /pre>	B81-23024 B81-23097 B81-23249 B81-23030 Luation B81-23031 ects of B81-23032 S E104 DDS With
<pre>repair [AD-A097195] JOSRPBSON, P. D. National runway friction measurement progra [AD-A097334] JOST, G. S. Patigue life variability in aluminum alloy aircraft structures [AD-A097198] JOYCE, G. T. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Stud overview [NASA-CE-152391-VOL-1] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Eval of prediction methodologies [NASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effor configuration variations from baseline [NASA-CE-152391-VOL-3] Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 4: BAL aerodynamic character E205 configuration aerodynamic character</pre>	<pre>B81-23024 B81-23097 N81-23097 N81-23030 Luation N81-23031 acts of N81-23032 S B104 pns with istics</pre>

# Κ

KABBLEVSKII, M. G. Method for evaluating the resistance of gas-turbine installation disks to thermal cycling A81-33168 KADUSBIN, I. Application of variable structure system theory to aircraft flight control [NASA-CE-164321] 881-23093 EALBE, B. Detection and location of faults in onboard aircraft systems with the aid of the Automatic Fault Identification System (APIS) 881-23022 EALNIN, V. E. Bydrodynamic modelling of the starting process in liquid-propellant engines A81-31287 KANNAL, B. P. Approximations and short cuts based on generalized functions A81-30730 KASDAN, H. L. Optics in metrology and guality assurance; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980 A81-32504

A81-33174

KATZ, J.

```
KATZ, J.
Full-scale aerodynamic characteristics of a
       propellar installed on a small twin-engine
       aircraft wing panel
[NASA-TM-81285]
                                                            N81-23039
KAWAI, T.
Study of the secondary flow in the downstream of a
moving blade row in an axial flow fan
                                                            A81-31767
KENYCH, B. D.
    Arny aviation - A perspective into the eighties
[AIAA PAPER 81-0931] A81-1
                                                            A81-32935
KIDA,
        1...
    A theoretical treatment of lifting surface theory
of an elliptic wing
                                                            181-30653
KING, S. B.
Forward-locking infrared /FLIB/ sensor for
autonomous vehicles
                                                            A81-32490
KLOSTBR, N.
    Belationships for a flight performance computer
                                                            N81-23014
KHOBLOCH, J.
    Procedure for pressure contact on high-power
       semiconductor devices free of thermal fatigue
       [NASA-TM-75733]
                                                            N81-22054
KO, 5.-Y.
    Computation of wall temperature and heat flux
       distributions of the fils cooled walls
                                                            A81-30802
KOBGEBOBBB, L. P.
    Commercial aviation icing research requirements
[NASA-CR-165336] N81-
                                                            N81-23069
LHASA-CH-100000,

KOEBBEB, B.

Technical evaluation report on the Pluid Dynamic

Fanel Symposium on Subsonic/Transonic

Configuration/Aerodynamics

N01-2:
                                                            N81-23431
KOHL, P. J.
    Combustion system processes leading to corrosive
       deposits
       [ NA SA-TH-81752 ]
                                                            N81-23243
KOSCHEL, N.
    Engine parameter trend analysis with LEADS 200:
Possibilities and limitations
                                                            N81-23010
KOSSA, L. B.
    Autonomous target handoff from an airborne sensor
       to a missile seeker
                                                             A81-32498
KOSZABNY, 2.

The effect of airplane noise on the inhabitants of

areas near Okecie Airport in Warsaw

[NASA-TM-75879] N81-225
                                                             881-22593
KBAMBB, P.
    Application of variable structure system theory to
       aircraft flight control
       [NASA-CR-164321]
                                                            N81-23093
KBAUS, P. R.
An Interactive Weight Accounting Program /IWAP/
[SAWE PAPER 1345] A81-31383
KRAVCHBNKO, B. A.
    Thermoplastic strengthening of a gas-turbine
engine disk lock joint - Determination of the
residual stresses
                                                             A81-33169
KRIJN, B.
    Navaids calibration evaluation with a
       computer-controlled avionics data acquisition
       system
                                                             N81-23020
KRYSIN, V. N.
    Bonded laminated structures in aircraft manufacture
                                                             A81-33700
KUBLHAB, G.
Application of ion implantation for the
       improvement of localized corrosion resistance of
       50 steel bearings
       [AD-A097230]
                                                             N81-23466
```

LABBLL, R. W. Aircraft wing weight build-up methodology with modification for materials and construction technigues [NASA-CR-166173] N81-23068

Ĺ

#### PRESONAL AUTROR INDEX

LAI, J. C. S. Experimental investigation of oscillating subsonic iets A81-32777 LANDRUS, B. J. Pressure and force data for a flat wing and a warped conical wing having a shockless recomparession at Mach 1.62 [NASA-TE-1759] N81-22016 LARUBLLE, G. Investigation of instantaneous distortions in air intakes at high angles of attack [AAAF PAPEE NT 80-38] A81-33931 LAVBINCHUK, V. M. Dynamic errors of the Kalman filtering of trajectory parameters A81-33687 LAWRENCE, D. L. An experimental investigation of the aerodynamics and cooling of a horizontally-opposed air-cooled aircraft engine installation N81-22015 [NASA-CB-3405] LAWRENCE, D. H. Groundspeed/airspeed differences as a wind shear indicator and flight evaluation of a DME-derived system to determine groundspeed [AD-A097566] N81-23768 LAWBEBCE, B. W. Air Force Geophysics Laboratory aerodynamically tethered balloon, 45,000 cubic feet [AD-A096758] N81-2 N81-22023 LEBDUSKA, J. Measurement of the aercdynamic forces acting on a harmonically oscillating wing at high subsonic speeds A81-31042 LRITUBE, R. T. Application of an aerodynamic configuration modeling technique to the design and analysis of X-Wing aircraft configurations A81-32013 LEVIT, S. B. Principles of aircraft-engine assembly A81-31799 LIDEN, S. P. V/STOLAND digital avionics system for XV-15 tilt Totor [ NASA-CR-152320] N81-22047 LILLEY, B. W. Microcomputer processing for Loran-C N81-22007 LISSANAN, P. B. S. Sun powered aircraft design [AIAA PAPER 81-0916] A81-32932 LITTLE, L. J. A microprocessor based land navigator A81-32833 LITTLEFIELD, J. A. An analysis of the adaptability of Loran-C tc air navigation N81-22003 The P/FOD project: Programmable/Pilot Oriented Display 881-22004 LLOYD, 1. Is it safe - The safety assessment of aircraft systems. IV - Methods, techniques, and organisation A81-33789 LOMMOS, J. E. Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 1: Study overview [NASA-CR-152391-VOL-1] N81-23030 Analysis of wind tunnel test results for a 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 2: Evaluation of prediction methodologies [NASA-CE-152391-VOL-2] Analysis of wind tunnel test results for a N81-23031 9.39-per cent scale model of a VSTOL fighter/attack aircraft. Volume 3: Effects of configuration variations from baseline [NASA-CB-152391-VOL-3] 881-23

