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Aeronautical Engineering
A Continuing Bibliography with Indexes

National Aeronautics and Space Administration

Aeronautical Engineering A Continuing Bibliography with Indexes
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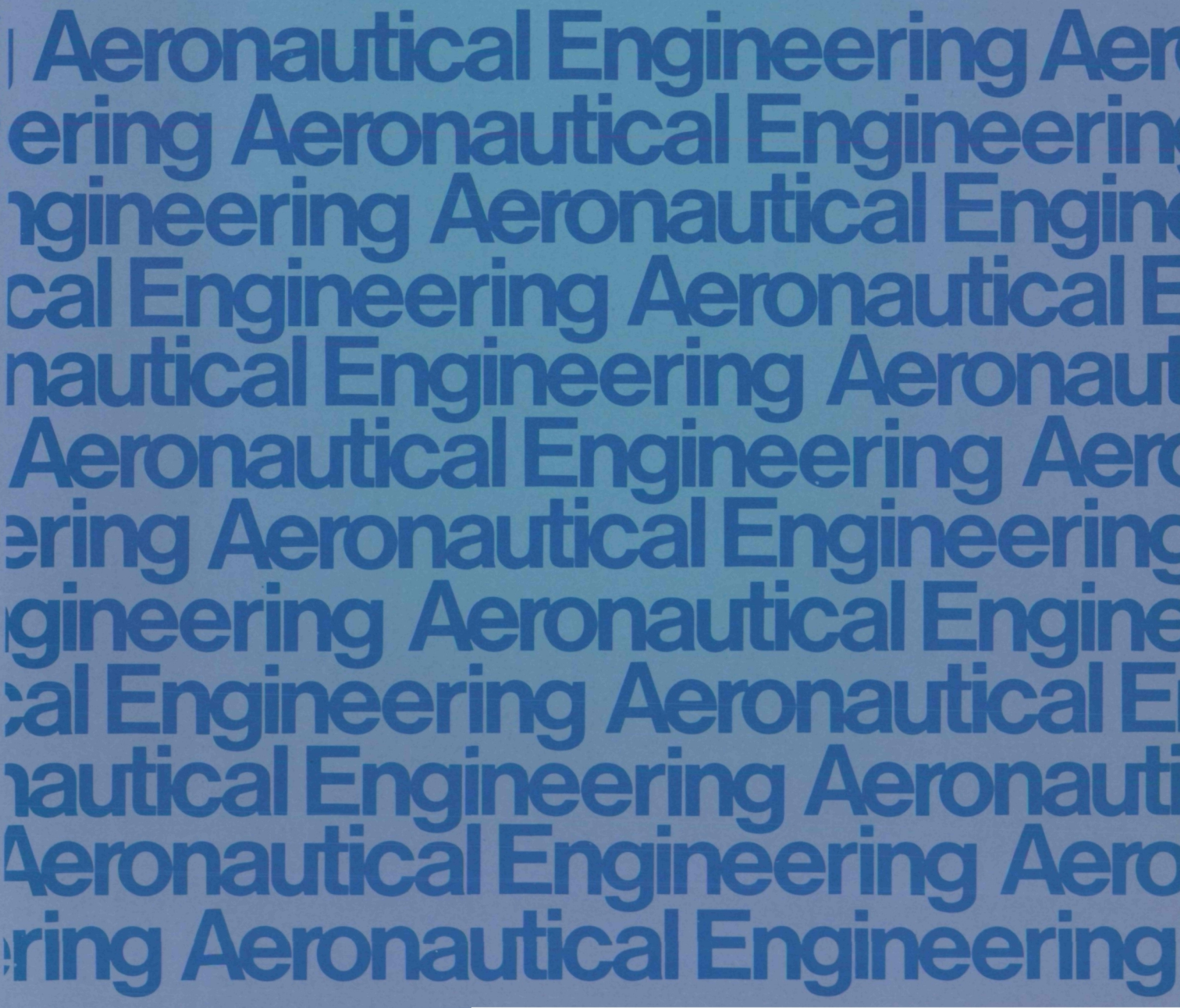

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AERONAUTICAL ENGINEERING

A Continuing Bibliography

Supplement 98

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 June 1978 in

- *Scientific and Technical Aerospace Reports (STAR)*
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This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 399 reports, journal articles, and other documents originally announced in June 1978 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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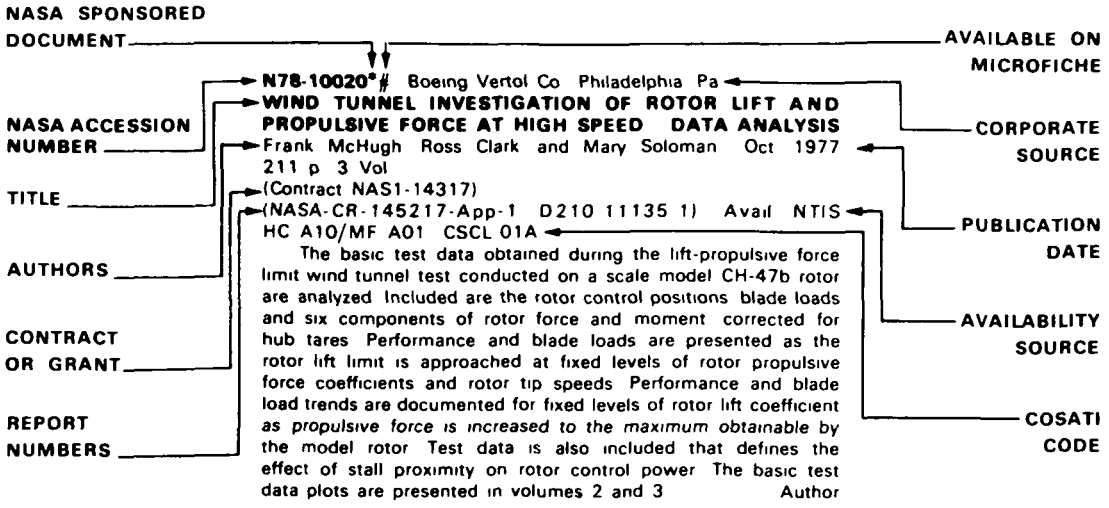

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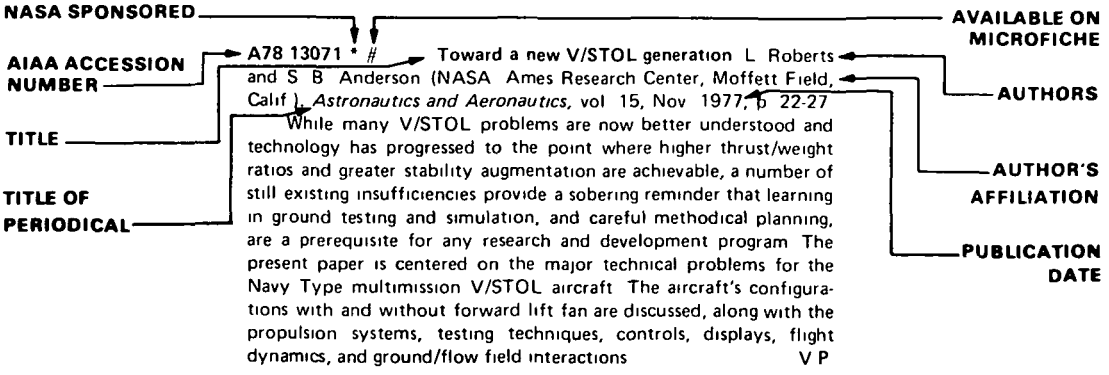

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 98)

JULY 1978

IAA ENTRIES

A78-28523 # Choice of optimal ellipsoid-surface projection onto a sphere in solving problems of air navigation (O vybore optimal'noi proektsii poverkhnosti ellipsoida na sferu pri reshenii zadach vozdushnoi navigatsii) V N Gan'shin (Leningradskii Inzhenerno Stroitel'nyi Institut, Leningrad, USSR) and A V Lipin *Geodeziia i Aerofotos'emka*, no 5, 1977, p 20-25 5 refs In Russian

It is demonstrated that for purposes of air navigation it is most suitable to approximate a geodesic line by the central section of an ellipsoid Kavraiskii's simple method (1958) for projecting an ellipsoid surface onto a sphere is analyzed, it is shown that in these projections the central section of the ellipsoid is in the form of the arc of a large circle Formulas for the transformation of elements (azimuths and arc lengths) of the central section to elements of a 'Kavraiskii sphere' are presented B J

A78-28560 Mode of operation and characteristics of Darrieus rotors (Arbeitsweise und Merkmale von Darrieus-Rotoren) H Selzer and C Cohrt (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) In Energy from wind, Meeting, 4th, Bremen, West Germany, June 7, 8, 1977, Report Munich, Deutsche Gesellschaft fur Sonnenenergie, 1977, p 111-124 In German

Some of the main features of the operation of a vertical-axis (Darrieus) rotor for wind energy conversion are examined The basic method for calculating the performance index of a rotor is shown Startup behavior, materials, conversion technique, and efficiency of operation are briefly discussed Curves showing the dependence of the performance index on the high-speed rpm number for an experimental Darrieus rotor are given along with a design chart giving the rotor diameter vs design wind speed relation for rotors of four different output classes from 1 kW to 100 kW P T H.

A78-28610 Boundary-layer interaction with a non-equilibrium two-phase stream on a surface being burned out in an axisymmetric Laval nozzle A A Glazunov, E G Zaulichnyi, V Ia Ivanov, and A D Rychkov *(PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki*, May-June 1977, p 53 62) *Journal of Applied Mechanics and Technical Physics*, vol 18, no 3, Jan 10, 1978, p 323-330 18 refs Translation

A method incorporating hyperbolic differential equations of subsonic and transonic flow is developed for analyzing the non-stationary problem of two-phase (gas and solid-particle) flow in an axisymmetric Laval nozzle Attention is given to the interaction of a turbulent boundary layer formed on the ablating nozzle wall with the nonequilibrium flow Numerical results are presented for two-phase mixtures with the following parameter values an initial pressure of 43 atm, an initial temperature of 3450 K and particle diameters of 2 microns B J.

A78-28789 Microfractographic fracture analysis of some aircraft parts S Nishijima, C Masuda, and M Shimodaira (National Research Institute for Metals, Tokyo, Japan) *Japan Society of Materials Science, Journal*, vol 27, Jan 1978, p 9-13 8 refs In Japanese, with abstract in English

A technique for the microfractographic fracture analysis of aircraft parts, such as propeller blades and hubs and landing gear link assemblies, is presented The method is illustrated by examples of fatigue caused fracture Analyses are performed by striation and bench-mark spacings, and by the undulating pitches of tear-dimple facets caused by fast overload fractures S C S

A78-28833 Clear air turbulence accidents A I Brunstein (National Transportation Safety Board, Washington, D C) *SAFE Journal*, vol 8, Spring 1978, p 17-19

National Transportation Safety Board air carrier records for 1964-1975 show 68 accidents involving clear air turbulence (CAT) One hundred eighty-four persons were injured and there were thirty six fatalities Most aircraft involved were jets and most accidents occurred between 31,000 and 35,000 feet in normal cruise CAT forecasting was not particularly accurate The airlines have suffered severe economic penalties, probably in excess of $23,000,000 annually It is concluded that more accurate and timely CAT forecasts are needed, CAT detection systems, airborne and ground-based are needed, and real-time weather data are required on the ground and particularly in the cockpit (Author)

A78-28834 Automatic airspace R E Gillman *Exxon Air World*, vol 30, no 1, 1978, p 6 10

Computer techniques, both in ATC and on board aircraft, are discussed with reference to their effectiveness in ensuring smooth separation and sequencing of commercial air traffic Attention is given to the terminal configured vehicle concept, which utilizes new display systems to assist the pilot, especially during the landing phase A TV screen, called the Electronic Attitude Direction Indicator (EADI) is evaluated in terms of its ability to graphically present runway approach patterns, i e , aircraft attitude, heading, and tracking D M W

A78-28835 Advanced flight decks for the 80s P N Giles (British Aircraft Corp , Ltd , Commercial Div , Weybridge, Surrey, England) *Exxon Air World*, vol 30, no 1, 1978, p 11-14

A modified VC-10 mock-up is employed to test new flight deck display systems Attention is given to man-machine interaction, whereby the former makes decisions based on information provided by the latter Flight parameters evaluated include aircraft attitude, location, distance from the runway, and engine functioning Pilots asked to evaluate the display systems generally gave them favorable ratings D M W

A78-28880 Use of NS LX1600A as a short-range altimeter B L Sawford and P C Manins (Commonwealth Scientific and Industrial Research Organization, Div of Atmospheric Physics, Aspendale, Victoria, Australia) *Journal of Physics E : Scientific Instruments*, vol 11, Feb 1978, p 158-160

Characteristics of the LX1600A pressure transducer are examined with the object of using the device as a short-range altimeter

for probing the lowest kilometer or two of the atmosphere In this application the device is subject to large temperature changes and stringent power restrictions It is shown that pressure determination to plus or minus 1 5% over ranges of 2 and 20 kPa is possible provided that temperature effects are calibrated out Operation of the device in a pulsed mode results in a considerable saving in power consumption (Author)

A78-28900 **Fault tolerant flight controls** R Poupard (IBM Corp , Federal Systems Div , Owego, N Y) *Aviation Engineering and Maintenance,* vol 2, Jan 1978, p 19, 21, 22, 29 8 refs

A method which uses multiple digital computer systems in fly-by-wire flight control is described in terms of its tolerance to faults Attention is given to the concept of 'coverage', which means that a fault can be detected, traced to a specific unit, and correct operation can be continued even after failure has occurred The number of faults which can be tolerated within a given system is the subject of a hard- and software analysis The NASA F-8 digital fly-by-wire research program is presented as an illustration of a two-fault tolerant redundant system, with particular applications in Space Shuttle avionics D M W

A78-28956 # **Hydrodynamic effect on a contour produced by an ideal incompressible flow of constant vorticity (Gidrodinamicheskoe vozdeistvie na kontur so storony potoka ideal'noi neszhimaemoi zhidkosti s postoiannoi zavikhrennost'iu)** S D Vil'khovchenko *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Jan -Feb 1978, p 52-58 11 refs In Russian

In the present paper, a problem involving a flow of uniform vorticity is reduced to the problem of the motion of a deformable contour in a potential flow An approximate method for calculating the hydrodynamic effect on the contour for a class of flows is proposed and is used to derive linear-approximation formulas for the hydrodynamic forces and moments The results are expressed in terms of the local characteristics of the external flow and the hydrodynamic characteristics of the contour's configuration The properties of the configuration characteristics are identified for contours with one and two symmetry axes Expressions, based on conformal mapping, are obtained for calculating the hydrodynamic characteristics of the contour's configuration V P

A78-28958 # **Calculation of supersonic flows past wings with allowance for trailing tangential discontinuities within the framework of a model employing a system of Euler equations (Raschet sverkhzvukovogo obtekaniia kryl'ev s uchetom skhodiashchikh s kromok tangentsial'nykh razryvov v ramkakh modeli, ispol'zuiushchei sistemu uravnenii Eilera)** A N Minailos *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Jan -Feb 1978, p 78-89 14 refs In Russian

A78-28959 # **Stability of subsonic gasdynamic flows (K ustoichivosti dozvukovykh gazodinamicheskikh techenii)** F A Slobodkina *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Jan -Feb 1978, p 90-97 10 refs In Russian

A system of partial differential equations describing the small perturbations of the steady flow of a perfect inviscid gas in a channel of variable cross section is analyzed The steady flow equations and the boundary conditions are analyzed, and the solution of the linearized equations is sought in the form of v(x) exp (lambda t), where v(x) is an eigenfunction, and lambda is the natural frequency of the boundary value problem under consideration Using this approach, the problem can be reduced to the solution of ordinary differential equations with variable coefficients that depend on the lambda parameter Analytical solutions are obtained for small values of lambda and for absolute values of lambda much greater than unity V P

A78-28961 # **Transonic flows past a lift profile (O transzvukovykh techeniiakh okolo nesushchego krylovogo profilia)** Iu B Lifshits and O S Ryzhov *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Jan -Feb 1978, p 104-112 14 refs In Russian

Asymmetric transonic gas flows past a lifting wing are analyzed An asymptotic solution to the flow problem is obtained for a region at some distance from the wing, and the dependence of the terms of the asymptotic expansion on the parameters characterizing the longitudinal and transverse dimensions of the wing is examined A law governing the variation of the lift as a function of the difference between Mach = 1 and the freestream Mach number is derived, assuming that the difference is small V P

A78-28969 # **Investigation of the flow in a plane diffuser by means of a laser Doppler anemometer (Issledovanie techeniia v ploskom diffuzore s pomoshch'iu lazernogo Doplerovskogo anemometra)** A Ia Shkvar *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Jan -Feb 1978, p 159-161 5 refs In Russian

A78-28972 # **An analytic study of free molecule flow fields at the front and back edges of a plate (Analiticheskoe issledovanie polei svobodnomolekuliarnogo techeniia v raionakh perednei i zadnei kromki plastiny)** S V Musanov *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* Jan -Feb 1978, p 171 176 5 refs In Russian

An analytic investigation of density fields and mass flux at the front and back edges of a plate fixed parallel to a free molecule flow is presented The limiting perturbations which may occur in the current are identified It is found that the effects previously observed under transient conditions (such as the development of a boundary layer, the formation of a shock wave, and a rarefied wake) are analogous to processes in the collisionless mode S C S

A78-29089 # **Observability criteria for nonlinear dynamic systems subjected to multiparameter measurements (Kriterii nabliudaemosti nelineinykh dinamicheskikh sistem pri mnogomernykh izmereniiakh)** A M Kovalev (Akademiia Nauk Ukrainskoi SSR, Institut Prikladnoi Matematiki i Mekhaniki, Donetsk, Ukrainian SSR) *Prikladnaia Mekhanika,* vol 13, Dec 1977, p 95-101 10 refs In Russian

The paper deals with the problem of observing a nonlinear dynamic system where the function of the phase coordinates, which is being measured and which is known at specified moments of time, is a nonlinear vector function Global and local formulations of the sufficient observability conditions are derived The applicability of sounding navigation to the autonomous determination of aircraft phase coordinates is studied from the standpoint of observability theory V P

A78-29174 **Giants battle in US small turbine market** J P Geddes *Interavia,* vol 33, Mar 1978, p 179 184

Rising fuel costs, federal noise regulations, and the availability of new technologies have spurred the development of a new generation of jet engines for small aircraft This paper describes a variety of such engines (under 4,500 kp thrust) with reference to market demand projections, and to the feasibility of designing new airframes around them Included in the discussion are turboprops as well as fan jets D M W

A78-29175 **US Navy examining a wide range of V/STOL concepts** H Levy *Interavia,* vol 33, Mar 1978, p 227-229

V/STOL and VATOL (vertical attitude take-off and landing) aircraft, designed to become operational in the 1990s, are analyzed within terms of mission requirements Three basic mission types are outlined high-speed multi-mission, supersonic fighter/attack, and anti-submarine (a LAMPS Mk 3 replacement) Attention is given to a

circulation control wing (CCW), which uses trailing-edge blowing to increase lift (the Coanda effect) Similar to the CCW is the X-wing rotor, built from high-strength composite materials, which can be stopped in flight and locked at a fixed angle to the fuselage in order to improve lift and control at high speeds Also discussed is the VATOL concept as applied to RPVs D M W

A78-29207 A method of calculating ILS approach surfaces L Marquina Sanchez (Escuela Tecnica Superior de Ingenieros Aeronáuticos, Madrid, Spain) *Airport Forum,* vol 8, Feb 1978, p 9-12, 14

A mathematical analysis is presented for ILS which expands the obstacle free room an approaching aircraft can use to maneuver It is proposed that the first section of the instrument approach surface be replaced by one horizontal plane, immediately followed by a second section with a slope of 2 5 percent The 14 3 percent transition surface slope could be replaced by a slope of 16 6 percent, and its lower edge limited to a line parallel with the runway center line D M W

A78-29208 More public consultation on airport plans. L P Michaels *Airport Forum,* vol 8, Feb 1978, p 25, 26, 28 (5 ff) 11 refs In English and German

This paper presents a critical review of airport planning over the last 20 years, stressing that the situation which has existed in the past, namely that almost every mid-size community wanted an airport, has changed in the sense that airports must now be considered within the framework of long range environmental planning Thus, airport planning can no longer be internalized, i e , concerned only with the requirements of air traffic in its vicinity Instead, air transport must be integrated into a total system of transportation, with attention to the health of the environment and the quality of life in the community it serves D M W

A78-29209 How to make an airport unattractive to birds J Hild (Federal German Defence Geophysics Bureau, Cologne, West Germany) *Airport Forum,* vol 8, Feb 1978, p 49, 50, 52-56 In English and German

The paper presents methods for modifying the environment around airports to discourage the habitation of birds The experience of the German air force is used as a model Among the methods considered are siting dumps far from runways, allowing grass to grow long and remain damp (because this environment is less suitable for the growth of large bird colonies), and allowing the growth of woods and thickets in the airport vicinity (because this habitat is suitable for smaller birds, which present less of a hazard to air traffic) D M W

A78-29213 Factors influencing schedule reliability in international operations R J Yates (Qantas Airways, Ltd , Sydney, Australia) *Aeronautical Journal,* vol 82, Jan 1978, p 1-11

Scheduling problems encountered by an international airline operating long-distance routes between the Northern and Southern Hemispheres are discussed Timetable setting, which depends on curfews in effect at the airports of arrival and departure, is considered, variations in flight time due to more or less favorable wind components are also mentioned Airport departure delays caused by aircraft defects, government authorities, passenger and baggage transport, ramp handling and crew relief problems also receive attention J M B

A78-29214 Current problems of flight simulators for research K J Staples (Royal Aircraft Establishment, Bedford, Hants , England) *Aeronautical Journal,* vol 82, Jan 1978, p 12-32 34 refs

Computation systems, visual information processing and motion systems of flight simulators used for research are discussed In particular, the application of distributive processing and the adoption of a number of microprocessors to control simulator peripherals are mentioned Included in the treatment of simulator visual information processing are field of view, resolution, contrast and color, perspective and distortion, stereoscopic effects, depth of focus, and dynamic response Motion generation systems, as well as the effects of pitch, roll, yaw, sway, heave and surge motions on pilot behavior receive attention In addition, problems such as turbulence modeling and loss of control at the extremes of the aircraft maneuvering envelope are discussed J M B

A78-29215 The aerodynamic behaviour of fully inflated parachutes R M Ayres *Aeronautical Journal,* vol 82, Jan 1978, p 38-44 15 refs Research supported by the Ministry of Defence and Science Research Council

Hydrodynamic theory as applied to three-dimensional objects undergoing large oscillations at low speeds was adopted to model the aerodynamic behavior of fully inflated parachutes, the computer model is capable of simulating parachute descent behavior studied in wind tunnel test data Inertia coefficients for parachute canopies are developed, and scale effects for the model parachutes are considered The parachute canopy force field as described by hydrodynamic theory appears to give an accurate representation of the descent behavior of conventional flat circular canopies J M B

A78-29221 Microwave landing systems F Pogust (Cutler-Hammer, Inc , AIL Div , Deer Park, N Y) *IEEE Spectrum,* vol 15, Mar 1978, p 30-36

The article discusses various types of microwave landing systems (MLS), including the time reference scanning beam and the Doppler system The development of the MLS is outlined, noting the primary deficiencies in instrument landing systems, and the introduction of Ground Control Approach (GCA) systems and Traffic Control and Landing Systems (TRACALS) The implementation of the scanning-beam landing system, yielding an improved signal path at low earth-grazing angles, is reviewed Scanning-beam landing techniques developed by the U S Navy are described S C S

A78-29295 * # Flight simulation - A vital and expanding technology in aircraft development P A Reynolds (Calspan Corp , Buffalo, N Y) and G W Hall (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 14th, Washington, D C , Feb 7-9, 1978, Paper 78-337* 11 p 28 refs

Flight simulation, both ground and in-flight, is experiencing major technological improvement and growth The increased capabilities are providing new opportunities for support of the aircraft development process The development of faster digital computers, improved visual displays, better motion systems and increased interest in simulation fidelity has improved the ground simulator to the point where it accomplishes a major portion of the aircraft development before work on the flight article begins The efficiency of the ground simulator as a forecaster for the flight testing phase is becoming well established In-flight simulation is properly being used to bridge the gap between the ground simulator and the flight test article Simulation provides the vital link between analysis, aerodynamic tests, and subsystem tests and the flight test article This paper describes the latest advances in flight simulation and its increasing role in the aircraft development process (Author)

A78-29326 * # Steady-state unbalance response of a three-disk flexible rotor on flexible, damped supports. R E Cunningham (NASA, Lewis Research Center, Cleveland, Ohio) *American Society of Mechanical Engineers, Design Engineering Technical Conference, Chicago, Ill , Sept 26-29, 1977, Paper* 41 p 15 refs

Experimental data are presented for the unbalance response of a flexible, ball bearing supported rotor to speeds above the third lateral bending critical Values of squeeze film damping coefficients

obtained from measured data are compared to theoretical values obtained from short bearing approximation over a frequency range from 5000 to 31,000 cycles/min Experimental response for an undamped rotor is compared to that of one having oil squeeze film dampers at the bearings Unbalances applied varied from 0 62 to 15 1 gm-cm (Author)

A78-29327 * # 'Chain pooling' model selection as developed for the statistical analysis of a rotor burst protection experiment A G Holms (NASA, Lewis Research Center, Cleveland, Ohio) *American Statistical Association, Annual Meeting, 137th, Chicago, Ill , Aug 15-18, 1977, Paper* 60 p 18 refs

A statistical decision procedure called chain pooling had been developed for model selection in fitting the results of a two-level fixed-effects full or fractional factorial experiment not having replication The basic strategy included the use of one nominal level of significance for a preliminary test and a second nominal level of significance for the final test The subject has been reexamined from the point of view of using as many as three successive statistical model deletion procedures in fitting the results of a single experiment The investigation consisted of random number studies intended to simulate the results of a proposed aircraft turbine engine rotor-burst-protection experiment As a conservative approach, population model coefficients were chosen to represent a saturated 2 to the 4th power experiment with a distribution of parameter values unfavorable to the decision procedures Three model selection strategies were developed (Author)

A78-29330 * # General aviation energy-conservation research programs at NASA-Lewis Research Center E A Willis (NASA, Lewis Research Center, Cleveland, Ohio) *Western Michigan University, Conference on Energy Conservation in General Aviation, Kalamazoo, Mich , Oct 10, 11, 1977, Paper* 23 p 14 refs

A review is presented of non-turbine general aviation engine programs underway at the NASA-Lewis Research Center in Cleveland, Ohio The program encompasses conventional, lightweight diesel and rotary engines Its three major thrusts are, in order of priority (1) reduced SFCs, (2) improved fuels tolerance, and (3) reducing emissions Current and planned future programs in such areas as lean operation, improved fuel management, advanced cooling techniques and advanced engine concepts, are described These are expected to lay the technology base, by the mid to latter 1980s, for engines whose total fuel costs are as much as 30% lower than today's conventional engines (Author)

A78-29334 Optimum tail plane design for artificially stabilized aircraft (Optimale Leitwerksauslegung fur Flugzeuge kunstlicher Stabilitat) G Sachs (Munchen, Hochschule der Bundeswehr, Neubiberg, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, Jan -Feb 1978, p 1-10 12 refs In German

The paper deals with optimum tail plane influence on drag and lift in trimmed flight and with the possibility of utilizing the lift and drag optimum c g range in designs of artificially stabilized aircraft A simple relation of wing tail interference drag resulting from mutual vortex interaction is developed Then, relations for minimum trimmed drag and for the drag optimum c g position are presented It is shown how to design the tail plane so that the drag increase caused by c g deviation from the drag optimum c g position remains small In regard to lift effects, it is shown how the maximum trimmed lift can be increased by full utilization of tail lift potential Then, it is described that the usable c g range is determined by control requirements Finally, it is examined how the optimum drag and lift c g range can be made compatible with the usable c g range determined by control requirements (Author)

A78-29338 Prediction of the unsteady airloads on harmonically oscillating spheroids based on an analytical solution of the governing wave equation K -L Chao and H Forsching (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Aeroelastik, Gottingen, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, Jan -Feb 1978, p 43-51 13 refs

Analytical solutions are presented for the unsteady aerodynamic pressure distributions on slender ellipsoids of revolution, oscillating harmonically in subsonic compressible flow The governing potential equation is first transformed into the classical Helmholtz wave equation by applying a gauge transformation and a coordinate scale transformation Then, with introduction of nonorthogonal prolate spheroidal coordinates, the wave equation is solved for the prescribed body surface and flow field boundary conditions through application of the method of separation of variables For a variety of slender spheroids, performing harmonic rigid body plunging and pitching oscillations, the unsteady aerodynamic pressure on the body surface is calculated These analytical results are compared to corresponding experimental results and to numerical results obtained from a panel approach and from Slender-Body Theory (Author)

A78-29401 # The helicopter as a control object (Vertolet kak ob'ekt upravleniia) S Iu Esaulov, O P Bakhov, and I S Dmitriev Moscow, Izdatel'stvo Mashinostroenie, 1977 192 p 38 refs In Russian

The helicopter is considered as a plant or control object in the analysis of helicopter motion Equations of motion are obtained for the helicopter with articulated suspended absolutely rigid blades by taking into account six degrees of freedom Characteristics of some types of main rotors are examined A simplified linearization of the helicopter equations of motion are obtained separately for forward and lateral motion by substituting the resultant for the main rotor The dependence of the dynamics of helicopter motion dynamics on the forward speed is analyzed M L

A78-29478 Effect of reliability programs on life cycle cost A case history R G Bertschy (Harris Corp , Syosset, N Y) *(Society of Reliability Engineers, Annual Canadian Symposium on Reliability Engineering, 4th, Ottawa, Canada, Oct 13, 14, 1977) Microelectronics and Reliability,* vol 17, Jan 1978, p 9 14

The effects of TACAN test set reliability programs on life cycle costs (LCC) of a specified TACAN test instrument are examined The numbers of reliability problems which have been prevented or passed on to production or field are identified for the following reliability activities design review (DR), failure analysis (FA), reliability demonstration, DR + FA, full reliability program, and no reliability program The LCC for the full reliability program is used as the baseline since that represents the actual program for which costs are available It is shown that the implementation of design review or failure analysis would not be as cost effective as the combination of the two The full reliability program chosen by the US Air Force for the TACAN test set program proves to be the most effective approach in reducing the total LCC S D

A78-29479 The AN/ARC-164 radio - Life-cycle-cost savings W H Boden (Magnavox Government and Industrial Electronics Co , Ft Wayne, Ind) *(Society of Reliability Engineers, Annual Canadian Symposium on Reliability Engineering, 4th, Ottawa, Canada, Oct. 13, 14, 1977) Microelectronics and Reliability,* vol 17, Jan 1978, p 15-23

The life-cycle-cost (LCC) model for the new US Air Force/Army 10-watt UHF radio AN/ARC 164 deals with three increments of costs the original acquisition cost of the hardware, the initial logistics cost for documentation, training, spares, etc , and the cost of recurring logistics to support the radio The discussion focuses on the LCC verification test designed to determine whether the radio meets its specified reliability and maintainability criteria The most important economies achieved by MTBFs and MTTRs appears to be the reduction of Air Force personnel requirements, both at the base avionics and at the depot Recommendations for future programs are to better identify cost drivers, to simplify the LCC model, to accept the principle of separating the LCC verification test and the real

world, and to gear the verification plan to intended performance
S D

A78-29582 # **Influence of structural components of a by-pass engine on its flight characteristics (Vliv konstrukcnich prvku dvouproudoveho motoru na jeho letove vlastnosti)** T Etlik and Z Masek *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1-3, 1976) Zpravodaj VZLU,* no 3, 1977, p 103-112 In Czech

Increasing the by-pass ratio is discussed as a possible means of satisfying the increased demands for greater values of the takeoff/cruise thrust ratio in STOL aircraft To achieve a by-pass ratio greater than 10 it is necessary to use a fan and reversible rotor blades However, the low specific thrust and low nozzle exit velocity in the outer circuit complicate the aerodynamic solution of the fan for large mass flow rate The resulting constraint makes it impossible to design and build by-pass engines of this design type with by pass ratio greater than 10-12
P T H

A78-29583 # **Control of aircraft turbine engine acceleration (Rizeni rozbehu leteckych turbinovych motoru)** J Muller *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1-3, 1976) Zpravodaj VZLU,* no 3, 1977, p 113-122 In Czech

Methods of controlling the transient processes in gas turbine engines by using suitable combinations of the thermodynamic similarity variables of the engine are discussed Two main types of controllers are examined controllers giving the fuel as a function of the thermodynamic variables, and feedback controllers controlling the angular acceleration of the rotor For both of these types of controllers a knowledge of the total pressure at the engine inlet is sufficient Simple control algorithms are given for designing a complete controller, including a controller for the steady state
P T H