881-23032

Bicroprocessor-based digital air data computer for flight test A81-32858

## Μ

BABEY, D. G.	
Oscillatory flows from shock induced separ	ations
on biconvex aerofoils of varying thickne	ss in
ventilated wind tunnels	
	N81-23056
MACCBBADY, P. B.	
Sun powered aircraft design	
[AIAA PAPEB 81-0916]	A81-32932
MACDOUGALL, A. C.	
The 'light-weight' system - A novel concep	t for
on-board weight and balance measurement	usina
fiber optics	-
[SAWE PAPER 1336]	A81-31377
HACH, N.	
Classification of operating conditions of	
turbomachines from solid horne sound	
	N81-23015
MACK. J.	101 10010
Drive system technology advancements	
	181-32015
NACT RURAN . 3 P	401 32013
National runway friction measurement progr	
fin-109722//3	N91-22007
	A01-23031
Development of noisterence retries to form	~~~t
bevelopment of maintenance metrics to fore	Cast
resource demands of meapon systems. And	TARTZ
and evaluation, revision A	
[AD-A036688]	881-22971
Development of maintenance metrics to fore	cast
resource demands of weapon system. Hain	tenance
metrics and weightings, revision A	
[AD-A096689]	N81-22972
Development of maintenance metrics to fore	cast
resource demands of weapon systems. Ana	lysis
and results of metrics and weightings, r	evision A
[AD-A096690]	N81-22973
Development of maintenance MRTRICS to fore	cast
resource demands of weapon systems (para	neter
nolarization) revision A	
	NA1-22226
NIROVPECRATE T	AU1-23525
DADVDIJAAIng is do	
Fallyue strength of gas turbine engine for	
blades in connection with structural cha	nges in
service	
· · · · · · · · · · · · · · · · · · ·	A81-31673
HABCHMAN, J. P., III	
Effectiveness of leading-edge vortex flaps	on 60
and 75 degree delta wings	
	<b>∆81-</b> 31368
HABBSCA, C. A.	•
Unsteady aerodynamics of an aerofoil at hi	gh angle
of incidence performing various linear	
oscillations in a uniform stream	
	A81-32017
HARGETSON, J.	
Tensile stress/strain characterization of	
non-libear materials	
	181-30915
MARSH. D. P.	-01 JU31J
Design considerations for future trabeases	
transporte	
CARE DIRAD 12401	
[SAWE PAPER 1340]	A81-31380
DABUSLI, U. I.	
ratigue strength of gas turbine engine rot	or
plades in connection with structural cha	ages in
service	
	181-31673
BASOJ, W. H.	
Pressure and force data for a flat wing an	d a
warped conical wing having a shockless	
recomparession at Mach 1.62	
[NASA-TD_1750]	E81-22014
LOUDE 15-11021	501-22010
uniunovių Us.im 1 mobilo anteoieno laboratova 6 11	
A MODILE EMISSIONS LADORATORY FOR ON-LINE	analysis
of compastion preducts from gas tarbine	4491165

MATHENS, B. Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles A81-32491 MATSUO, B. M. Fuel/engine/airframe trade off study [AD-A097391] N81-23073 HATUSŽEVSKI, H. É. Helicopter rotor blade effects on mast-mounted sensor images A81-31114 BAZAIBA, P. K. Orientation of measurement sensors for optimum end-of-life performance A81-32697 HAZIABEA, S. The effect of airplane noise on the inhabitants of areas near Okecie Airport in Warsaw [NASA-TH-75879] N81-2259 N81-22593 MCCALÌ, D. L. Microcomputer processing for Loran-C 881-22007 ACCANN, R. P. Measuring dynamic stresses on helicopter transmission gear teeth utilizing telemetry A81-32859 MCCABTY, J. B. Operational responses to aft empty C.G. [SAWE FAPES 1338] A81-31378 HCCABIY, P. E. Development of a noninterference compressor blade stress measurement system A81-32874 ACCOBAICE, B. R. Equilibrium spinning of a typical single-engine low-wing light aircraft A81-31598 MCFABLAND, R. H. Application of endfire arrays at contemporary glide-slope problem sites A81-32695 Investigation of air transportation technology at Ohio University, 1980 N81-22005 BCEBLUBY, B. B. Commuter aircraft design FAIAA PAPER 81-09131 A81-32931 ACMANUS, B. L. Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] N81-23064 BCVBIGH, 8. A. Preliminary design study of advanced composite blade and bub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies [NASA-CE-152336-1] 881-23064 ABBRS, B. J. A microcomputer-based signal data converter for runway visual range measurements [AD-A097568] N81-23060 ABLLEB, N. A. Subsonic gas flow past a wing profile A81-31034 BBBBITT, P. High frequency angular vibration measurements in vehicles [AAS FAFBE 81-024] A81-32886 BEBSCH, S. H. Techniques for evaluation of aircraft windscreen optical distortion A81-32507 MERZ, A. W. The variable-speed tail-chase aerial combat problem A81-31295 BEURSEC, J. L. Comparison of computed and measured unsteady pressure fields on a supercritical wing [OBERA, TP BO. 1981-12] A81-32541 MICHAS, B. D. Plight evaluation of the concept of the stage A Peripheral Vision Borizon Device (PVBD) using the CH 135 aircraft of 403 Squadron - CEB Gagetown [AD-A096870]