A78-29584 # **Using simulation to determine the transfer function of the electronic part of a control loop (Vyuziti simulatoru k urceni prenosu elektronickeho clenu regulacni smycky)** J Barton *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1 3, 1976) Zpravodaj VZLU,* no 3, 1977, p 123-131 7 refs In Czech

A method of determining the dynamic characteristics of the corrector unit of a control system by simulating the dynamic characteristics of an aircraft engine is proposed The transfer function is simulated on an analog computer in real time and is used in the model solution of a gas turbine engine with actual parts of the control circuit
P T H

A78-29586 # **Use of a stepping motor for measuring fuel quantity in a digital system for control of rotational speed (Pouziti krokoveho akcniho clenu k rizeni mnozstvi paliva v obvodu cislicove regulace otacek)** J Muller *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1-3, 1976) Zpravodaj VZLU,* no 4, 1977, p 161-170 16 refs In Czech

The possible effect of the dynamics of the stepping motor of a fuel valve on the transient characteristics of rotational speed control is analyzed The lower stopping speed of the stepping motor as compared to a valve with proportional characteristic must be taken into account
P T H

A78-29587 # **Properties of hydraulic servomotor controlled by flapper valve or by edge valve (Vlastnosti hydraulickeho servomotoru rizeneho klapkou-tryskou nebo nozovym ventilem).** E Heriban *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1-3, 1976) Zpravodaj VZLU,* no 4, 1977, p 171-179 In Czech

The equation of motion of the hydraulic servomotor in a turbojet engine control system is derived On the basis of this, the dynamical parameters are determined as functions of fuel pressure in the controlled chamber Special attention is given to the influence of the real flow characteristics of the nozzle on the dynamic properties of a hydraulic servomotor
P.T H

A78-29588 # **Properties of fuels used in the Czechoslovak aircraft industry (Vlastnosti paliv pouzivanych v Cs. leteckem prumyslu)** J Krotky *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1-3, 1976) Zpravodaj VZLU,* no 4, 1977, p 181-187 In Czech

Those characteristics of jet engine fuels that might influence the reliability of the fuel system are analyzed Particular attention is given to antiwear properties, lubricating ability, and corrosive action Causes of fuel pollution by mechanical microparticles, water, and microorganisms are examined Higher standards for fuel purity are called for
P T H

A78-29589 # **Main characteristics of the ADT 4000-4100 digital computer for a hybrid computing system (Zakladni charakteristiky cislicoveho pocitace ADT 4000-4100 pro hybridni vypocetni system)** P Neustupa *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1-3, 1976) Zpravodaj VZLU,* no 4, 1977, p 189-192 In Czech

The requirements on a computer for modeling a modern jet engine are examined The merits of analog and digital machines for these purposes are compared A brief description of the ADT 4000 desk computer with operational memory of 16K words and 16 (maximum) interface panels, and the larger version ADT 4100 with operational memory of 32K words and 56 interface panels, is given Performance characteristics are summarized, and elements of the operating system are enumerated
P T H

A78-29590 # **Determining the reliability requirements of aircraft engine control systems during design stage (Pozadavky na spolehlivost projektovanych soustav rizeni leteckych motoru)** M Svoboda *(Konference na thema Regulace Leteckych Proudovych Motoru, Velesin, Czechoslovakia, June 1-3, 1976.) Zpravodaj VZLU,* no 4, 1977, p 193-201 6 refs In Czech

The requirements on reliability of aircraft engine control systems are expressed through the reliability characteristics of the repair parts The requirements are derived from acceptable safety levels and the criterion of attaining optimal cost effectiveness of the designed system
P T H

A78-29641 * # **Investigation of interior noise in a twin-engine light aircraft** J S Mixson, C K Barton (NASA, Langley Research Center, Hampton, Va), and R Vaicaitis (Columbia University, New York, N Y) *Journal of Aircraft,* vol 15, Apr 1978, p 227-233 26 refs

This paper describes experimental studies of interior noise in a twin-engine, propeller-driven, light aircraft An analytical model for this type of aircraft is also discussed Results indicate that interior noise levels in this aircraft due to propeller noise can be reduced by reducing engine rpm at constant airspeed (about 3 dB), and by synchrophasing the twin engines/propellers (perhaps up to 12 dB) Ground tests show that the exterior noise pressure imposed on the fuselage consists of a complex combination of narrow-band harmonics due to propeller and engine exhaust sources This noise is reduced by about 20-40 dB (depending on the frequency) by transmission through the sidewall to the cabin interior The analytical model described uses modal methods and incorporates the flat-side geometrical and skin-stringer structural features of this light aircraft
(Author)

A78-29642 * # **Low-speed test limit of V/STOL model located vertically off-center** S Shindo and W H Rae, Jr (Washington, University, Seattle, Wash) *Journal of Aircraft,* vol 15, Apr 1978, p 253, 254 7 refs Grants No DA-ARO(D)-31-124-G1114, No NGR-48-002-035

A vertically off-centered V/STOL model - a 2-ft-diam three-bladed aluminum propeller operating in a rotor mode - is tested in an 8 by 12 ft wind tunnel with and without ground plane along with an associated 3 by 4 5 ft test section insert The objective was to assess the effect of the vertically off-centered model on the low-speed test

limit The aerodynamic data of the model at a constant negative angle of attack (-3 deg) are recorded at selected tunnel dynamic pressures to provide adequate data points to define the model lift variation with respect to the tip speed ratio The adverse effect of the rotor low-speed test limit is observed in the form of lift change with respect to the tip speed ratio A major conclusion is that for rotors tested with a ground plane or in the vicinity of the floor, the ratio of distance between floor and model to rotor radius defines the low-speed test limits S D

A78-29643 * # **Handling qualities of aircraft in the presence of simulated turbulence** I D Jacobson and D S Joshi (Virginia, University, Charlottesville, Va) *Journal of Aircraft,* vol 15, Apr 1978, p 254-256 Grant No NGR-47-005-208

A previous paper (1977) has presented results from flight simulator experiments on instrument-flight-rule handling-quality studies of a STOL-type aircraft in the presence of various models of simulated turbulence (Gaussian, modified Gaussian, Rayleigh, and variable length and intensity, VLI) In this paper, additional results are presented for flight simulator experiments on visual-flight-rule approach landings of a STOL-type aircraft Pilot opinion ratings of the landing approach with visual display are analyzed to determine the most realistic turbulence model and to identify the variables that critically affect the handling quality of aircraft in turbulence It is shown that turbulence simulated by a VLI model adequately match the desired statistical properties of real atmospheric turbulence, and that aircraft handling quality and pilot task performance are critically affected by turbulence Realistic turbulence models present greater difficulty in controlling the aircraft than a simple Gaussian model S D

A78-29657 **Product support for French equipment used by civil aviation companies (L'après-vente des équipements français aux compagnies aériennes civiles)** P Gravelle (Societe Française d'Equipements pour la Navigation Aerienne, Division Apres-Vente, Orly, France) *L'Aéronautique et l'Astronautique,* no 68, 1978, p 11 16 In French

Product support is discussed from the viewpoint of the aviation equipment construction industry Concepts of reliability and maintenance of equipment are examined, and the interrelationship of air company and equipment company desires within the framework of government regulation of the industry is considered Several kinds of equipment guarantees are surveyed, and problems caused by product support delays are described M L

A78-29672 # **Theory of dolphin-style sailplane flight and the principles of dynamic flight II (Teoria przelotu szybowcowego metoda delfinowania oraz zasady lotu dynamicznego II)** J Sandauer (Instytut Lotnictwa, Warsaw, Poland) *Technika Lotnicza i Astronautyczna,* vol 33, Feb 1978, p 8-10 5 refs In Polish

The current status of the theory of dolphin-style flight is reviewed, and the associated aerial tactics are discussed The optimal flight parameters under simulated meteorological conditions are analyzed, and the basic principles of dynamic flight are outlined Some aspects of using Abzug's speed ring for cloud street flying are examined V P

A78-29673 # **Aircraft and helicopter cockpit noise (Halas w kabinach samolotow i smiglowcow)** A Rudiuk (Instytut Lotnictwa, Warsaw, Poland) *Technika Lotnicza i Astronautyczna,* vol 33, Feb 1978, p 10-14 6 refs In Polish

In the present paper, the detrimental influence of cockpit noise on pilot hearing and reactions is studied as a function of noise duration and intensity The acoustic spectrum is analyzed, and an attempt is made to establish acceptable noise level standards The need for reducing noise in crop-duster cockpits is noted V P

A78-29674 # **Systematic analysis of safety in aviation II (Systemowa analiza bezpieczenstwa w lotnictwie II)** J Morawski and T Smolicz *Technika Lotnicza i Astronautyczna,* vol 33, Feb 1978, p 23-25 13 refs In Polish

In the present paper, the occurrence of pilot error is discussed in terms of the skill/difficulty balance The application of information theory to the evaluation of the difficulty of pilot tasks is examined, and a method of optimizing the arrangement of instruments on the instrument panel to facilitate the pilot's task is outlined A logical basis for flight safety analysis is formulated, along with requirements for aircraft and crew V P

A78-29712 **Computation of the pressure on the surface of a fuselage with a wing in an ideal fluid** L A Maslov and V P Iushin *(Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May-June 1977, p 110-115) *Fluid Dynamics,* vol 12, no 3, Jan 1978, p 433-438 Translation

A method proposed by White (1952) for calculating the surface pressure on a fuselage is extended to a fuselage/wing configuration A distinctive feature of the extended method is the technique developed for solving the basic integral equation The technique is shown to reduce the computational labor without impairing accuracy V P

A78-29718 **Drag formula for elongated aircraft noses** M I Follé *(Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May-June 1977, p 156 160) *Fluid Dynamics,* vol 12, no 3, Jan 1978, p 472-476 6 refs Translation

A drag formula in the framework of linear theory is obtained for the case of low supersonic speeds for an object whose elongated forebody in cross section is an n-rayed star which undergoes a smooth transition to a circular midsection The solution of the wave equation for the elongated forebody is considered, and the drag of a reference cylindrical surface is calculated M L

A78-29720 **Normal force of a flat triangular wing in a supersonic flow** V I Lapygin *(Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May-June 1977, p 162-164) *Fluid Dynamics,* vol 12, no 3, Jan 1978, p 479, 480 8 refs Translation

In numerical calculations for conditions of flow with bow shock wave attached to a leading edge, the coefficient of normal force of a windward side of a flat delta wing depends on a certain parameter for a broad range of conditions For engineering calculations, a simple relationship can be obtained by representing these characteristics in the form of laws of similarity Two cases in which the normal force arising on the windward side of the wing do not depend on the sweep angle are analyzed M L

A78-29777 * # **Preliminary design of composite wings for buckling, strength and displacement constraints** J H Starnes, Jr (NASA, Langley Research Center, Structures and Dynamics Div , Hampton, Va) and R T Haftka (Illinois Institute of Technology, Chicago, Ill) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 1-13 10 refs Grant No NsG-1266 (AIAA 78-466)

An unstiffened panel buckling constraint for balanced, symmetric laminated composites is included on the global design level in a mathematical programming structural optimization procedure for designing wing structures Constraints are introduced by penalty functions, and Newton's method based on approximate second derivatives of the penalty terms is used as the search algorithm to obtain minimum-mass designs Constraint approximations used during the optimization process contribute to the computational efficiency of the procedure A criterion is developed that identifies the appropriate conservative form of the constraint approximations that are used with the optimization procedure Minimum-mass design results are obtained for a multispar high-aspect-ratio wing subjected to material strength, minimum-gage, displacement, panel buckling and twist constraints The material systems considered for the examples are all graphite-epoxy, graphite-epoxy with boron-epoxy spar caps, and all aluminum The composite material designs are shown to have an advantage over the aluminum designs since they

can often satisfy additional constraints with only small mass increases (Author)

A78-29785 # **Crashworthiness of aircraft fuselage structures** R C Tennyson, J S Hansen, H Teichman (Toronto, University, Toronto, Canada), F Cicci, and M Ioannou (De Havilland Aircraft of Canada, Ltd , Downsview, Ontario, Canada) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 101-109 12 refs National Research Council of Canada Grant No A-9185, Canadian Transportation Development Agency Contract No 01SU,T8200-6-6549 (AIAA 78-477)

A combined analytical and experimental programme was undertaken to study the dynamic structural response of aluminum model aircraft fuselage structures A drop-test gantry was used to provide a simulation of the wheels-up landing condition for both level and oblique angle impacts on a concrete pad for a range of wing loads and vertical descent velocities Dynamic measurements of strain and g loads at discrete locations were obtained together with high speed photographs of the failure modes for comparison with a lumped mass-stiffness model of the structure using a finite element approximation (Author)

A78-29794 # **A fail-safe analysis of a spanwise wing-panel splice** J M Anderson (Georgia Institute of Technology, Atlanta, Ga), C S Chu, and J F Malluck (Lockheed-Georgia Co , Marietta, Ga) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 183-186 5 refs (AIAA 78-487)

Transient dynamic analyses have been performed for a typical wing-panel assembly The assembly consists of a center panel and two side panels containing short edge cracks at the spanwise splices The analysis employs the finite-element method and exploits a special singularity element to represent the crack-tip neighborhood Transient stress-intensity factors are determined for the edge cracks following failure of the center panel Stress-intensity factors corresponding to instantaneous failure of the center panel are substantially higher than a static prediction An additional case of less-than-instantaneous failure is analyzed and an assessment of the effect of fastener stiffness is presented (Author)

A78-29805 # **A theoretical technique for analyzing aeroelastic stability of bearingless rotors** D H Hodges (U S Army, Aeromechanics Laboratory, Moffett Field, Calif) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 282-294 22 refs (AIAA 78-503)

A technique is introduced for aeroelastic stability analysis of certain hingeless helicopter rotors termed bearingless because of their lack of a pitch-change bearing The rotor is modeled as three or more rigid blades each joined to the hub by means of a flexible appendage known as the flexbeam or strap The pitch-control system twists the flexbeam to provide blade pitch change The analysis is capable of implicitly treating the aeroelastic couplings that arise from the pitch-control geometry, the equilibrium deflected shape of the flexbeam, and the built-in angular offsets of the flexbeam and blade The stability of the system in both hub-fixed motion and coupled rotor-body motion is considered The same basic parameters that influence hingeless rotor stability also influence bearingless rotor stability Aeroelastic couplings can be chosen to stabilize most soft inplane configurations for the hub-fixed case The same parameters will also, under certain conditions, stabilize the coupled rotor-body system in hovering flight (air resonance) (Author)

A78-29806 # **The use of transient testing techniques in the Boeing YC-14 flutter clearance program** R S Imes (Boeing Co , Seattle, Wash), W P Jennings (ASTEC Engineering Co , Renton, Wash), and N L Olsen (Hewlett-Packard Co , Bellevue, Wash) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 295-299 5 refs (AIAA 78-505)

Excitation and analysis techniques used in transient testing are discussed together with the results of YC-14 tests employing these methods The YC-14 flutter clearance program used transient techniques in wind tunnel model, ground vibration, electrical flight control system-structural interaction, and flight flutter tests Results presented indicate that detailed data can be obtained using transient techniques at costs and flow times lower than those associated with conventional techniques (Author)

A78-29809 # **Experimental investigation of composite wing failure** J H Pimm (Vought Corp , Dallas, Tex) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 320-324 7 refs Contract No F33615-73 C-5066 (AIAA 78-509)

A premature structural failure occurred during static testing of the No 1 composite outer wing for the A-7D aircraft Failure was at 120% of design limit load (150% required) A thorough investigation was initiated to determine the cause of this failure Experimental and analytical methods were utilized This paper emphasizes the experimental activity and presents correlation to current failure theories A discussion of events which led to the wing failure and conclusions made from the investigation are provided The wing was modified and subsequently qualified (Author)

A78-29811 # **Cutout reinforcement of stiffened cylindrical shells** J A Cervantes (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio) and A N Palazotto (USAF, Institute of Technology, Wright-Patterson AFB, Ohio) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 331-339 5 refs (AIAA 78-512)

A study was carried out to determine the optimum placement and volume of a reinforcing frame around a cutout in an axially loaded stringer and ring and stringer stiffened cylindrical shell The problem was analyzed using the linear bifurcation portion of STAGS (Structural Analysis of General Shells) Four parameters were varied stringers versus rings and stringers, cutout size, ratio of frame volume to cutout volume, and frame position It appeared that in most cases the position with the frame next to the cutout edge was the most effective This can be attributed to the frame's ability to delay the onset of local buckling However, there was a relative maximum in the frame distance versus critical load curves for a frame positioned away from the cutout edge at a low ratio of frame to cutout volume (Author)

A78-29812 # **Stress analysis of typical flaws in aerospace structural components using 3-D hybrid displacement finite element method** S N Atluri (Georgia Institute of Technology, Atlanta, Ga) and K Kathiresan In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3 5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 340-350 28 refs Research supported by the Georgia Institute of Technology, Grant No AF AFOSR 74-2667 (AIAA 78-513)

An assumed hybrid displacement finite element method for the solution of modes I, II and III stress intensity factors which vary along an arbitrary curved three-dimensional crack front in structural components was developed for linearly elastic materials The present method can be applied to three-dimensional mixed mode fracture problems with complex crack and structural geometries Special

crack front singular elements were developed where proper asymptotic solutions for displacements and stresses are embedded The above finite element method is presently used to analyze some important and typical flaw (fracture) problems which are commonly encountered in aerospace structural component applications (Author)

A78-29820 # **A lifting surface theory based on an unsteady linearized transonic flow model** D D Liu (Northrop Corp , Aircraft Div , Hawthorne, Calif) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 414-421 22 refs Research supported by the Northrop Independent Research Program (AIAA 78-501)

This paper presents the basic formulation of a unified unsteady lifting surface method currently in progress, which would bridge the purely subsonic and purely supersonic methods through the regime of linearized transonic flow An approximate transonic acceleration potential as well as its governing equation are derived The equation includes a number of additional terms, which are due to mean flow influence and have been ignored by previous investigators Consequently, the transonic kernel functions are generalized based on the concept of parabolic approximation to include the nonplanar case Numerical and analytical techniques to evaluate the transonic kernel functions will be described A Mixed Kernel Function procedure in combination with the oscillatory shock jump condition will be discussed Finally, assessments of various transonic kernel function methods are given (Author)

A78-29822 # **Future trends in aircraft structural design and materials** W A Stauffer (Lockheed California Co , Burbank, Calif) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md , April 3-5, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978 11 p (AIAA 78-465)

Future trends in the major fields of structures, dynamics and materials as applied to aircraft design are discussed In the field of structures, the evolution of damage tolerance and durability requirements, commercial and military, is described and emerging trends for the future identified In the field of dynamics and loads, improved load prediction methods, repeated loads spectra, and gust loads are discussed from the standpoint of needed and attainable improvement In the field of materials, trends in the future development and potential of advanced aluminum alloys, titanium alloys, high-strength steels, and advanced composites are presented Projections for production incorporation of these advances in new aircraft designs are made (Author)

A78-29854 **Geometric restitution of single coverage aircraft multispectral scanner data** M M Ethridge and E M Mikhail (Purdue University, West Lafayette, Ind) In Mapping with remote sensing data, Proceedings of the Second Annual William T Pecora Memorial Symposium, Sioux Falls, S Dak , October 25-29, 1976 Falls Church, Va , American Society of Photogrammetry, 1977, p 382-392 9 refs

In order to demonstrate the potential of MSS aircraft data, six restitution techniques are tested using four strips of actual data The six techniques tested include the collinearity model, piecewise polynomials, weighted arithmetic mean, moving averages, meshwise linear, and Gauss-Markov Since the Gauss-Markov technique has only been recently proposed, more discussion and computational results are presented A statistical evaluation was employed to determine the significance of various factors affecting the restitution techniques, and results from this evaluation indicate that the piecewise polynomial model is the optimum restitution technique of those considered (Author)

A78-29859 # **Gyroscopic instruments of orientation and stabilization systems (Giroskopicheskie pribory sistem orientatsii i stabilizatsii)** D S Pel'por, Iu A Osokin, and E R Rakhteenko Moscow, Izdatel'stvo Mashinostroenie, 1977 208 p 37 refs In Russian

The basic principles of designing modern gyroscopic instruments for stabilizing the attitude of flight vehicles and orienting antennas and optical systems are outlined The dynamic errors of gyroscopic sensitive elements are analyzed, and their influence on the precision of stabilization and orientation is examined The design and parameters of some advanced gyroscopic instruments are discussed, with particular reference to air-supported gyroscopes, gas floated spinning spheres, and free rotor gyroscopes V P

A78-29906 **Integrated Doppler/TACAN navigation through conformity with the least squares method - Analysis from registered flight data (Integrierte Doppler /TACAN-Navigation durch Ausgleichung nach der Methode der kleinsten Quadrate - Erprobung mit registrierten Flugdaten)** K Ramsayer, M Reich, and W Scholler (Stuttgart, Universitat, Stuttgart, West Germany) *(Deutsche Gesellschaft fur Ortung und Navigation, Kreiselsymposium, Stuttgart, West Germany, Sept 28, 29, 1977) Ortung und Navigation,* no 4, 1977, p 59-88 17 refs In German

A Transall transport aircraft was used to test a composite system of navigation Directional impulses were measured by a Bendix Doppler radar DRA 12B, the magnetic course by a Sperry gyroplatform SYP 820, and the aircraft distance and direction by an on-board TACAN ARN 21B The data thus provided was subjected to a computerized error analysis, and fitted to a least squares model Attention is given to deviations in the data provided by the exact location indicator, and to methods for correcting it The exponential process is preferred to the window method as a means of data correction, because it is simpler D M W

A78-29907 **Some test results concerning visibility of obstacle and hazard beacons (Einige Versuchsergebnisse zur Sichtbarkeit von Hindernis- und Gefahrenfeuern)** H -E Hoffmann and R H Buell (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Physik der Atmosphare, Oberpfaffenhofen, West Germany) *(Deutsche Gesellschaft fur Ortung und Navigation, Kreiselsymposium, Stuttgart, West Germany, Sept 28, 29, 1977) Ortung und Navigation,* no 4, 1977, p 89-97 6 refs In German

Helicopter observations were used to determine maximum detection range for obstacle and hazard beacons A red 150 W obstacle beacon was detected in bright daylight at a distance of 2 km, and one hour after sunset at 7 km Horizontal standard visibility ranged between 6 and 13 km No significant differences were noted between 100 and 150 W red obstacle beacons, but a 1000 W red hazard beacon could be detected up to 6 km further than the obstacle beacons. The mast for the hazard beacons was detected before the obstacle beacon during the day, but the reverse was true at night D M W

A78-29934 # **Doppler MLS - The UK solution** T Ford *Aircraft Engineering,* vol 50, Feb 1978, p 4-7

The ILS system for ATC is outdated and must be replaced This paper presents an outline of the design and operating characteristics of the British Doppler MLS, which will permit precision approach guidance over a wide angular area A source of radiation is moved at constant velocity on the ground, and compared with a stationary frequency in an approaching aircraft The frequency difference provides a direct measurement of the angle of the receiver from the array boresight A unique frequency code is given for every angle in the coverage D M W

A78-29935 # **Fly-by-wire flight control** R P G Collinson *Aircraft Engineering,* vol 50, Feb 1978, p 8-13

Developments of automatic control systems for aircraft are outlined with attention to active controls These include sensors which detect disturbances in flight stability and make automatic corrections by means of actuators and aerodynamic control surfaces Advantages of active controls include improved handling and maneuvering, relaxed static stability margins, and direct lift control Also discussed are developments in fault detection technology, using digital data and fiber optics, and fault correction, using rate gyros and a quadruplex actuator The Boeing YC 14 is presented as an illustration of up to date fly-by-wire technology D M W

A78-29936 # **Some lessons learned from aircraft accidents - The engineering aspects** E Newton *Aircraft Engineering,* vol 50, Feb 1978, p 16-23

Sources of aircraft failure (and disaster) are analyzed Major sources include material fatigue (25% of all accidents), fires, poor maintenance, misreading data, and defective engines Attention is given to defects in the design and assembly of aircraft components and fail-safe criteria are discussed Murphy's Law (applied to aviation) is cited, which states that if it is mechanically possible to assemble a part incorrectly, someone, somewhere, sometime will do just that D M W

A78-29944 **Critical considerations on the legal development of personal liability with attention to air transportation (Kritische Betrachtung der gesetzlichen Entwicklung des Haftungsrechts der Personenbeforderung unter besonderer Berucksichtigung des Luftverkehrs)** R Beine *Zeitschrift fur Luft- und Weltraumrecht,* vol 27, Mar 1978, p 3-14 46 refs In German

The question of an airline's liability to a passenger in case of injury aboard an aircraft is examined with reference to German law regarding similar situations aboard a train Attention is given to the international character of air traffic, noting that laws which might apply to German passengers on domestic airlines might not apply to German passengers on foreign airlines, or to foreigners on German airlines D M W

A78-29945 **Flying over the exclusive economic zone** P P Heller *Zeitschrift fur Luft- und Weltraumrecht,* vol 27, Mar 1978, p 15-17 10 refs

The paper deals with legal problems arising from the definition of the term 'high seas' In other words, does the 200 mile economic zone, extending from the coastlines of many countries, constitute a part of the high seas in terms of aircraft overflight According to the Informal Composite Negotiating Text (ICNT), which followed the third UN conference on the Law of the Sea in 1977, the economic zone is not included in the term 'high seas' Thus, aircraft overflight regulations become vague for this region and need to be legally defined D M W

A78-30002 **Three-dimensional flow of hypersonic gas past a thin airfoil** A I Golubinskii and V N Golubkin (Tsentral'nyi Aerogidrodinamicheskii Institut, Zhukovskii, USSR) *(Akademiia Nauk SSSR, Doklady,* vol 234, June 11, 1977, p 1032-1034) *Soviet Physics - Doklady,* vol 22, June 1977, p 275, 276 8 refs Translation

Formulas are derived for a low-aspect ratio thin wing at angle of attack in hypersonic flow Its leeward side is in aerodynamic shadow, while the windward side receives the main portion of aerodynamic loading Shock layer theory, with a small parameter epsilon defined by density ratio for a strong shock, is used to analyze flow past the windward surface Consideration is given to cases of a basic 'Newtonian' flow and of a flow with conical symmetry (the formulas obtained in this latter case are analogous to those for a delta wing) B J

A78-30024 # **A reliable modular automatic system adapted to avionics controls Design through successive refinements - Production (Automate sûr et modulaire adapte aux régulations avioniques A S M A R A - Conception par raffinements successifs - Realisation)** C Beounes Toulouse III, Universite, Docteur Ingenieur Thesis, 1977 189 p 25 refs In French Research supported by the Direction des Recherches et Moyens d'Essais and Société Nationale d'Etude et de Construction de Moteurs d'Aviation

A reliable modular control system for an aircraft turbine engine is developed through use of high-level integration circuits and hierarchical modeling and simulation The design process, which relies on successive refinements, makes use of PETRI nets for the functional aspect, and state graphs associated with Markov processes for the reliability aspect Attention is also given to the processor and memories used in the control system The prototype control system is subjected to evaluation J M B

A78-30039 # **The effect of hub fairings on wind turbine rotor performance** R E Wilson (Oregon State University, Corvallis, Ore) *ASME, Transactions, Journal of Fluids Engineering,* vol 100, Mar 1978, p 120-122

Studies are made of the effect of hub fairings on the performance of a wind turbine The contribution of velocity change to the torque is calculated and it is found that the effect on power may be either positive or negative Various hub fairings have been used to test both wind turbines and propellers It is shown that the design of an effective hub fairing must take into account the effect of velocity change on torque, blade section aerodynamics, and the potential flow around the center body in the rotor plane with reference to the specific center body being used S C S

A78-30096 **Whither MLS** F B Pogust (Cutler-Hammer, AIL Div , Deer Park, N Y) *Journal of Air Traffic Control,* vol 20, Jan Mar 1978, p 8, 9

The concepts of commonality and proliferation are discussed with reference to the use of microwave landing systems It is suggested that, although common civil/military air navigation systems might have been desirable in the past, the situation is different for the case of MLS The reason for this conclusion is that the candidate systems for ICAO standardization were not conceived or optimized as military tactical systems, which means that large-scale expenditures would be required to prove their military feasibility and to develop appropriate hardware The only advantage foreseen that would accrue to the armed services from adopting a standardized ICAO systems is that it would provide the ability to land at civilian airports during adverse weather, and cheaper alternative methods of achieving this ability are thought to exist Proliferation of landing systems is said to be desirable since it would permit testing of various design approaches It is thought that the possibility of an alternative system being chosen for standardization should not disturb users who derive benefit from the system they selected M L

A78-30097 **Landing systems - The Navy viewpoint** D B Tuttle (U S Navy, Washington, D C) *Journal of Air Traffic Control,* vol 20, Jan -Mar 1978, p 19-22

A history of landing systems used by the USN is presented with attention to the unique characteristics required for landings at sea Reasons why most landing systems used at sea were not incorporated into Navy land airports and why some systems used at civilian or other military airports were not adopted by the Navy are explained It is concluded that aging ground-controlled-approach (GCA) equipment should be retained throughout the 1980's and that a GCA update program should be initiated Modifications planned for the GCA update are surveyed A conversion to the national microwave landing system (NMLS) in the mid-80's to mid-90's is planned with a phase-out of GCA to follow M L

A78-30123 # **Laser and optical methods of monitoring in aircraft construction (Lazernye i opticheskie metody kontrolia v samoletostroenii)** E T Vagner, A A Mitrofanov, and V N Barkov Moscow, Izdatel'stvo Mashinostroenie, 1977 176 p 54 refs In Russian

Consideration is given to the application of lasers and other optical instruments to the quality control of assembly procedures in aircraft production Particular attention is given to the monitoring of shapes and dimensions of aircraft parts, to the centering of parts via laser beams, and optomechanical scanning systems for assembly B J

A78-30124 # **Helicopters Calculation of integral aerodynamic performance and air-technical data (Vertolety Raschet integral'nykh aerodinamicheskikh kharakteristik i letno-tekhnicheskikh dannykh)** L S Vil'dgrube Moscow, Izdatel'stvo Mashinostroenie, 1977 152 p 59 refs In Russian

Methods are outlined for calculating rotor performance and helicopter air-technical data within the framework of helicopter vortex theory Simplified methods of determining the induced velocity field of a rotor in hover and in vertical and horizontal flight are described, along with methods of optimizing rotor blades for various modes of helicopter operation The fundamentals of the theory of the blade-tip vortex sheet in horizontal flight are examined, and the theory is applied to the determination of the aerodynamic moment and the components of the aerodynamic force arising in the rotor, and also to the determination of the flapping coefficient and inductive effects of rotors of a multirotor system V P

A78-30175 # **Weight design and the efficiency of passenger aircraft Volume 2 - Calculation of the center of gravity and moments of inertia of aircraft Weight analysis (Vesovoe proektirovanie i effektivnost' passazhirskikh samoletov Volume 2 - Raschet tsentrovki i momentov inertsii samoleta Vesovoi analiz)** V M Sheinin and V I Kozlovskii Moscow, Izdatel'stvo Mashinostroenie, 1977 208 p 68 refs In Russian

Principles of construction design and weight-reduction methods are discussed with reference to the airframe, propulsion unit, and equipment Described procedures of weight analysis involve classification of the forms of efficiency, parametric analysis, comparison rules, and reduction methods The significance and calculation of the center of gravity of aircraft are explained, and applications of this calculation to problems involving passenger aircraft are considered The calculation and experimental determination of aircraft moments of inertia are described M L

A78-30244 # **Profile of the airport-development crisis** R J Hodge (Tippets-Abbett-McCarthy-Stratton, Washington, D C) *Astronautics and Aeronautics,* vol 16, Apr 1978, p 39-44 5 refs

The rapid increase in the volume of air traffic necessitates improvement in ATC, as well as the construction of new airports Prospects for both are evaluated in terms of cost, government regulation, aircraft payload and economy, and location of various urban centers D M W

A78-30245 # **Looking offshore at the airport future** C J Lord (Ralph M Parsons Co , Pasadena, Calif) *Astronautics and Aeronautics,* vol 16, Apr 1978, p 45-49 9 refs

Increases in the volume of air traffic is expected to present a critical problem for U S and world airports during the 1980s Solving the problem of the trailing vortex behind aircraft, together with the microwave landing system (MLS), should ease the crunch somewhat New airports, however, will still be needed This paper discusses the feasibility of locating airports off shore, with attention to cost and population density factors The Honolulu International Airport is presented as an example of an operational off-shore facility Off-shore airports in Hong Kong, using land fill from excavations, and for Cleveland, using land reclaimed from Lake Erie by a polder (dike), are considered for the near future D M W

A78-30252 New trends and problem areas in automatic flight control D McRuer (Systems Technology, Inc , Hawthorne, Calif) *(Israel Annual Conference on Aviation and Astronautics, 19th, Tel Aviv and Haifa, Israel, May 2, 3, 1977) Israel Journal of Technology,* vol 15, no 1-2, 1977, p 1-10 52 refs