MIHALOBU, J. R. A nonlinear propulsion system simulation tehnique for piloted simulators [NASA-TH-82600] N81-23085 MILES, R. B. Laser beacon collision avoidance systems N81-22009 MILEY, S. J. An experimental investigation of the aerodynamics and cooling of a horizontally-opposed air-cooled aircraft engine installation [NASA-CR-3405] N81-22015 MILLBE, B. A. The propeller tip vortex. A possible contributor to aircraft cabin poise [NASA-TH-81768] N81-22838 MILLER, D. S. Pressure and force data for a flat wing and a warped conical wing having a shockless recomparession at Mach 1.62 [NASA-TP-1759] 88 N81-22016 AITCHELL, S. C. Design concepts for low-cost composite turbofan engine frame [NASA-CR-165217] N81-22053 HOBN, J. H. Bearing wear detection using radioactive iron-55 tagging [ASLE PREPEINT 81-AM-6A-3] A81-33868 MONNETT, J. T. Design of low powered aircraft, a philosophy fcr future personal sport aircraft [AIAA PAPBR 81-0905] A81-32926 MORGAN, N. B. HOBGAN, W. H. Sun powered aircraft design [AIAA PAPEB 81-0916] A81-: HOBEIS, C. B. K., JE. Analytical study of the cruise performance of a class of remotely piloted, microwave-powered, high-altitude airplane platforms [MASA-TH-81969] K81-: A81-32932 N81-22040 MOBBISON, G. L. The role of coherent structures in the generation of noise fcr subsonic jets [NASA-CR-164214] N81-22 N81-22833 HOBBOG, J. J. CH-53E combat survivability assessment and survivability enhancement program [SAWE PAPER 1384] A81-31400 HOSIEB, S. A. Puel/engine/airframe trade off study [AD-A097391] N81-23073 MOSS, D. G. MISS: Airplane system modeling [NASA-CR-165700] MUNSON, H. B. N81-23059 Application of ion implantation for the improvement of localized corrosion resistance of 150 steel tearings [AD-A097230] N81-23466 HURPHI, A. C. Transonic flutter and gust-response tests and analyses of a wind-tunnel model of a torsion free wing airplane [NASA-TM-81961] N81-N81-23072 MIRES, A. W. Reduction of helicopter vibration through control of hub-impedance A81-32009

## Ν

NAGY, B. J.	
Analytical testing	
[NASA-CR-3429]	N81-23487
BARBHDRA, P. H.	
Advanced target tracking by dynamic scene a	analysis A81-32499
NATABAJAD, K.	
Use of Loran-C for general aviation aircrat navigaticn	Et
•	N81-22002
BEGRE, I.	
Generalized active control - Its potential directions of research	and
[AAAF PAPES NT 80-29]	181-33928

.

## PEBSONAL AUTHOR INDEX

BELSON, H. K.	
Development and testing of a new technology	veight
and balance indicator	
[SAWE PAPER 1341] A	81-31381
BELSON, V. S.	
Modern techniques of conducting a flight loa	ıds
survey based on experience gained on the B	lack
Hawk helicopter	
A	81-32014
BIBBBBDING, W. C.	
Bigh temperature electronic requirements in	
aeropropulsion systems	
A	181-32547
BIBWALD, B. J.	
Technology growth in mini-RPV systems	
(AIAA PAPER 81-0936] A	81-32937
BOVACKI, S. M., III	
Microcomputer processing for Loran-C	
B	181-22007
BOBAR, H.	_
Influence of hinge line gap on aerodynamic f	torces
acting on a harmonically oscillating thin	
profile in an incompressible flow. I, II	
<b>B</b>	181-30956
BUTTBE, J.	
Leading-edge separation from a thick, conica	14 <i>.</i>
siender wing at small angles of incidence	
A	181-31687

## 0

OKBS, S.
Advanced fiber reinforced thermoplastic structures
[AD-A096759] N81-22106
OLSEN, J. J.
Past and future trends in structures and dynamics
[AIAA FAPEE 81-0896] A81-32921
CHALLEY, C. D.
Analysis of wind tunnel test results for a
9.39-per cent scale model of a VSTOL
fighter/attack aircraft. Volume 1: Study
overview
[NASA-CE-152391-VOL-1] 881-23030
Analysis of wind tunnel test results for a
9.39-per cent scale model of a VSTOL
fighter/attack aircraft. Volume 2: Evaluation
of prediction methodologies
[NASA-CB-152391-VOL-2] B81-23031
Analysis of wind tunnel test results for a
9.39-per cent scale model of a VSTOL
fighter/attack aircraft. Volume 3: Bffects of
configuration variations from baseline
[NASA-CE-152391-VOL-3] N81-23032
Analysis of wind tunnel test results for a
9.39-per cent scale model of a VSTOL
fighter/attack aircraft. Volume 4: BALS B104
aerodynamic characteristics and comparisons with
E205 configuration aerodynamic characteristics
[NASA-CB-152391-VOL-4] 881-23033
OROB, B.
Analysis, design and simulation of line scan
aerial surveillance systems
Alrhorne ground velocity determination by digital
processing of electro-optical line sensor signals
A81-32490
UTUULS, Ja
GPS Mavstar, the universal positioning system of
the luture
601-303/3
UNDA, De CDC Nerster, the refrence] resitioning groter of
the future
LDE IULULE 191-30075
C15AC-109 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
An experimental interstigation of the accodumnation
and cooling of a horizontally-opposed air-cooled
aircraft engine installation
[NASA-CR-34051 N81-22015
[
-

## Ρ

PACEBE, L. L. Bearing wear detection using radioactive iron-55 tagging [ASLE FREPRINT 81-AM-6A-3] A81-33868