Two categories of automatic flight control are discussed - those in which additional functions are the consequence of greater interdependence between airframe and controller, and those which represent a revolution in which digital/discrete replace analog/continuous controller elements Concepts in the first category include flight-phase-dependent flight control system configurations, active control, and control precision improvement Changes in mechanization features of flight control systems are examined, and system level problem areas in automatic flight control are described, with attention to emulation versus direct digital synthesis and closed-loop simulation with actual hardware M L

A78-30253 Benefits of strapdown over gimbal INS systems for aircraft application J C Shaw (Boeing Commercial Airplane Co , Seattle, Wash) *(Israel Annual Conference on Aviation and Astronautics, 19th, Tel Aviv and Haifa, Israel, May 2, 3, 1977) Israel Journal of Technology,* vol 15, no 1-2, 1977, p 11-21 11 refs

Independent laboratory and aircraft flight tests during 1975 of three diverse potentially low-cost strapped-down (strapdown) inertial navigation systems (INS) have demonstrated the technical feasibility of a less-than one-nmi/h strapdown INS in an aircraft environment One system is an integrated strapdown air data sensor (ISADS) with a projected production purchase price of $34K-41K per channel Based on average industry data taken from a transport development program, an ISADS type system is expected to have equivalent or lower total cost of ownership than the non-INS, conventional avionics it replaces, thus providing INS functions for no additional cost A direct comparison is made between an equivalent gimballed INS and two strapdown INS approaches, orthogonal and skewed-axis, to establish the potential cost effectiveness of the strapdown INS approach (Author)

A78-30256 Performance of the ARAVA aircraft with wing-tip winglets Y Eliraz and D Ilan (Israel Aircraft Industries, Ltd , Lod, Israel) *(Israel Annual Conference on Aviation and Astronautics, 19th, Tel Aviv and Haifa, Israel, May 2, 3, 1977) Israel Journal of Technology,* vol 15, no 1-2, 1977, p 35-43 7 refs

A wing-tip winglet configuration installed on the twin-engine ARAVA aircraft was flight tested recently Cruise and climb performance have been evaluated, the main objective being to establish the one engine out-climb case Much consideration was given to evaluating the lateral-directional characteristics of the aircraft, up to the maximum sideslip angles associated with FAR requirements for this type of aircraft The winglet configuration evolved from a series of wind tunnel tests carried out in a low-speed wind tunnel The wind tunnel tests indicated and the flight tests later substantiated that the adoption of winglets to a STOL twin-engined aircraft is strongly affected by the overall lateral-directional characteristics, some of which are difficult to simulate in wind tunnel testing, mainly those associated with strong propeller power effects, dynamic behavior, and Reynolds numbers The tested configuration reduced the induced drag at climb lift coefficients by 20%, with good correlation between wind tunnel and flight test data (Author)

A78-30257 Evolution of the aircraft gas turbine engine M A Zipkin (General Electric Co , Advanced Engineering and Technology Programs Dept , Cincinnati, Ohio) *(Israel Annual Conference on Aviation and Astronautics, 19th, Tel Aviv and Haifa, Israel, May 2, 3, 1977) Israel Journal of Technology,* vol 15, no 1-2, 1977, p 44-58

The history of the aircraft gas turbine engine is presented with attention to engine power (thrust) efficiency and weight as well as improvements in component technology The development of gas turbine technology and its role in aircraft design are considered, engine performance trends are examined, future challenges posed by technological and environmental concerns are indicated, and new systems/applications are reported M L

A78-30259 Analytical and experimental fatigue program for the Kfir main and nose landing gears B Abraham (Israel Aircraft Industries, Ltd , Lod, Israel) *(Israel Annual Conference on Aviation and Astronautics, 19th, Tel Aviv and Haifa, Israel, May 2, 3, 1977) Israel Journal of Technology,* vol 15, no 1-2, 1977, p 70-78 9 refs

This paper describes the program that was carried out on the Kfir main and nose landing gears in order to insure adequate service life The fatigue program began in the detail design phase, next came the development of loading spectra used for analysis and test A fatigue analysis was then performed for several suspected critical locations on both gears A flight-by flight fatigue test was performed on both landing gears with the aim of demonstrating four service-

lifetimes of operation Design modifications were introduced based on the results of these tests Finally, rational inspection and replacement intervals were established for the main and nose gear, some of which require monitoring of aircraft operations (Author)

A78-30273 # **The An-26 aircraft Construction and use (Samolet An-26 Konstruktsiia i ekspluatatsiia)** Zh S Chernenko, G S Lagosiuk, and B I Gorovoi Moscow, Izdatel'stvo Transport, 1977 342 p In Russian

The An-26, based on the An 24, is a medium-distance twin-engine turboprop transport aircraft which can transport 5 5 tons of freight 1000 km with a 435 km/h cruising speed at a height of 6000 m Topics discussed include airframe construction, flight control, the undercarriage, the hydraulic system, the propulsion unit, high-altitude equipment, the deicing system, and transport and accom modations equipment The operation of some systems is explained M L

A78-30351 # **Aircraft noise and its sources (Hluk letadel a jeho zdroje)** J Sulc *Zpravodaj VZLU,* no 5, 1977, p 231-244 25 refs In Czech

Fundamental theories on noise sources in aircraft are reviewed The principles of noise generation and the acoustic properties of the principal noise sources are described, with attention given to piston engine exhaust processes, exhaust jets from jet engines, the compressor of a jet engine, and airscrews and rotors The effect of these sources on noise levels in the cabin is examined, and the effects of further sources such as the turbulent boundary layer and the air conditioning system are also discussed Sonic boom is briefly considered P T H

A78-30352 # **Effect of noise on life of aircraft structure and design of parts resistant to acoustic loads (Vliv hluku na zivotnost letecke konstrukce a konstrukce casti odolnych proti akustickemu zatizeni)** K Tyzner *Zpravodaj VZLU,* no 5, 1977, p 245-252 18 refs In Czech

The effect of aircraft noise on the fatigue strength of aircraft structures, instruments, and systems is examined The design of parts to withstand acoustic loading is described, and recommendations are given for the design of special antiacoustic equipment P T H

A78-30353 # **Measuring noise in aircraft cabins (Mereni hluku v kabinach letadel)** P Marjanek *Zpravodaj VZLU,* no 5, 1977, p 253-258 5 refs In Czech

The complex acoustical engineering problem of measuring different types of noise in aircraft cabins is discussed The main types of equipment used in such measurements are briefly characterized A typical measuring system, including the airborne part and the ground part of the system, is described Examples of noise spectra in a transport aircraft cabin are given which show how the amount of information on the frequency composition of noise depends on the bandwidth of the analysis procedure P T H

A78-30354 # **Methods and equipment for testing for acoustic fatigue (Zkusebni metody a zarizeni pro zkouseni akusticke unavy)** D Sejnost *Zpravodaj VZLU,* no 5, 1977, p 259 261 In Czech

Methods for testing the acoustic fatigue resistance of samples of aircraft structural components are discussed A method of obtaining a high experimental noise level by means of a modulated air jet is discussed The use of a wideband siren for modulating the jet is described P T H

A78-30355 # **Methods of reducing aircraft noise (Metody snizovani hluku letadel)** J Hofr *Zpravodaj VZLU,* no 5, 1977, p 263-270 6 refs In Czech

The problem of reducing internal aircraft noise is considered The dependence of the cabin noise on the general layout of the aircraft is examined for turboprop transport aircraft Acceptable designs for the double-pane windows and for the elastic fasteners for the interior panels are shown Acoustic characteristics of double walls are examined Data on the effect of the distance of the propeller tips from the fuselage and engine speed on noise level in the cabin are presented P T H

A78-30356 # **Basic fatigue curves of aircraft structures (Zakladni unavove krivky leteckych konstrukci)** V Kahanek *Zpravodaj VZLU,* no 6, 1977, p 291-301 15 refs In Czech

The elements of representing the fatigue characteristics of whole aircraft and their parts are presented Suitable S-N curves and Haigh diagrams for light alloy structures, steel lugs, welded steel structures and joints are taken from the literature for the purpose of designing new aircraft and calculating their life at the design stage Methods of interpreting the fatigue curves and using them for life prediction of aircraft parts are described P T H

A78-30357 # **Choice of engine design for small transport aircraft (Prispevek k volbe koncepce leteckeho motoru pro maly dopravni letoun)** J Ruzek and E Heriban *Zpravodaj VZLU,* no 6, 1977, p 303-308 In Czech

The influence of the heat circuit parameters on the parameters of a bypass engine under conditions of ground running is analyzed The dependence of the optimal compression value in the blower on the bypass ratio, total air compression in the compressor, and the total gas heat before the turbine is established The effect of the bypass ratio on the average fuel consumption and the blower size is analyzed, and it is shown that a turboprop engine gives more thrust and has less fuel consumption than a bypass engine The method of reversing the thrust of a bypass engine by rolling up the fan rotor blades is analyzed P T H

A78-30358 # **The problem of the acoustic properties of the propeller and Q-fan type blower with regard to exterior and interior noise in transport aircraft (Prispevek k problematice akustickych vlastnosti vrtule a dmychadla typu Q-fan z hlediska vnejsiho a vnitrniho hluku dopravnich letadel)** R Eichler *Zpravodaj VZLU,* no 6, 1977, p 309-316 11 refs In Czech

The interior and exterior noise due to the power plant of a transport aircraft is examined The noise characteristics of ordinary propellers are compared with those of a low-noise airscrew with Q fan type blower The possibility of suppressing noise through proper use of present-day materials for passenger cabin walls is discussed P T H

A78-30360 # **Fatigue life analysis of the L 13 /Blanik/ glider** V Kahanek *Zprava VZLU,* no Z-31, 1977 24 p 9 refs

A review of the service life analysis conducted on the L 13 Blanik wing and horizontal tail surfaces is given It covers all modes of operation, including take-off, flight training to a sailing syllabus as well as the glider handling on the ground The analysis is completed with results of the measurements in operating conditions, particularly from the glider load assessment at winch launching The paper contains a program of fatigue testing of the wing and horizontal tail surfaces mounts From the fatigue tests, those principal failures are mentioned, for which the safe life of wing and tail surface were determined In conclusion there are recommendations concerning operation and maintenance as well as important structural design experience resulting from the analysis and fatigue tests (Author)

A78-30506 * **Remotely piloted aircraft in the civil environment** T J Gregory, W P Nelms (NASA, Ames Research Center, Moffett Field, Calif), and J S Karmarkar (Systems Control, Inc , Palo Alto, Calif) *Mechanism and Machine Theory,* vol 12, no 5, 1977, p 471-479 9 refs

Improved remotely piloted aircraft (RPAs), i e , incorporating reductions in size, weight, and cost, are becoming available for

civilian applications Existing RPA programs are described and predicted into the future Attention is given to the NASA Mini-Sniffer, which will fly to altitudes of more than 20,000 m, sample the atmosphere behind supersonic cruise aircraft, and telemeter the data to ground stations Design and operating parameters of the aircraft are given, especially the optical sensing systems, and civilian RPA uses are outlined, including airborne research, remote mapping, rescue, message relay, and transportation of need materials Civil regulatory factors are also dealt with D M W

A78-30572 # **Effect of boundary layer suction through slits on the efficiency of turbomachine outlet diffusors (Vliianie shchelevogo otsosa pogranichnogo sloia na effektivnost' vykhodnykh diffuzorov turbomashin)** A A Basovskaia and A P Stepanenko (Akademiia Nauk Ukrainskoi SSR, Institut Mekhanicheskoi Teplofiziki, Kiev, Ukrainian SSR) *Energetika,* vol 21, Jan 1978, p 134-137 6 refs In Russian

The influence of slit arrangement and suction intensity on losses in short conical and annular curvilinear diffusors were studied experimentally at inlet section Mach numbers of 0 2 to 0 4 and Reynolds numbers of 450,000-900,000 It is shown that suction reduces losses effectively only in very short diffusors with angles and expansion ratios significantly larger than optimum By application of suction, it is possible to increase turbine efficiency It is shown that a diffusor with an L/D ratio of 0 54 and a diffusor with a relative length of 0 8, without suction have identical loss coefficients M L

A78-30677 # **Tandem-queue algorithm for airport user flows** W J Dunlay, Jr (Pennsylvania, University, Philadelphia, Pa) and C -H Park (Seoul National University, Seoul, South Korea) *ASCE, Transportation Engineering Journal,* vol 104, Mar 1978, p 131 149 14 refs U S Department of Transportation Contract No OS-50232

The paper presents an analytical framework for uniting successive queueing models of airport components into a modular airport system model The objective is to represent the arrival rate at one set of components as a function of the arrival rates and operating characteristics of the preceding set of components An algorithm is presented which applies to sets of successive components that are used by nearly all passengers, it is assumed that all passengers go directly from one of these sets to the next without making intermediate stops In a continuation of the analysis, detailed consideration is given to the effects of optional or ancillary activities that exist between certain sets of components on the flow of passengers through subsequent airport processing components One of the conclusions is that queueing models of successive sets of components within an airport can be related using transfer times, time-dependent delays, and flow-split (and directional split) percentages M L

A78-30678 # **Airport/community environmental planning** S C Orlick (California Polytechnic State University, San Luis Obispo, Calif) *(American Society of Civil Engineers, Conference on Airport Planning, University of Washington, Seattle, Wash , Feb 3-5, 1977) ASCE, Transportation Engineering Journal,* vol 104, Mar 1978, p 187-199 26 refs

The paper is concerned with the nature of recent airport environmental planning practices, the inherent shortcomings of these practices, and the type of changes that will bring about desired improvements The tendency of project sponsors to use environmental impact statements more as an aid to decision making than as a means of informing the public is considered A composite model of recent airport environmental planning practice, which is based on an eight-step model of rational planning, is examined with attention to methodological deficiencies, input weaknesses, and structural weaknesses Planning processes are discussed which would replace the concept of airport environmental planning with the concept of community environmental planning for airports M L

A78-30679 # **Runway roughness characterization by DDS approach** F Nassirpour, S G Kapoor, and S M Wu (Wisconsin, University, Madison, Wis) *ASCE, Transportation Engineering Journal,* vol 104, Mar 1978, p 213-226 13 refs

The proposed dynamic data system for runway roughness characterization involves the development of a mathematical model in the form of a stochastic differential equation for runway profile heights, computation of the geometric statistical properties of runway profiles from parameters of the model, and application to the characterization of runway roughness at four major airports A preliminary evaluation of this approach to characterizing runway unevenness is presented along with a critical review of power spectrum analysis of runway roughness The dynamic data system and some applications are described, and results involving depth measures, stochastic models, correlation, and the spectrum are reported M L

A78-30689 # **Tunnel interference assessment by boundary measurements** C F Lo (ARO, Inc , Arnold Air Force Station, Tenn) *AIAA Journal,* vol 16, Apr 1978, p 411-413 5 refs

An approach is proposed which avoids the difficulties encountered in the classical method of assessing and correcting wind tunnel interference This approach requires only the measurement of flow variables at a control surface near the tunnel wall inside the test section A two-dimensional example is chosen to illustrate the formulation of the computation procedure The Fourier transform technique is applied to the subsonic flow case for obtaining the interference flowfield and the flow variables under free-air conditions at the control surface To validate the approach, a numerical demonstration is performed by simulating the flow in a wind tunnel with the inviscid transonic small-disturbance equation The approach is also verified experimentally for a two-dimensional 15 24-cm-chord airfoil, the tunnel test section configuration consisting of variable perforated walls for the top and bottom walls and solid plexiglass sidewalls S D

A78-30690 * # **Influence of spin rate on side force of an axisymmetric body** R L Kruse (NASA, Ames Research Center, Moffett Field, Calif) *AIAA Journal,* vol 16, Apr 1978, p 415, 416

Results are presented for an experimental study in which a 10-deg half-angle pointed cone model 57 9 cm long and made of magnesium (for lightness and minimization of inertial effects) is spun at several rates about its axis of symmetry The model is spun in both directions, but most of the data presented are for the counterclockwise rotation The resulting side force is recorded on an oscillograph It is shown that the side force observed occurs under conditions of spin about the longitudinal axis, and that the general shape of the side-force curve with roll position does not depend strongly on spin rate However, the peak-to-peak value of side force decreases substantially with spin rate, suggesting that the vortices producing the side force require a significant amount of time to change position and/or strength S D

A78-30697 # **The division of air transport markets between carriers - Local service operations** E R D Andersen and W I Bobye (Pacific Western Airlines, Ltd , Vancouver, Canada) *(Canadian Aeronautics and Space Institute, General Meeting, Toronto, Canada, May 11, 1976) Canadian Aeronautics and Space Journal,* vol 24, Jan -Feb 1978, p 17-31 9 refs

Government regulations and economic constraints on Canadian local-service air carriers are discussed Among the economic constraints considered are aircraft productivity, operating costs and passengers' acceptance of turboprop craft, multi-stop service and long traveling times Subcontracting of thin routes to carriers owning aircraft with small seating capacities may provide a local-service carrier with an alternative to flying these routes at low capacity with larger aircraft The future Canadian demand for 50-seat turboprop and 100-seat jet aircraft is assessed J M B

A78-30698 # **Aviation fuel usage - Economy and conservation** V F J Craig and B G Smith *(Roads and Transportation Association of Canada, Annual Conference, 8th, Quebec City, Canada, Sept. 13, 1976)* *Canadian Aeronautics and Space Journal,* vol 24, Jan-Feb 1978, p 34-49

Methods of conserving aircraft fuel are discussed, the emphasis is on short-term operational and procedural measures Reduction of required fuel reserves for flights operating under excellent weather conditions, minimization of jet-powered taxiing maneuvers, better sequencing of takeoffs at peak hours, and the selection of appropriate airspeed, altitude, climb, cruise and descent options are cited as means to limit unnecessary fuel consumption In addition, the use of turboprop aircraft on short-haul sectors and more rational air routings and terminal area control are suggested to decrease fuel waste J M B

A78-30850 # ***The wind and turbulence measuring system of the NAE Airborne V/STOL Simulator*** M Sinclair and W S Hindson (National Aeronautical Establishment, Flight Research Laboratory, Ottawa, Canada) *Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin,* no 4, 1977, p 27-29, 31-40

An airborne V/STOL simulator has been used to record characteristics of disturbances in the boundary layer of the earth Real-time wind and turbulence calculations are made both directly from a Doppler radar and indirectly through integration of the accelerations derived from an accelerometer/gyroscope package, the final inertial velocity computation relies on a mixing of the redundant estimates in a third-order complementary filter system Time histories of computed wind components and of a shear encounter are presented J M B

A78-30856 **Alloy needs and design - The airframe** R F Simenz (Lockheed California Co., Science and Engineering Div., Burbank, Calif.) and M A Steinberg (Lockheed Aircraft Corp., Burbank, Calif.) In Fundamental aspects of structural alloy design New York, Plenum Press, 1977, p 229-254, Discussion, p 254-256 8 refs

Clad aluminum surfaces and exfoliation-resistant alloys selected for the airframes of wide-body aircraft are discussed, and developments in titanium- and aluminum-alloy designs for advanced aircraft are reviewed In aluminum alloy design, the emphasis is placed on the attainment of superior fatigue and strength properties in conjunction with immunity to stress-corrosion cracking Achievement of lower cost titanium alloys with more reliable fatigue and toughness properties is a principal aim for airframe development programs In addition, fail-safe and damage-tolerant structures are important requirements in advanced airframe design J M B

A78-30886 **Space optical communications with the Nd YAG laser** M Ross, J Abernathy, J Wolf (McDonnell Douglas Astronautics Co., St Louis, Mo.), P Freedman, G Matassov, and J D Barry (USAF, Space and Missiles System Organization, Los Angeles, Calif.) *IEEE, Proceedings,* vol 66, Mar 1978, p 319-344 38 refs

The development of a Nd YAG space laser communication system is discussed with respect to history, potential applications, and present status The basic design of an Air Force Space Communications Flight Test operable at a data rate of 1000 Mbit/s is described at both the system and component level An engineering feasibility model of this system has been completed, and the results of tests data are reported Communications at 1000 Mbit/s with a receiver sensitivity of 20 photoelectrons/bit was demonstrated for a bit error rate of 10 to the 6, interterminal tracking with angle errors less than 1 microrad, and station to station acquisition in less than 6 s A simulated range of 40,000 km was used (Author)

A78-30891 **Variational principles for the transonic airfoil problem** G F Carey (Texas, University, Austin, Tex.) *Computer Methods in Applied Mechanics and Engineering,* vol 13, Feb 1978, p 129-140 11 refs

The transonic airfoil problem is formulated, and associated variational principles are constructed Both the full potential form of the governing equations and small disturbance theory are considered Variational functionals are developed for the full potential equation using a modified Plateau integral and also directly from the continuity equation A simpler nonlinear functional is obtained for the small disturbance approximation by direct divergence manipulations to a weak solution form of the Galerkin requirement For slightly supercritical flows, iterative methods and Mach number perturbation techniques lead to simpler but less general variational principles Appropriate finite element formulations are developed using the principles (Author)

A78-31019 * **On sound transmission into a heavily-damped cylinder** L R Koval (Missouri-Rolla, University, Rolla, Mo.) *Journal of Sound and Vibration,* vol 57, Mar 8, 1978, p 155, 156 Grant No NsG-1050

A mathematical model for the transmission of sound into a thin monocoque cylindrical shell is discussed The model is used to evaluate an oblique plane wave incident upon a flexible thin cylindrical shell The solution is applicable to the transmission of sound under actual flight conditions The model is then used to determine curves of cylinder-transmission loss for heavily damped cylinders Numerical results are found for several plane wave incidence angles for a narrow-bodied jet fuselage made of aluminum It is noted that damping (i e , the loss factor) increases, dips because of reduced cylinder resonances, and eventually disappears when the loss factor of the shell is large enough S C S

A78-31034 **Sensitivity reduction in aircraft control systems** N Sundararajan (Indian Space Research Organization, Vikram Sarabhai Space Centre, Trivandrum, India) *IEEE Transactions on Aerospace and Electronic Systems,* vol AES-14, Mar 1978, p 292-297 5 refs

A method for reducing trajectory sensitivity to parameter perturbations for linear feedback systems is described Application of the method to the design of aircraft control systems, with special reference to a helicopter forward flight control system, is illustrated The response of the system based on this method is found to be better than that obtained with fixed-feedback gain controllers, although the response may not be as good as that of an adaptive control scheme The main advantage of the method is the simplicity of its implementation relative to that of the adaptive control scheme which requires an on-board computer (Author)

A78-31038 **Radio interference in helicopter-borne pulse Doppler radars** M K Moaveni (Pahlavi University, Shiraz, Iran) *IEEE Transactions on Aerospace and Electronic Systems,* vol AES-14, Mar 1978, p 319-328 7 refs

Radio interference generated in a helicopter-borne pulse Doppler radar system due to rotating blades is analyzed for the case that blades are located in the far field region of the radar antenna A first-order estimate of the blade interference power spectrum is obtained as a function of antenna depression angle and radar (helicopter) altitude and speed Numerical calculations show that blade interference is very weak compared with the direct ground clutter It extends, however, into the clutter-free region which causes false alarms and degrades the radar performance (Author)

A78-31050 **Flight tests of digital data transmission** J R Juroshek, G E Wasson, and G H Stonehocker (NOAA, Institute for Telecommunication Sciences, Boulder, Colo.) *IEEE Transactions on Aerospace and Electronic Systems,* vol AES-14, Mar 1978, p 403-410. 8 refs Research supported by the U S Department of Transportation and FAA

A series of flights were made to measure the characteristics of air-to-ground digital transmission in the VHF aeronautical mobile frequency band Digital transmission rates of 2400 and 4800 bit/s were used with minimum shift keying (MSK) as the baseband modulation format Signal level, signal fading, and radio horizon characteristics are described Bit error rates and the causes of the errors also are discussed (Author)

A78-31126 Some specific hydrodynamic and aerodynamic problems of surface-effect ships with sidewalls (Quelques problèmes d'hydro-aérodynamique spécifiques des NES/AQL) R J Balquet and F Jodelet (Service Technique des Constructions et d'Armes Navales, Division Navires Speciaux, Paris, France) *Association Technique Maritime et Aéronautique, Bulletin,* no 77, 1977, p 415-429, Discussion, p 430-432 In French

Interrelated hydrodynamic and aerodynamic problems associated with the development of surface effect ships, which ride on an air cushion, are discussed Topics considered include the partitioning of and the required pressure for the air cushion, the behavior of the air cushion over oil, the significance of sidewall dimensions, and problems associated with support, water exclusion, and propulsion The importance of the length/breadth ratio parameter is indicated M L

A78-31127 Mixed ventilated foils (Ailes ventilées mixtes) M Pouillot (Societe Nationale Industrielle Aerospatiale, Division Helicopteres, Marignane, Bouches-du-Rhône, France) *Association Technique Maritime et Aéronautique, Bulletin,* no 77, 1977, p 433-455, Discussion, p 456-460 15 refs In French

The paper surveys several approaches to analyzing mixed ventilated foils considered with reference to hydrofoils The term 'mixed' indicates an immersed foil design which can be adapted to several modes of operation Classic hydrodynamic profiles and mixed profiles are compared, indirect and direct problems are examined, and experimental investigations of two-dimensional models along with qualitative studies of three-dimensional assemblages are reported Direct problems include two-dimensional flow with and without a free surface and three-dimensional flows M L

A78-31152 Supersonic transports H A Goldsmith (British Aircraft Corp , Bristol, England) In Advancing technologies London, Mechanical Engineering Publications, Ltd , 1977, p 10-24

Techniques for minimizing the drag of supersonic transport aircraft are considered, and the rationale leading to adoption of a maximum speed of about Mach 2 3 for first-generation slender wing supersonic transports is discussed The efficiency of the supersonic transport craft may be limited by the convergence of inlet air momentum and gross thrust with increasing Mach number The kinetic heating which determines a great deal of supersonic transport structural design also receives attention J M B

A78-31153 The aircraft ducted fan R M Denning (Rolls Royce, Ltd , Bristol Engine Div , Bristol, England) In Advancing technologies London, Mechanical Engineering Publications, Ltd , 1977, p 25-40

Aircraft turbofan design is discussed, with attention given to efficiency, noise characteristics, pressure ratios, and the effects of flight speed Two- and three-shaft fan engines are described, engine design improvements such as the increase of peak gas temperatures and the development of air-cooled turbine blades are mentioned The noise emission from high bypass ratio engines is also assessed In addition, variations in specific fuel consumption with flight speed receive consideration J M B

A78-31302 * # The NASA Aircraft Energy Efficiency Program J M Klineberg (NASA, Washington, D C) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings
Ottawa, Canadian Aeronautics and Space Institute, 1978, p 1-1 to 1-32

The objective of the NASA Aircraft Energy Efficiency Program is to accelerate the development of advanced technology for more energy-efficient subsonic transport aircraft This program will have application to current transport derivatives in the early 1980s and to all-new aircraft of the late 1980s and early 1990s Six major technology projects were defined that could result in fuel savings in commercial aircraft (1) Engine Component Improvement, (2) Energy Efficient Engine, (3) Advanced Turboprops, (4) Energy Efficiency Transport (aerodynamically speaking), (5) Laminar Flow Control, and (6) Composite Primary Structures B J

A78-31303 # Prospects for energy conserving STOL transports using prop-fans B Eggleston (de Havilland Aircraft of Canada, Ltd , Downsview, Ontario, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 2-1 to 2-16 8 refs

A study has examined the application of the prop-fan type of advanced propeller design to a 1986 technology, 50 passenger STOL transport aircraft cruising at Mach numbers of 0 50, 0 60 and 0 70 Comparisons were made with an equivalent 1977 technology STOL transport (cruising at Mach 0 38) sized to meet the same design requirements In a 1986 technology aircraft the greatest fuel savings were found at Mach 0 50 and maximum energy efficiencies of 98 passenger miles per Imperial gallon were predicted At short ranges the direct operating costs of the 1986 technology aircraft at Mach 0 50 and 0 60 were found to be very similar to the 1977 technology STOL transports The energy efficiencies of a prop-fan aircraft designed for Mach 0 70 were found superior to 1977 technology STOL and jet CTOL aircraft by 10-20% B J

A78-31304 * # Some aspects of powerplant airframe integration affecting fuel conservation J E Farbridge (de Havilland Aircraft of Canada, Ltd , Downsview, Ontario, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings
Ottawa, Canadian Aeronautics and Space Institute, 1978, p 3-1 to 3-15 12 refs Research sponsored by the Department of National Defence of Canada and NASA

The performance criteria for STOL transport aircraft place many constraints on engineering design, which, in turn, may have a direct bearing on fuel efficiency these constraints become even more severe with the introduction of powered-lift for turbofan aircraft Consideration is given to some aspects of performance and design which arise as a result of powerplant/airframe integration and an attempt is made to assess these factors in terms of transport fuel efficiency The drag polars of various powered lift concepts are analyzed to determine the installed thrust/weight required and a simple method of relating this to fuel efficiency is suggested Some other factors have been identified as being important to this aspect of design and these are discussed in more general terms Finally, special consideration is given to recent Canadian research in the realm of supercritical airfoil technology as applied to an multi-foil section which could be utilized both for the STOL regime of flight and for cruise at transonic speeds (Author)

A78-31305 # Improved energy efficiency for small CTOL transport aircraft S Bernstein, G A Adams, and A Oberti (Canadair, Ltd , Montreal, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 4-1 to 4-14

An exploratory investigation was carried out into potential improvements in fuel efficiency and direct operating costs (DOC) by the application of new airframe and propulsion system technologies (supercritical wings, advanced composite materials, high aspect ratio wings, advanced propulsion systems, wing tip winglets, active controls and laminar flow) to the smaller CTOL transport aircraft Fuel savings of up to 12% are possible by increasing aspect ratio

alone Incorporation of supercritical airfoils and advanced composites with the higher aspect ratios can save a further 5% Advanced propulsion system technology offers similar or higher potentials for fuel savings - 15-20% with new turbofans and a further 15-20% with prop-fans Total cumulative fuel savings of 40-45% are possible with incorporation of all the new technologies investigated Equivalent DOC improvements are of the order of 15-18% and these increase to 20-22% as the fuel cost increases from 40 to 70 cents per gallon B J

A78-31306 * # **Fuel saving potential of Mach 0 8 twin engine prop-fan transports** F J Davenport (Boeing Commercial Airplane Co , Seattle, Wash) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 5-1 to 5-19 Contract No NAS2 9104

The fuel saving and economic potentials of the prop-fan high-speed propeller concept have been evaluated for twin-engine commercial transport airplanes designed for 3333 6 km range, 180 passengers, and Mach 0 8 cruise A fuel saving of 9 7% at the design range was estimated for a prop-fan aircraft having wing-mounted engines, while a 5 8% saving was estimated for a design having the engines mounted on the aft body The fuel savings and cost were found to be sensitive to the propeller noise level and to aerodynamic drag effects due to wing-slipstream interaction Uncertainties in these effects could change the fuel savings as much as plus or minus 50% A modest improvement in direct operating cost was estimated for the wing-mounted prop-fan at current fuel prices (Author)

A78-31307 # **Fuel efficiency - Where we are heading in the design of future jet transports** R H Hopps (Lockheed-California Co , Burbank, Calif) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 6-1 to 6-16

Consideration is given to the 1980s jet-transport market with emphasis on narrow-body vs wide body aircraft, the benefits of increased size and capacity and the feasibility of superlarge aircraft Technology of the 1980s relating to span, active controls and composites is briefly reviewed Three potential technologies for the 1990s are discussed laminar flow control, advanced turboprops and liquid hydrogen It is noted that the technology of the 1980s will not offer dramatic improvements over all the aircraft flown today, large improvements can be offered only in comparison with the older narrow body aircraft B J

A78-31308 # **Aviation fuels - A supplier's perspective** C B Rupar (Imperial Oil Enterprises, Ltd , Sarnia, Ontario, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 7-1 to 7-8

Current availability of aviation kerosene is limited by the freeze point, flash point and aromatics content In the future these constraints will become more critical as increasing volumes of synthetic liquids are produced to supplement natural petroleum Ideally, to maximize security of supply and to control cost, the next generation of aircraft should be designed to operate safely and efficiently on fuels with a wider range of properties (Author)

A78-31309 # **Aircraft fuel economy - The propulsion system contribution** R A Harvey, R E Morris, and B J Palfreeman (Pratt and Whitney Aircraft of Canada, Ltd , Longueuil, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 8-1 to 8-20

Results are presented of some engine performance and design studies intended to determine the potential improvements in fuel efficiency that can be made over a 10 year period by advances in engine technology The study is confined to 'small' gas turbine engines of the type used for executive and commuter aircraft, i e , turboprops up to 2500 SHP and turbofans up to 6000 lb thrust Using projections of technology improvements, equivalent 1987 production engines were synthesized, this showed that a 15-19% reduction in cruise specific fuel consumption could be expected for this class of engine over the next 10 years Two pairs of aircraft were designed - turboprop and turbofan powered using 1977 and 1987 engines but constant 1977 airframe technology Reduction in specific fuel consumption and specific weight results in reduction in aircraft weight for the same mission with further reduction in fuel flow, from 17% for the larger turbofan engine to 21% for the larger turboprop B J