PALENYI, B. G. Aircraft equipment /2nd revised and enlarged
edition/
PALEBR, B. B.
of V/STOL configurations in transition
PANDA, D. P.
Advanced target tracking by dynamic scene analysis A81-32499
New technology applied to an IPP diversity
transponder A81-31133 PARE, J., E.
ATTACK vs SCAN: A comparison of endgame aircraft
[AD-A097663] N81-23076
Bnergy efficient engine flight propulsion system:
Aircraft/engine integration evaluation [NASA-CR-159584] N8V-22051
PAYNE, B. W. Experimental flutter at high subsonic speeds and
its theoretical prediction, taking into account wing thickness and Reynolds number
PRICOCE. A. T.
Puel/engine/airframe trade off study
[AD-A09/391] 881-230/3 PEAKE, D. J.
Topology of three-dimensional separated flows [NASA-TM-81294] N81-23037
PELLOBE, C. Study of the characteristics of a base-vented wing
in nonlinear theory
PETERSON, A. A.
Research review and recommendations
[NASA-CR-165344] 881-23070 PHILIPPE, JJ.
Pressure distribution computation on a non-lifting symmetrical helicopter blade in forward flight A81-33291
Rolls-Boyce BB 211-535 power plant
[AIAA PAPER 81-0807] A81-33886 PIETEUCEA, J.
A new method of airfoil flutter control A81-33844
A design analysis technique for evaluating size
[SAWB PAPER 1386] A81-31402
PLATZER, B. F. Experimental investigation of oscillating subscnic
jets A81-32777
PLOMBLEB, H. B., JR. Installation effects on propeller noise
[AIAA PAPEB 80-0993] A81-31369 POBEBEZHY, P. H.
The art of designing experimental aircraft - An
[AIAA PAPER 81-0944] A81-32939
A review of in-flight emergencies in the ASES data
base [NASA-CR-166166] 881-22031
POVINELLI, L. A. Factors which influence the behavior of turbofan
forced mixer nozzles
POWELL, J. A.
arya temperature electronic requirements in aeropropulsion systems
PEATT-BABLOR, C. E. A81-32547
Transonic flutter study of a wind-tunnel model of an arrow-wing surersonic transport
[NASA-TH-81962] N81-23071 PROKOPENKO, A. V.
Experimental determination of the stress intensity
complex parts /gas turbine blades/
A81-31264

# Q

QUBBN, S. J. Quiet propulsive-lift technology ready for civil and military applications A81-32521

## R

BAJALA, S. A. A study of real-time computer graphic display technology for aeronautical applications [NASA-CB-164221] 88 N81-22727 BABABÔBTI, V. Coriolis effect on the vibration of flat rotating low aspect ratio cantilever plates A81-30914 RAPPOLD. R. A. An investigation of two safe escape from base flight profiles [AD-A096571] N81-22034 BAPSON, B. L. Advanced composites - Evolution of manufacturing technology [AIAA PAPER 81-0895] A81-32920 REBERCHI, B. An analysis of thermal balance in the cooled cabin of a Sea King Belicopter [AD-A097199] N81-23077 REBORT, J. H. Unsteady aerodynamics of an aerofoil at high angle of incidence performing various linear oscillations in a uniform stream A81-32017 BEDDY, A. D. Behavior of continuous filament advanced composite isogrid structure N81-22095 BEDDY, C. S. Investigation of aerodynamic characteristics of wings having vortex flow using different numerical codes [NASA-CR-165706] N81-23034 REDBEBR. G. Computation of pressure distribution on the DFVLE wing-body model by the panel method [DFVLE-FB-80-02] N81-22029 BEGARD, D. O.H.B.E.A. ramjet test facilities A81-33285 RBICEBET, G. Belicopter vibration control - A survey A81-33047 BHODES, N. D. Concepts for improving the damage tolerance cf composite compression panels A81-32825 BIDBBODB, R. W. Computer aided technology interface with weights engineering [SAWE PAPEE 1346] A81-31384 BIBDEB, P. P. MLS: Airplane system modeling [NASA-CE-165700] N81-23059 BOBBETS, A. Charge-coupled device /CCD/ camera/memory optimization for expendable autonomous vehicles A81-32491 BOBINSON, P. The engine usage monitoring system: An heuristic approach to cost effective data monitoring and analysis N81-23013 BOCHE, J. P. The relationship between noise and annoyance around Orly [ NASA-TE-76573 ] 881-22594 BOGINSET, N. L. Microprocessor-based digital air data computer for flight test A81-32858 BOB, J. Transonic viscous-inviscid interaction over airfoils for separated laminar or turbulent flows A81-31612
ROSEBE, D. B.

PBBSOBAL	ADTHOR	INDEX

ROSHER, D. B.	
Compustion system processes leading to co.	rrosive
deposits	
[NASA-TH-81752]	1081-23243
ROWB, A.	
Study of the characteristics of a base-ve	nted wing
in nonlinear theory	
[AAAP PAPEE ST 80-40]	A81-33927
ROBEN, H. D.	
Description of the British Civil Aviation	
Airworthiness Data Recording Programme	(CAADEP) N81-23017
ROBLEE, J.	
Antenna design and development for the mi	CIQWAVe
subsystem experiments for the terminal	
configured vehicle project	
[ NASA-CB-164220 ]	N81-22282
RUD, R. C.	
Flight evaluation of the concept of the s	tage A
Peripheral Vision Sorizon Device (PVHD)	using
the CH 135 aircraft of 403 Squadron - C	EB Gagetown
[AD-A096870]	N81-22050
BUDD, H. J.	
Laser Doppler airspeed and altitude senso	r
[AD-A096980]	N81-22049
RUHLIN, C. L.	
Transonic flutter study of a wind-tunnel	model of
an arrow-wing supersonic transport	
[ NA SA-TH-8 1962 ]	N81-23071
Transonic flutter and gust-response tests	and
analyses of a wind-tunnel model of a to	rsion
free wing airplane	
[ NA SA-TH-8 1961 ]	N81-23072
RUPPRECHT. S. D.	
Investigation of air solubility in jet A	fuel at
high pressures	
[NASA-CR-3422]	N81-22130
[NASA-CR-3422] BUSSBL, B. J.	N81-22130
[NASA-CE-3422] BOSSEL, B. J. Airships - Transport of the future	N81-22130
[NASA-CR-3422] BUSSBL, B. J. Airships - Transport of the future	N81-22130 A81-31699

# S

3	
SABELKIN, V. P.	
Increasing the strength properties of sheet	carts
by exclosive forming of them with optimiz	aticn
of the production parameters	
or the production parameters	181-33174
CITER TARE D C	201-33174
JAIBI JVDS, Be on	
A design analysis technique for evaluating	size
and weight of V/STOL fift fans	
[SAWE PAPER 1386]	A81-31402
SAINT-CYR, G. J.	
A computer code for the calculation of airc	raft
trailing vcrtices	
	A81-30710
SAKATA, I. P.	
Design considerations for composite fuselage	ie
structure of connercial transport aircraft	t
[NASA-CR-159296]	N81-27419
SANDRES. R. L.	201 22415
The structural weight fraction - Perisited	for
fighton (attack type airgraft	101
fighter/actack type afforant	101 11207
SAWE PAPER IJOJ	¥91-21381
SANKEWITSCH, V.	<b>•</b> • •
Ploor and fuel vitration isolation systems	for the
Eceing Vertol connercial Chinock	
	A81-32016
SASHIKUNA, Ho	
Study of the secondary flow in the downstre	ea∎ of a
moving blade row in an axial flow fan	
	A81-31767
SATYABARAYABA, B.	
Adaptive-wall wind-tunnel development for	
transonic testing	
	191-31367
CAULAS CH	A01-51507
The optimal lift-drag ratio of a civil air	ft
()) P DIEPD MR 90. 261	101 23033
LAVAL BARAT BARAT	891-33923
SAVAGE, J. S.	
The use of allspace - one way to save fuel	
	A81-33150
SCHAIBER, K.	
Adaptive-wall wind-tunnel development for	
transonic testing	
	A81-31367

SCHEB, B. B.
two element interferometer
A81-31125
Transonic rotor poise - Theoretical and
experimental comparisons
SCHUBBLY, F. D.
Technology growth in midi-BPV systems [ATAN PAPER 81-0936] A81-32937
SCHOBH, B. L.
An aircraft manufacturer's view of airport B&D meeds [ATAA FAPRE 81-0793] A81-33887
SCHOTTBR, R. J.
Study to develop improved fire resistant aircraft passenger seat materials
[NASA-CR-152408] 881-23058
General Aviation Activity and Avionics Survey
[AE-A097604] N81-23081
Application of the parameter space method to
aerospace vehicle digital control system design
SENGUPTA, D. L.
Inflight aircraft vibration modes and their effect
181-31370
SEVALL, N. G. Description of recent changes in the Langley 6- by
28-inch transonic tunnel
[NASA-TH-81947] N81-23096 SHAGBHA Ja Lag JB
A new generation IPF - The AN/APX-100/V/ transponder
881-31132 SHANROTH S. J.
Analysis of turbulent flow about an isolated
airfoil using a time dependent Navier-Stokes procédure
N81-23053
A new generation IFF - The AN/APX-100/V/ transponder
A81-31132
Airframe noise of a small model transport aircraft
and scaling effects [NASA-TE-1858] N81-22832
SHER, L.
vehicles
[AAS PAPER 81-024] A81-32886
Hydrodynamic modelling of the starting process in
liguid-propellant engines
SHIVASHABBABA, B. H.
Noise characteristics of two parallel jets with unequal flow
[AIAA PAPER 80-0168] A81-31601
Study to develop improved fire resistant aircraft
passenger seat materials
SIMBONS, J. H.
Experimental investigation of oscillating subsonic jets
A81-32777
SIBPSON, B. N. Investigation of air transportation technology at
Massachusetts Institute of Technology, 1980
SIES, E. L.
Comparison of theoretical predictions of orbiter
results for a Mach number of 0.52
[NASA-TH-81358] N81-23066
Application of ion implantation for the
improvement of localized corrosion resistance of NSO steel bearings
[AD-A097230] 881-23466
SINDA, A. N. Airport capacity enhancement by innovative use of
runway geometry

#### PERSONAL AUTHOR INDEX

SKODA, Z.	
Mathematical model of the linear unsteady	•
aerodynamics of the entire aircraft	481-31020
SKOBPIK, J. B.	801-21025
In-flight fatigue crack monitoring using a	coustic
ewission	101-22057
SHITE H. B.	A01-32037
High frequency drive mechanism for an acti	٧e
controls systems aircraft control surfac	e
SATTR. K. R.	881-22400
Preliminary design study of advanced compo	site
blade and hub and nonmechanical control	system
for the tilt-rotor aircraft. Volume 1:	
[NASA-CR-152336-1]	N81-23064
SHITH, H. C.	•
An analysis of opportunistic maintenance p	olicy
	N81-23025
SHITH, T. B.	
PABAN - A new weight sizing routine	
SNIDER, J. J.	A81-31389
Fuel/engine/airframe trade off study	
[AD-A097391]	N81-23073
A simulator to test compressor research fa	cility
control system software	
	A81-31110
Discrete Address Beacon System	•
AINTERS MATCHA PLACE	A81-31134
SOLIGINC, JL.	
Experimental study of the separation at th	e
after-body	area
•	A81-33281
SOLODIANKIN, S. H.	
by explosive forming of them with optimi	zaticn
of the production parameters	
COARTE R R	A81-33174
Weights information systems using minicomp	uters
[SAWE PAPER 1347]	A81-31385
SORBUSEN, J. A.	2
time-of-arrival constraints	a
	A81-31297
SPARNO, J. D.	
Rapport tactical self protection systems d	A81-31113
SREBBIVASANURTHY, S.	
Coriolis effect on the vibration of flat r	otating
tow aspect fatto cantilever plates	A81-30914
STAPLETON, B. P.	
MLS: Airplane system modeling	N01_33050
STASZBK, J.	701-73033
Subsonic and transonic flow on a wing at d	ifferent
sweep angles. I	191-31240
Subsonic and transonic flow on a wing at d	ifferent
sweep angles. II	
	A81-31250
Combustion system processes leading to cor	rosive
deposits	
[NASA-TH-81752]	181-23243
P-8C adaptive control law refinement and s	oftware
development	
[ BASA-CB-163093 ]	B81-22059
SIBLE, B. Functional analysis and operational access	ment of
an onboard glide path guidance system fo	r visual
approaches (visual approach monitor VAM)	
[BSA-TT-655] STREERL, R. F.	N81-22038
Investigation of air transportation techno	•
	logy at
Frinceton University, 1980	logy at