A78-31310 # **Energy conserving aircraft from the engine viewpoint** R M Denning (Rolls-Royce, Ltd , Aero Div , Bristol, England) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 9-1 to 9 35 5 refs

The paper is mainly concerned with fuel-efficiency improvement in conventional gas turbine propulsion systems for airline operation, a broad philosophy of engine improvements for short, medium and long-haul aircraft is reviewed It is stressed that minimizing all aircraft direct operating costs is the ultimate yardstick for the engine designer Higher fuel prices may change priorities in engine design and justify more complex and expensive engines particularly for longer-range operations Optimum engine design for shorter range can be significantly different because of the implication of cyclic life on air-cooled turbine blades Lower-specific-thrust engines are worthy of close consideration particularly for short-haul operation B J

A78-31311 # **Thrust computing system applications to increase engine life and provide fuel conservation** G B Mackintosh (Computing Devices Co , Ottawa, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 10-1 to 10-20 Research supported by the Canadian/United States Defense Production Sharing Program

The paper describes a method of computing the gross thrust required by a jet engine based only on measurements of pressure in the engine tailpipe and of ambient static pressure It is shown how this technique can be applied to improve the overall efficiency of engine operation, the result of this improvement is that the number of engines operating at abnormally high exhaust gas temperatures can be reduced In addition to the fuel saving achieved, very great reductions in hot-section parts consumption and maintenance requirements can result from even a small decrease in operating temperature The performance of the thrust computation procedure is substantiated by data obtained on military aircraft engines under USAF and Canadian Government contracts B J

A78-31312 # **STOL system fuel savings - Ground and air** A F. Toplis and J H Nazareth (de Havilland Aircraft of Canada, Ltd , Downsview, Ontario, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 11-1 to 11-16 14 refs

It is maintained that, for intercity travel, a STOL system with STOLports located near the major downtown passenger traffic zones can provide substantial savings in the fuel required for access and egress from the air terminal as compared to a CTOL system A model for estimating the passenger traffic diverted to STOL from the CTOL short haul system is described, the associated fuel savings and profitability of a STOL system are calculated For example, a STOL system centered on the Toronto Island Airport using Dash 7 aircraft would prove more convenient than CTOL to some 1 5 million air travelers in 1980 Also the STOL system would save close to 5 million gallons of fuel as compared with a purely CTOL system and could operate with a profit margin of some 30 million dollars in the same year The STOL system would still save fuel when advanced,

more fuel-efficient CTOL and STOL aircraft are presumably in operation in 1986 B J

A78-31313 # **The energy costs of some noise abatement procedures** R K Leong (Transport Canada, Ottawa, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 13-1 to 13-17

The fuel consumption and noise reduction benefits of two noise abatement departures are compared with a standard non noise abatement departure The analysis consists of determining the fuel consumed in each segment defined by changes in airplane configuration, engine thrust or speed Results show that extra fuel is consumed in each of the noise abatement departure procedures, the magnitude of the fuel penalty is aircraft dependent The weight of the aircraft at takeoff is found to affect the amount of fuel consumed considerably in the case of the Boeing 747 (Author)

A78-31314 # **Air traffic control and energy conservation in air operations** H R Merritt (Transport Canada, Ottawa, Canada) In Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1978, p 14-1 to 14-8

The Canadian ATC system is discussed in the framework of energy conservation in air transportation Such ATC activities as the Joint Enroute Terminal System, the Integrated Communications Control System, MLS, The Vortex Avoidance System, area navigation, and airspace planning are examined It is concluded that good planning for the provision of energy conservation in future ATC services is to maintain a dynamic concept of user-demand change and to produce, on a timely basis, those changes in operational capability which will best match system capacity with demands B J

A78-31425 **Fire power** D Richardson *Flight International,* vol 113, Apr 1, 1978, p 921-926

Airborne radar systems for western nations (USA, UK, France, Sweden, Israel), and for the USSR and China are reviewed in light of recent developments in avionics A table of comparison is presented which outlines the available data relating to the performance characteristics of the radar systems discussed, e g , China, Scan Can, France, Cyrano, Aida, and Mirage 2000, Israel, EL/M-2001 B and EL/M-2021, USSR, Skip Scan, Jaybird, High Lark, and Fox Fire, Sweden, SS-37 A and PS-46 A, UK, Tornado ADV and Blue Fox, and USA, AN/APQ, AN/APG, AN/AWG, and F-16 D M W

A78-31582 # **Special problems in the determination of the radiation characteristics of antennas on aircraft and satellites with the aid of geometric diffraction theory (Spezielle Probleme bei der Bestimmung der Strahlungscharakteristik von Antennen auf Flugzeugen und Satelliten mit Hilfe der geometrischen Beugungstheorie)** A Schrott and V Stein (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugfunk und Mikrowellen, Oberpfaffenhofen, West Germany) *(Arbeitsgemeinschaft Ionosphare, URSI, and Nachrichtentechnische Gesellschaft, Gemeinsame Tagung, Kleinheubach, West Germany, Sept 26-Oct. 7, 1977) Kleinheubacher Berichte,* vol 21, 1978, p 41-50 8 refs In German

The methods of geometric diffraction theory are applied to the calculation of the radiating properties of high-frequency antennas of aircraft or satellites, where reflections from individual surfaces of the aircraft or satellite contribute to the radiation field The paper describes the geometric diffraction computation of the diffracted field for special cases such as (1) sudden change of the incident field, (2) the transition zone for convex bodies, and (3) caustics. P T H

A78-31700 **The next generation EW system - ASPJ** C Rodgers *Military Electronics/Countermeasures,* vol 4, Mar 1978, p 34, 36, 42(3 ff)

Electronic warfare (EW) requirements of the Air Force and Navy have been sufficiently reconciled to permit the use of a single internal anti-jamming system (ASPJ or airborne self protection jammer) on the aircraft of both services into the 1990s The ASPJ, developed by the Navy, can operate in both lethal and non-lethal modes, i e , flack suppression, anti-radiation missiles, precision emitter locating systems, and support jamming and onboard defensive ECM Program management and engineering objectives are outlined, with emphasis on design competition, risk reduction, high initial production rate, and sustained production competition Attention is given to the installation of the ASPJ on currently operational aircraft, especially the F-14 and F-18 prototype D M W

A78-31733 **Acoustic emission detection of fatigue crack growth in a production-size aircraft wing test article under simulated flight loads** W M Pless, C D Bailey, and J M Hamilton (Lockheed Georgia Co , Marietta, Ga) *(American Society for Nondestructive Testing, Spring Conference, Phoenix, Ariz , Mar 28-30, 1977) Materials Evaluation,* vol 36, Apr 1978, p 41-48 10 refs Contracts No F33615-75-C 5249, No F33657-15053 AF Project 7531, AF Order P00972

A structural article representative of a large full-production military aircraft wing was subjected to flight by flight load spectra to initiate and propagate fatigue cracks in 17 selected fastener holes in eight test areas One-hundred unit flights were applied to the wing to initiate crack growth at sharp notch sawcuts and existing cracks, followed by 2,000 unit flights to propagate the cracks Seven test areas were monitored for acoustic emission (AE) using a 32 channel AE flaw locator system and triangulated sensor arrays AE was detected from 12 of the 15 test holes monitored which experienced crack growth After the tests, the test holes were removed from the structure for fractographic analysis of crack growth Correlations between AE and crack growth for several of the test holes are discussed Experimental positioning of sensor arrays to determine possible airborne AE system configurations are discussed (Author)

A78-31745 **Going for a spin - Fighter style** B R A Burns (British Aerospace Aircraft Group, Warton, Lancs , England) *Flight International,* vol 113, Apr 8, 1978, p 985-989

Combat experience in Vietnam and Korea has underscored the necessity for effective aircraft performance in air-to air combat Causes of spin encountered during high angles of attack and rapid lateral movement are analyzed with reference to aerodynamic design parameters It is noted that rudder modifications can be effective in reducing spin, especially within the framework of an aileron-rudder interconnect Also mentioned are the possibilities of forebody strake addition and artificial stability control augmentation to conventionally designed aircraft in order to provide spin resistance throughout the entire flight envelope D M W

A78-31755 # **Mirage 2000 (Mirage 2000)** J Morisset *Air et Cosmos,* vol 16, Apr 1, 1978, p 23-28 In French

Design characteristics of the Mirage 2000 air superiority fighter are discussed with attention to the boron- and carbon-composite materials used in its construction, and in comparison with the Mirage III and Mirage F-1 It is noted that the Mirage 2000 has a larger surface area than the other Mirages, comparable to that of the F-15, and that its aerodynamics permit good overall stability, especially at large angles of attack The construction and operation of the landing gear are also outlined, with reference to its resistance to stress Also dealt with is the history of the development of the SNECMA M53 engine, and avionics for navigation, weapons systems, and aerodynamic stability D M W

A78-31811 # **The effect of a parachute on the motion of an axisymmetric object dropped from an aircraft (Wplyw spadochronu na ruch zasobnika osiowo symetrycznego zrzucanego z samolotu)** J Maryniak, K Michalewicz, and Z Winczura (Warszawa, Politechnika, Wojskowa Akademia Techniczna, Warsaw, Poland) *Mechanika Teoretyczna i Stosowana,* vol 16, no 1, 1978, p 57-70 28 refs In Polish

The paper analyzes the dynamic characteristics of an air-dropped free-falling axisymmetric vehicle with drag chute and

accelerating rocket engine The vehicle is considered a rigid body with five degrees of freedom, its motion is described by a system of nonlinear differential equations, which are integrated numerically. Flight paths, changes in the angles of elevation, azimuth, attack and sideslip are calculated as well as changes in center of mass for different air-drop parameters Aerodynamic characteristics were obtained from wind tunnel tests B J

A78-31836 # **Some measurements in two-dimensional turbulent wakes** K W Everitt (Warwick, University, Coventry, England) *Aeronautical Quarterly*, vol 29, Feb 1978, p 28-32 7 refs

An investigation is made of the wakes behind four different two-dimensional bodies circular, square, aerofoil and reversed aerofoil cylinders The lasting influence of the upstream history of the flow development is particularly noted The production time scale is a significant fraction of the time scale for mean flow development, this fraction increases with downstream distance As the flow develops, the advection term in the equation for turbulent energy transfer increases S C S

A78-31838 # **On the calculation of the incompressible flow past an aerofoil with a jet flap** R O'Mahoney and F T Smith (Imperial College of Science and Technology, London, England) *Aeronautical Quarterly*, vol 29, Feb 1978, p 44-59 20 refs. Research supported by the Science Research Council

The incompressible planar flow past a wing with a jet issuing from the trailing edge is calculated by two separate methods, both adaptations of conformal mapping routines that are numerically exact in the jet-free case These are the well-known circle mapping method and the half-plane method The former is rendered inexact by the jump conditions across the jet and an approximation is necessary The half-plane method, however, remains exact in principle, and a range of results is presented The most accurate of the previous calculations is verified, and comparisons between the half-plane and circle methods are also made. The half-plane scheme seems well suited for such wake-controlled flows and has been extended to transonic conditions in a related study (Author)

A78-31868 **Sweden's latest- and last** J Thinesen *Airports International*, Feb-Mar 1978, p 8-11

A new airport Landvetter, for Gothenburg, Sweden, is described with reference to its design and capacity, both for passengers and for aircraft A passenger capacity of around 2 million per year (evenly divided between domestic and international) is available now, with growth to 3 million in 1985 and 6 million in 2000 foreseen The airport's runway and ATC system are able to handle all types of commercial passenger and freight aircraft currently in operation Attention is given to environmental considerations, both in the construction and siting of the airport and in the design of terminal facilities for passenger comfort It is noted that the Landvetter facility is constructed to be (become) large enough to serve the major population centers of western Sweden, but is located far enough from them to keep noise at an acceptable level D M W

A78-31869 **Ground radar - Vital tool or luxury** M Hirst *Airports International*, Feb-Mar 1978, p 24-26

The disaster at Tenerife has underscored the necessity for ground radar, at least during conditions of poor visibility from the tower With the advent of MLS, the amount of air traffic in bad weather is sure to increase Various ground radar systems are described in terms of cost, and effectiveness in providing the tower with the exact position of aircraft on the ground Since the systems which are currently available can be prohibitively expensive, surveillance for single runways has also been tested, i e , Corail at Paris/Orly An Integrated Terminal Surveillance System (ITSS) using SSR (secondary surveillance radar), under development in the United States, has the ability to cover an entire airport at reduced cost D M W

A78-31915 * # **Differential altimetry for satellite orbit determination** H Hagar, Jr and D H Boggs (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *American Astronautical Society and American Institute of Aeronautics and Astronautics, Astrodynamics Specialist Conference, Jackson Hole, Wyo , Sept 7-9, 1977, Paper* 31 p 8 refs Contract No NAS7-100

Differential altimetry is concerned with the employment of differenced satellite altimeter measurements at orbit ground trace intersections The employment of this procedure makes it possible to eliminate two of the major error sources found in direct altimetry Previous applications have not included the appropriate dynamic constraints required to account for correlations due to satellite orbit motion A description is given of an investigation in which these correlations are included The methodology produced is consistent with the dynamic environment The regional or local limitations of previous approaches are overcome by extending the technique to the global scale Attention is given to the description of the data type, the geometric topography height, altimeter errors, discretization errors, an approximate orbit determination problem, and a comparison of differenced altimeter measurements for retrograde and prograde orbits G R

A78-31942 # **Use of and experience with simulation in the development of the VFM 614 and the VAK 191 (Einsatz und Erfahrungen der Simulation bei der Entwicklung der VFW 614 und der VAK 191)** D Dey and K -H Unterreiner (Vereinigte Flugtechnische Werke-Fokker GmbH, Bremen, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper 77-083* 39 p 5 refs In German

In the present paper, such aspects of simulation as its organization, application, cost effectiveness, and the successes and achivements are discussed in an attempt to put simulation in proper perspective and thereby narrow the gap between the advocates of simulation and the corporate management that has to pay for it The topics discussed are illustrated by the results obtained with simulation in the development of aircraft V P

A78-31943 # **Simulation in the development of the training and ground-attack aircraft Alpha Jet (Simulation bei der Entwicklung des Schul- und Erdkampfflugzeugs Alpha Jet)** H Friedrich (Dornier GmbH, Friedrichshafen, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper* 32 p In German

The role of ground simulators in formulating the design criteria of the Alpha Jet is reviewed in terms of its unmanned and manned modes Tests conducted in the unmanned mode included evaluations of aerodynamic stability and response to emergency situations, i e , failure of major aircraft systems In the manned mode the tests concentrated on mission simulation, with emphasis on new handling concepts Finally, the cost effectiveness of the simulator tests is discussed D M W

A78-31944 # **The HFB 320 airborne simulator of DFVLR as test instrument for determining flight characteristics (Der Fliegende Simulator HFB 320 der DFVLR als Versuchsgerat zur Ermittlung von Flugeigenschaften)** D Hanke and H -H Lange (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugmechanik, Braunschweig, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper 77-082* 19 p 9 refs In German

The design principles and operation of the HFB 320 airborne flight simulator and its test systems are described The model sequence control concept and the control of the onboard computer are discussed Flight test results of the simulation of the B10 X aircraft are presented to demonstrate the simulation quality Results of studies of the influence of direct thrust control on an altitude maintenance problem as a function of the frequency of the short period oscillation are given P T H

A78-31945 # **Proposal and construction of a hybrid flight-sight simulator with large picture projection (Entwurf und Aufbau einer hybriden Flugsichtsimulationsanlage mit Grossbildprojektion)** B Hechler (Darmstadt, Technische Hochschule, Darmstadt, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper 77-087* 13 p In German

The design of a synthetically produced, computer driven visual simulation operating in real time is presented. A digital system is employed to transfer the geodetic coordinates onto the aircraft display system Attention is given to the development of a computer program designed to provide changing data profiles in the shortest possible time (an average of 4 ms for linear calculations) A video-beam television projector supplies the image, which is linked to the digital computer through a hybrid calculating unit D M W

A78-31946 # **Digital computer program maneuver pilot (Digitales Rechenprogramm Manoverpilot)** L Platzoder and H J Munser (Dornier GmbH, Friedrichshafen, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper* 23 p In German