STRDEL P. S.	
Thermal and flow analysis of a convection	
nir-cooled coraris costed perces estal at	
all-cooled certaic coaled polous metal co	ucept
for turbine vames	
[NASA-TE-81/49]	N81-22056
STEENBEGER, L. L.	
The Modular Life Cycle Cost Model for advan	iced
aircraft systems - An overview 🕚	
[SAVE PAPER 1351]	181-31386
STERBFELD, H., JR.	
A study of the effect of terrain on helicor	ter
noise propagation by acoustical modeling	
[AD-A097626]	N81-23864
	101 13004
Decide concepts for low-cost connection turk	ofor
spring from the low cost composite curr	orau
engine irame	
[ NASA-CH- 16521/ ]	881~22053
STOLIABOVA, L. I.	
Method for evaluating the resistance of	
gas-turbine installation disks to thermal	cycling
• •	181-33168
STRAUB, P. K.	
A Galerkin type finite element method for	
rotary-wing aeroelasticity in hover and f	orward
flight	
	191-33050
CODINCC F D	201-22020
But no H C ist fueld - b refinerie misurei	
rutule 0.5. jet lueis - a leilueis viewpoj	.ut . 
LATAA PAPER 81-0//0]	V01-33610
STROUBERG, W. J.	
Performance deterioration based on simulate	a
aerodynamic loads test, JT9D jet engine	1 A 1
diagnostics program	
[NASA-CE-165297]	N81-23086
STOBHLEB, B.	
Classification of operating conditions of	
turbomachines from sclid borne sound	
	N81-23015
SHRRT, L.	
Dead reckoner navigation project	
	N81-22010
Concrel emistion eignland fuel concert such	001-22010
ceneral aviation arrhidge iner economy plat	891-00011
	801-22011
SUBSI, Le Do	
Laser peacon collision avoidance systems	
	N81-22009
SZATA, R.	
The effect of airplane noise on the inhabit	tants of
areas near Okecie Airport in Warsaw	
[ BASA-TH-75879 ]	N81-22593
SZEWCZIE, Z.	•
A new method of airfoil flutter control	
	A81-33844

# Т

 

 TANHA, H. K.

 Installation effects on propeller noise [ATAM FAPER 80-0993]
 A81-31369

 TABMER, A. E.
 Crashworthiness design parameter sensitivity analysis [AT-A096550]
 N61-22041

 TEMIS, IU. B.
 Numerical methods for studying the stress-strain state and service life of aircraft gas-turkine engine disks
 A81-31256

 TEBLANDER, E. A.
 A81-31256

 Application of computer colour raster displays in the cockpit in research flight simulation [AD-A096542]
 N81-22063

 THOMAS, J.
 Functional analysis and operational assessment of an onboard glide path guidance system for visual approaches (visual approach monitor VAM) [BSA-TT-655]
 B81-22038

 THOMPSON, A. D.
 MLS: Airplane system modeling [NASA-CB-165700]
 B81-23059

 THOMPSON, J. W., JE.
 Development of a noniterference compressor klade stress measurement system
 A81-32274

 THOMSON, B. G. Designing for aircraft structural crashworthiness [AA PAPEE 81-0803]
 A81-33882

.

TISDALE, G. E. Autononous target handoff from an airborne sensor to a missile seeker A81-32498 TOBAE, M. Topology of three-dimensional separated flows [NASA-TH-812941 N8 N81-23037 TOBUSKOETTBE, H. Investigations into local fault detection on turbojet engines N81-23011 TOBES, N. Laser beacon collision avoidance systems N81-22009 TORNSBED, J. C. Pressure and force data for a flat wing and a warped conical wing having a shockless recomparession at Mach 1.62 [NASA-TP-1759] N81-22016 TRABOLD, B. Lo Study to develop improved fire resistant aircraft passenger seat materials [NASA-CB-152408] N81-23058 TRUNK, G. V. Maximum likelihood elevation angle estimates of radar targets using subapertures A81-32691 TUCK, B. O. Steady flow and static stability of airfoils in extreme ground effect A81-31686 TOBIAN, V. A. Aircraft assembly A81-31872 TURNBR, A. H. Maintenance tomorrow and the day after A81-33790 TYB, W. Is it safe - The safety assessment of aircraft systems. IV - Methods, techniques, and organisation A81-33789 TYLER, M. C.

Structural Integrity Recording System (SIR) for U.S. Army AB-16 Belicopters [AD-A097283] N81-23438

#### U

UMMEL, B. B. Analysis of ejection seat stability using easy program, volume 1 [AD-A096597] N81-22033 URSELL, C. B. Design, fabrication, calibration, application, and testing of advanced aircraft weighing systems [SAWE PAPER 1383] A81-31399

#### V

VAN DEN BERG, B. Role of laminar separation bubbles in airfoil leading-edge stalls A81-31613 VANDEBPLAATS, G. N. Structural optimization - Past, present and future [AIAA PAPER 81-0897] A81-329. VAUNOIS, J.-P. A81-32922 Aerodynamic trials with the linear motor-driven Flatform at the Toulouse Aeronautic Testing Center FAMAF PAPER NT 80-411 A81-33943 VEINOT, D. E. X-ray fluorescence spectrometric analysis of wear netals in used lubricating oils [AD-A097552] N81-23087 VICKBBS, T. K. Some design and procedural aspects of in-flight collision avoidance [AIAA PAPER 81-0805] A81-33885 VISUANTIAN, S. P. Reduction of belicopter vibration through control of hub-impedance A81-32009 VOLKOBDOV, A. P. Aircraft equipment /2nd revised and enlarged edition/ 481-31823

#### PERSONAL AUTHOR INDEX

VOLLBRUER, N- F. Dynamic errors of the Kalman filtering of trajectory parameters 181-33687 VONGLANN, D. Comparison of predicted engine core noise with proposed PAA helicopter noise certification requirements [NASA-TH-81739] N81-22839 VUKBLICH, S. R. Wing-body carryover at supersonic speeds with finite afterbodies A81-31622 Ŵ WAIHLAND, D. M. A microcomputer-based signal data converter for runway visual range measurements [AD-A097568] N81-23060 WALEN, D. B. HLS: Airplane system modeling [NASA-CB-165700] N81-23059 WALKEB, C. L. Component research for future propulsion systems [NASA-TH-82613] N81-22055 WALKER, G. A. Development of maintenance metrics to forecast resource demands of weapon systems. Analysis and evaluation, revision A [AD-A096688] N81 Development of maintenance metrics to forecast N81-22971 resource demands of weapon system. Maintenance. metrics and weightings, revision A [AD-A096689] B81 Development of maintenance metrics to forecast N81-22972 resource demands of weapon systems. Analysis and results of metrics and weightings, revision [AD-A096690] N81 Development of maintenance METRICS to forecast N81-22973 resource demands of weapon systems (parameter polarization), revision A [AD-A097692] N81-23325 Weapons system support resources demand parameters logistics [AD-A097517] 81-23937 WALLACE, W. The rejuvenation of properties in turbine engine hot section components by hot isostatic pressing [AD-A097551] N81-23088 WALLIS, D. B. Low-frequency radio navigation system [NASA-CASE-NPO-15264-1] N81-22036 [AD-A097356] N81-23043 WALTON, G. S. Applications of new technology in the infrared A81-31126 NAIG, K.-F. On St. Venant flexure and torsion problem for symmetrical airfoil sections 181-33245 BANG. I. F. Application of ion implantation for the improvement of localized corrosion resistance of M50 steel bearings [AD-A097230] N81-23466 FARHOCK, W. B. Flatbed - The universal transport airplane [SAWE PAPER 1343] 181-31382 WATERS, B. S. Airborne method to minimize fuel with fixed time-of-arrival constraints A81-31297 NEDEN, G. J. Component research for future propulsion systems [NASA-TH-82613] N81-22055 BBECK, N. C. National runway friction measurement program [AD-A097334] R81-23097 BERGENI, G.

WERGENI, G. Operator training systems/simulators A81-31109

WESLEB, J. E. Pederal policies affecting airport noise compatibility programs [AIAA PAPEE 81-0829] A81-33879

ZUK, J. Component research for future propulsion systems [NASA-TH-82613] B81-22055

WEST. C. L.	
Analysis of ejection seat stability using o	easy
program, volume 1	-
[AD-A096597]	N81-22033
WESTOVER, B.	
Advanced target tracking by dynamic scene a	analysis ·
	A81-32499
BRITE, D. J.	
Implementing Aircraft Structural Life Manag	e ne nt
to reduce structural cost of ownership	,
[SAWE PAPER 1331]	A81-31376
HILLIANS, J. B JR.	
Wing-body carryover at supersonic speeds w	ith
finite afterhodies	
	181-31622
WILLIAMS, J. G.	
Concepts for improving the damage tolerance	e of
composite compression namels	
composite complession panels	A81-32825
WILLSHIRE H. L. JR.	
Lateral attenuation of high-hy-mass ratio	ongined
aircraft noise	enginea
	N81-23062
	801 23002
Development of maintenance metrics to fore	ract
recourse demands of Meanon systems in a	lveie
and oralization revision 1	1919
The solution, levision A	881-22071
Development of maintenance metrics to fore	801-22971
Tocource demands of weapon system . Main	topanco
notrice and weightings revision 1	cenance
fan_anossen	N81-22072
Development of maintenance metrics to fore	801-22972
Tocourse depends of weepen suctors in the	lucic
and receive of metrics and veightings m	LISIS
The MOGGON	N81_22072
LAD-AUGUGUJ Dozolopmont of maintonange MPERICS to form	801-22373
recourse depends of weapon sustains (pare)	tast notor
resource demands of weapon systems (paras	lerer
polatization, tevision a	#01-2222E
	401-23323
NUCSE, Me Ae	
A COSC FUNCTION FOR MILITARY ATELEANES	N81-23066
Lau-AVJ/JJ0j 1 cost function for an airframe production	au 1-23300
A COST FUNCTION FOR AN ATTITAME PRODUCTION	FIGT 23043
[Vh-4/2/24/]	801-23901
HUBUy De Lacen beagen collicion avoidance encione	
Laser reacon corresion avoidance systems	891-22000
	B01-22009

· Y

. . ....

IDDg Us De	
An extremely lightweight fuselage-integrate	ed
phased array for airborne applications	
proble dire; for directle approactors	101-20220
	801-20/19
YORK, P.	
Aircraft wing weight build-up methodology	with
modification for materials and construct	ion
techniques	
[BASA-CE-166173]	N81-23068
TOUNG, N. H., JR.	
Finid mechanics mechanisms in the stall nr	ocess of
alfiolis for melicopters	
	181-32779
YOUNIS, & B.	
A time marching finite volume method for	
blada ta blada flava paisa a bada fibiad	
fiade-to-blade fices using a body-fitted	
curvilinear mesh	
	A81-30717
TIL J. C.	
Non-flaw and turbulance recommended in th	h.a.
Head-riow and turbulence measurements in th	ue
vicibity of the trailing edge of an NACA	(63 SUD
1)-012 airfoil	
[NASA-TP-1845]	N81-23410
IUg In de	
Transonic rotor noise - Theoretical and	
experimental comparisons	
	A81-33049
Average as to	
ADALYSIS OF ejection seat stability using	easy
program, volume 1	
FAD-A0965971	881-22033
L	

## Ζ

ZADBIE, 8. Calculation of the flow pattern behind an aircraft wing

A81-31041

# CONTRACT NUMBER INDEX

AERONAUTICAL ENGINEERING / A Continuing Bibliography (Suppl. 138)

#### AUGUST 1981

#### Typical Contract Number Index Listing





Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the *IAA* accession numbers appearing first. The accession number denotes the number by which the citation is identified in either the *IAA* or *STAR* section.

NP DROT 2051	N91-220#5
N81-23083	P33615-77-C-0075
N8 1-23084	N81-22971
AF PROJ. 2304	N81-22972
N8 1-23025	N81-22973
AF PROJ. 2305	N81-23325
N81-22049	P33615-78-C-1496
AF PROJ. 2401	A81-31125
NO 1-22 100	F33615-78-C-2001
NR 1-22033	R33615-78-C-2008
N81-22042	A81-33868
N81-22044	F33615-79-C-3407
AF PROJ. 3048	N81-22033
N81-23073	F33615-80-C-5102
AF PROJ. 6665	N81-22974
N81-22023	P49620-78-C-0023
NR 1-22035	NO 1-22049 NAC 1-112 N91-22022
AF-A FOSR-0102-80	NAG2-8 N81-23093
N8 1-23025	NAG2-45 N81-23433
DA PROJ. 1F2-62209-AH-76	NASH-2342 N81-22969
N8 1-23438	N81-23078
DA PROJ. 1L1-62209-AH-76	NASH-3198 N81-22060
N8 1-2204 1	N81-22098
DAAG29-78-C-0002	N81-22589
N81-23864	N81-22593
DAAJ 02-75-C-0050	N81-22594
BO 1-23430	NASE-3135 B01-22034
AR1-32642	NAS1-13681 N81-22129
DAAK51-79-C-0042	NAS1-14549 N81-22722
N8 1-2204 1	N81-22723
DAAK70-79-C-0150	N81-22724
A8 1-32499	N81-22725
DOT-PA01-81-C-0001	N81-22726
A01-33091	NAS1-14880 N81-23059
N8 1- 23063	NAS1-15414 N81-23487
DOT-FA788A-4242	NAS1-15497 A81-31297
N81-23097	NAS1-15949 B81-22419
DOT-BS57-80C-00103	NAS1-15988 881-23411
<b>A8 1- 3388</b> 3	NAS1-16247 N81-22032
DRET-78-490 A81-33927	NAS2-9337 N81-23058
DEET-79-515 A81-33950	NAS2-9434 881-23095
EF-//-A-V1-2393	NAS2-9803 N81-23088
PAA PROJ. 154-451-180	NAS2-10060 881-22031
N81-23768	N81-22037
PAA PROJ. 219-151-200	NAS2-10160 B81-23064
B8 1-23060	N81-23065
F19628-73-C-0155	BAS2-10326 B81-22047
N81-22023	NAS2-10344 N81-23030
r 1962 - 77-C-0232	N81-22031
P19628-80-C-0002	881-23032
881-23063	NAS3-19429 N81-22052
P30602-78-C-0329	NAS3-20632 N81-23086
A8 1- 30776	HAS3-20643 H81-22051
P33615-75-C-5218	BAS3-22160 881-22053
N81-23083	BAS3-22361 B81-23069
N81-23084	HAS3-22384 N81-23070
r33013-70-C-3048	BAS4-2344 N81-22059
80 1-22 140 233615-76-C-3135	NGL-22+009-640
881-22044	K81-72002

NG R-22-009-818
N81-23035
NG R-36-009-017
N81-22003
NR FRCJ. 047-202
N81-23966
N81-23967
NSP CME-79-16933
A81-30786
NSG-1083 N81-22015
NSG-1331 N81-22282
NSG-1355 N81-22727
NSG-1561 N81-23034
NSG-1578 A81-33050
NSG-3306 N81-22130
N00014-75-C-0451
№81-23966
N81-23967
N62269-78-C+0363
N81-23075
BR0220844 N81-23466
WF4140100 N81-23466
WP41400000 N81-23043
WP61562001 N81-23288
304-90-00 N81-22130
505-06-53-01 N81-23034
505-31-33-04 N81-23036
N81-23096
505-31-43-01 N81-22016
505-31-63-01 N81-22061
505-32-03-05 N81-23410
505-32-03-06 ¥81-22832
505-33-53-01 N81-23072
505-35-13-01 N81-23713
505-35-41 N81-22031
N81-22037
505-41-13-01 N81-22015
505-42-21 N81-22039
505-44-12 881-23070
506-53-31 ¥81-23037
506-53-64 N81-23067
530-01-13-02 N81-22040
530-04-11 N81-23039
533-01-13-07 N81-23071
535-03-12 N81-22836
N81-22838

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1. Report No. NASA SP-7037(138)	2. Government Access	ion No.	3. Recipient's Catalog	No.
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A Continuing Bibliography (Supplement 138)		138)	o, renorming organiz	
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9. Performing Organization Name and Address			10. Work Unit No.	
National Aeronautics an Washington, D.C. 20546	d Space Adminis	tration	11. Contract or Grant	No.
12. Sponsoring Agency Name and Address			13. Type of Report an	d Period Covered
			14. Sponsoring Agency	Code
15. Supplementary Notes	·······	<u></u>		·
16. Abstract				
This bibliography lists introduced into the NAS in July 1981.	366 reports, a A scientific an	rticles, and other d technical inform	documents nation system	
17. Key Words (Suggested by Author(s))		18. Distribution Statement	·	<u></u>
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