A simulation of combat and flight situations for military aircraft requires in addition to the use of an aircraft simulation model also a consideration of the actions of the pilot The use of an actual pilot involves an introduction of subjective and random effects These effects have now been eliminated by developing a pilot model which can replace the actual pilot The pilot model can be employed in connection with simple control tasks, air-ground maneuvers, and air combat simulations In the case of composite maneuvers a decision model for maneuver selection is also needed An additional tactical model, which determines and changes the control parameters in response to the given current situation, is required for air combat simulation Attention is given to the design of the controller, the considered maneuvers, and the development of the tactical models G R

A78-31948 # **The Dual-Flight-Simulator on the evaluation of air combat effectiveness (Der Dual-Flug-Simulator zur Bewertung der Luftkampftauglichkeit)** P Sepp (Industrieanlagen-Betriebsgesellschaft mbH, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper 77-080* 19 p 5 refs In German

Design and operating characteristics of the DFS are described with attention to computer software The simulation of one-on-one dogfights is realized by analog and digital (HSI/SS-100 and CDC 6600, respectively) programs which control the projection of each aircraft's position with respect to the other, and in terms of its own built-in combat capability, i e , two different types of aircraft can be pitched against each other in simulated combat An Evaluation Program System is described, which is designed to take virtually all major simulation parameters into account in a 240 msec computer tape D M W

A78-31949 # **The Dual-Flight-Simulator as an aid for a government mission specialist (Der Dual-Flug-Simulator als Beurteilungshilfsmittel fur einen offentlichen Auftraggeber)** V Wenthe (Wehrtechnische Studienbeauftragte, Ottobrunn, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper 77-079* 16 p In German

Three basic questions must be answered about any new military aircraft (1) What are the performance parameters of the aircraft as a whole, (2) What are the performance parameters (effectiveness) of the weapons systems, and (3) How well can the pilot be integrated into the total scheme In addition, questions pertaining to specific types of combat, both air superiority and ground attack, must be dealt with, and all questions, especially from the standpoint of a government defense budget, must be considered in light of cost The Dual-Flight Simulator (DFS), in the service of the W German defense ministry since 1976, is evaluated in terms of its ability to answer these questions by simulating the functioning of aircraft on the ground The cost of the DFS has been found to be high (due primarily to its flexibility of program) However, the defense ministry is of the opinion that the cost of effective simulation is far cheaper than would be field tests of actual hardware D M W

A78-31950 # **New aspects in the movement simulation of the research flight simulator of DFVLR (Neue Aspekte bei der Bewegungs-Simulation am Forschungsflugsimulator der DFVLR)** F Erdmann (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugfuhrung, Braunschweig, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper 77-086* 17 p In German

To improve the simulation of movement in flight simulators, suggestions for redesign of both the hydraulic servosystem as well as the computer software, e g , wash-out algorithms, are presented Attention is given to the simulation of translational and rotational acceleration It is noted that long lasting acceleration can not be adequately simulated mechanically, and that movement simulation in general must be optimized to the type of aircraft being tested Standard linear wash-out systems are compared with the nonlinear system proposed D M W

A78-31951 # **Simulation tests of anti-flak profiles (Simulationsuntersuchungen zu Anti-Fla-Profilen)** A Neubecker (Industrieanlagen-Betriebsgesellschaft mbH, Munich, West Germany), H J Munser (Dornier GmbH, Friedrichshafen, West Germany), and P Klonk *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper* 26 p In German

The tight air defense capability of the Warsaw Pact necessitates the development of an effective penetration technique for ground-attack missions Of the various flight profiles available to advanced NATO aircraft, an optimization scheme is presented which takes the following factors into account appropriate amplitude and frequency relations for the approach to target, pilot stress during approach, the necessary recovery time for the pilot to orient himself to the ground-attack mode after approach, and the accuracy of the attack itself (including strafing) Methods of simulating a chosen flight profile are discussed with attention to cockpit display systems D M W

A78-31955 # **Catalytic flame stabilization for aircraft afterburners** T J Rosfjord and B Eresman (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio) *Combustion Institute, Fall Meeting, Stanford, Calif , Oct 17, 18, 1977, Paper* 10 p 10 refs

The paper examines the application of catalytic flame stabilization to aircraft afterburners A model was developed for the porous, catalytically-active flameholder in an effort to determine trade-offs between flameholder blockage and imposed pressure loss for various

honeycomb catalyst substrates A conventional J85 flameholder presents a 36% blockage and imposes a 3 2% pressure loss The model predicts that a similarly-sized honeycomb with length-diameter ratio of 40 would impose only a 2% loss A 45%-blockage honeycomb would impose a loss equivalent to the conventional solid body A study was also made of the potential gain in combustion efficiency versus the possible increased flameholder pressure loss P T H

A78-31972 * # **Terminal-area flight experience with the NASA Terminal Configured Vehicle** S A Morello and L H Person, Jr (NASA, Langley Research Center, Hampton, Va) *Flight Safety Foundation, Annual Corporate Aviation Safety Seminar, 23rd, Washington, D C , Apr 9-12, 1978, Paper* 20 p 6 refs.

Increases in the volume of air traffic around major terminals, as well as the advent of MLS and other sophisticated ATC techniques, have prompted the development of aircraft specifically optimized for flight in terminal areas A modified Boeing 737, developed by NASA, is presented as an illustration of a Terminal Configured Vehicle (TCV) Among the TCV systems discussed are the electronic attitude direction indicator (EADI) and the electronic horizontal situation indicator (EHSI), both of which are advanced display systems capable of positioning the runway center line from a variety of glide slope paths, and with reference to time, i e , the on-board computer can predict where the aircraft will be at a given number of seconds from the time of the analysis Thus, 4-D navigation (time path) can be selected as a control mode, together with vertical and horizontal path modes D M W

A78-32037 # **Dynamic stability of a two blade rotor (Stabilité dynamique d'un rotor bipale)** C T Tran (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aérospatiale,* Jan -Feb 1978, p 25-40 In French Research supported by the Centre d'Essais Aeronautiques de Toulouse

An analytical method is presented in which Lagrange equations are simplified to a system of ordinary differential equations with constant coefficients in an evaluation of the dynamic stability of a two blade rotor at high tip speeds with negligible aerodynamic disturbance Attention is given to the parameterization of the divergence velocity It is noted that the coupling of the degrees of freedom of the rotating arm and of the flexibility degrees of freedom of the stand may provoke divergence D M W

A78-32058 Psychological Assessment of Aircraft Noise Index. C Hayashi (National Institute of Statistical Mathematics, Tokyo, Japan), S Kondo (Hitachi, Ltd , Tokyo, Japan), and H Kodama (Japan Women's University, Tokyo, Japan) *Acoustical Society of America, Journal,* vol 63, Mar 1978, p 815-822 11 refs

The development and characteristics of the Psychological Assessment of Aircraft Noise Index are described The index is based on an unfavorableness ratio variable which evaluates measurements including maximum A-weighted noise level, duration of noise over 70 dB, and noise frequency spectra The method was tested at a location 40 km west of Tokyo having a high level of aircraft noise and a low level of background noise during the day Thirty subjects were assigned to locations including those in the vicinity of the airdrome and those under flight paths Their sensory ratings, a social survey, and other sets of psychological ratings were transformed into Guttman scores S C S

A78-32098 # **More about flight-path-angle transitions in optimal airplane climbs** J V Breakwell (Stanford University, Stanford, Calif) *Journal of Guidance and Control,* vol 1, May-June 1978, p 205-208

If the reciprocal of maximum L/D is treated as a small parameter (epsilon) in various optimal airplane climb problems, flight-path-angle transitions between vertical climbs or dives and 'singular' climb arcs are found to follow a particular universal pattern investigated previously in connection with minimum-time climbs with negligible mass loss The time scale of the transition is of the order of the square root of epsilon, and universal formulas are given for the loss in payoff during transition due to the induced drag, the loss being of the order of epsilon to the 3/2 power (Author)

A78-32118 Joint ASD/AFWAL Combined Environment Reliability Test /CERT/ Evaluation Program D L Earls (USAF, Flight Dynamics Laboratory, Wright Patterson AFB, Ohio) and P A McAdam (USAF, Aeronautical Systems Div , Wright-Patterson AFB, Ohio) In Environmental technology '77, Proceedings of the Twenty-third Annual Technical Meeting, Los Angeles, Calif , April 25-27, 1977 Mount Prospect, Ill , Institute of Environmental Sciences, 1977, p 203-206

The article discusses the U S Air Force Combined Environment Reliability Test (CERT) Evaluation Program which is aimed at surveying the technical merit of combined environment reliability testing, determining cost-effectiveness, and providing implementation planning The program is comprised of laboratory tests for avionics equipment in operational service Test chambers are used to simulate conditions such as random vibrations, humidity, temperature, altitude, and airflow The program is also applicable to avionics subsystems and various types of aircraft S C S

A78-32123 The error function of analytical structural design H B Chenoweth (Rockwell International Corp , El Segundo, Calif) In Environmental technology '77, Proceedings of the Twenty-third Annual Technical Meeting, Los Angeles, Calif , April 25-27, 1977 Mount Prospect, Ill , Institute of Environmental Sciences, 1977, p 231-234 10 refs

A statistical analysis of structural static test failure data for major components of aircraft is presented The data sample, based on the Lustig data is compared with the basic Jablecki-Chenoweth data The analysis results in the approximate determination of the specific statistical strength cumulative distribution as a function of rupture strength Finally, the required factor of safety is computed for the 'no static test' or analytical design case for the aforementioned components over a wide range of unreliabilities It is concluded that components require factors of safety for the no static or analytical design over three times above the usual standard and would be prohibitive if implemented (Author)

A78-32126 A test using simulated mission profile environments W D Everett (U S Navy, Pacific Missile Test Center, Point Mugu, Calif) In Environmental technology '77, Proceedings of the Twenty third Annual Technical Meeting, Los Angeles, Calif , April 25-27, 1977 Mount Prospect, Ill , Institute of Environmental Sciences, 1977, p 264-267

A Manufacturer's Run-In (MRI) test has been used for improving the reliability of the Air-borne Instrumentation Subsystem (AIS) pod The environmental stresses applied in this test were those of a representative flight mission profile and were induced in the pod by the thermo-acoustic facility at the Pacific Missile Test Center (PACMISTESTCEN) The test yielded realistic results in terms of the types and rate of failures that occurred in the pods (Author)

A78-32127 Unique test capabilities of the Eglin AFB McKinley Climatic Laboratory W Drake (USAF, Climatic Laboratory, Eglin AFB, Fla) In Environmental technology '77, Proceedings of the Twenty-third Annual Technical Meeting, Los Angeles, Calif , April 25-27, 1977 Mount Prospect, Ill , Institute of Environmental Sciences, 1977, p 268-273

The 3 28 million cubic foot Main Chamber of the Climatic Laboratory is unique in that it is the largest and most complex climatic environmental test chamber in the world It employs an air makeup system to cool or heat air to the test temperatures and ingest this air into the chamber to allow the operation of jet engines during climatic tests Other test chambers discussed are the 97,000 cubic foot Engine and Equipment Test Cell and the 75,000 cubic foot Sun, Wind, Rain, and Dust Facility (Author)

A78-32129 **An engine nozzle vibration phenomenon encountered in B-1 flight tests.** S K Dobbs, J R Stevenson (Rockwell International Corp., El Segundo, Calif.), and C L Arulf (General Electric Co., Aircraft Engine Group, Cincinnati, Ohio) In Environmental technology '77, Proceedings of the Twenty-third Annual Technical Meeting, Los Angeles, Calif., April 25-27, 1977 Mount Prospect, Ill., Institute of Environmental Sciences, 1977, p 318-323

An engine nozzle vibratory instability encountered in B-1 flight tests is described Measured engine and engine nozzle ground and flight vibration data were utilized to develop a theory that both explains the phenomenon and discloses a stable nozzle configuration Flight and engine test cell data are presented demonstrating the validity of the theory (Author)

A78-32134 **Practical experience in vibration testing external avionics systems** H Caruso (Westinghouse Electric Corp., Aerospace and Electronic Systems Div., Baltimore, Md.) In Environmental technology '77, Proceedings of the Twenty-third Annual Technical Meeting, Los Angeles, Calif., April 25-27, 1977 Mount Prospect, Ill., Institute of Environmental Sciences, 1977, p 362-364

Two techniques for the vibration testing of large, externally-mounted avionics systems are discussed The test specimen is a 10-inch by 12 foot pod weighing 425 pounds In the first method the setup employs two electrodynamic exciters for applying different random vibration profiles at the same time In the second setup a single electrodynamic exciter is used to apply random vibration at the pod's center of gravity It is suggested that combining the approaches yields an optimal technique The basic requirements are (1) acquiring representative in-flight structural response data, (2) comparing laboratory and flight responses and establishing accelerometer locations, (3) developing a preliminary input vibration spectrum, and (4) refining the spectrum to yield structural responses which correspond to in-flight measured responses S C S

A78-32176 # **Dynamic response of lift fans subject to varying backpressure** J M Durkin (U S Naval Material Command, David W Taylor Naval Ship Research and Development Center, Bethesda, Md.) and L H Luehr (Aerojet Liquid Rocket Co., Sacramento, Calif.) *American Institute of Aeronautics and Astronautics and Society of Naval Architects and Marine Engineers, Advanced Marine Vehicles Conference, San Diego, Calif., Apr 17-19, 1978, AIAA Paper 78-756* 12 p Navy-supported research

An analytical investigation of the dynamic performance of a centrifugal lift fan was conducted to provide an explanation for the behavior which occurred when the fan was subjected to a varying backpressure Analysis of test data shows that the fan response can be represented by a first order lag system An in-depth analysis of the various elements of the lift fan system revealed that the inertia of the air within the fan was the primary contributor to the observed fan behavior The analysis further showed that variations in fan speed would not produce the behavior measured in the test and that the response due to the compliant properties of air within the fan occurs at a frequency that is much higher than the frequency range of the test A time-domain digital computer program has been developed which integrates the rate of change of fan flow with a varying backpressure Good correlation is exhibited between test data and the computer predictions at all frequencies (Author)

A78-32222 **Air quality impact of aircraft at ten U S Air Force bases** D F Naugle, B C Grems, and P S Daley (USAF, Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.) *Air Pollution Control Association, Journal,* vol 28, Apr 1978, p 370-373 7 refs

The Air Quality Assessment Model (AQAM) was used in a study of the impact of aircraft emissions at 10 Air Force bases, and it was found that the annual aircraft emissions contributed an average of less than 1% to the regional emissions The EPA developed Pollutant Standards Index (PSI) was used to relate air quality predictions to levels of health effects Aircraft contributions to the yearly maximums at 5 km from the air bases were 2% or less of the PSI levels designated for initial health effects for carbon monoxide, particulate matter, and sulfur dioxide, but the nitrogen dioxide levels were 5% The importance of reducing hydrocarbon emission is indicated M L

A78-32257 # **Basic problem of control of the motion of a non-Newtonian fluid in a gap (Osnovnaia zadacha upravleniia dvizheniem ne-N'iutonovskoi zhidkosti v zazore)** V I Elizarov *Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 39-45 In Russian

The paper considers the problem of controlling the motion of a non-Newtonian fluid (including such aircraft structural materials as plastics, rubber and heat-insulating materials) in the gap between rotating cylinders The controls are parameters of a process in which are satisfied inequality constraints on values of functionals characterizing the pressure of flattening produced by the cylindrical rollers and the deviation of temperature in the gap from a specified temperature A minimax approach is taken to the problem of determining controls B J

A78-32258 # **The problem of choosing design parameters for unpiloted flight-vehicles (K zadache vybora proektnykh parametrov bespilotnykh letatel'nykh apparatov)** N G Zaripov and T K Sirazetdinov *Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 46 52 6 refs In Russian

The paper considers the analytical design of a hypothetical unpiloted flight-vehicle, the problem is posed in terms of a system of ordinary differential equations with inequality constraints on the phase coordinates and controlling parameters The controlling parameters examined are initial thrust conditions, initial load on the vehicle and the operational time of the engine B J

A78-32262 # **Analytical design of an automaton for the longitudinal control of an aircraft (Ob analiticheskom proektirovanii avtomata prodol'nogo upravleniia samoletom)** T K Sirazetdinov and V K Ivanov *Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 73-79 In Russian

The paper considers the analytical design of a system for the automatic control of the longitudinal motion of an aircraft that has feedback with respect to angular velocity of pitch and normal acceleration loading The analysis is based on examination of specific technical constraints on the short-period longitudinal motion of the aircraft An algorithm for realizing the design of the control system is presented B J

A78-32264 # **Theory of bending-torsional self-oscillations of an aircraft wing system (K teorii izgibno-krutil'nykh avtokolebanii v sisteme kryla samoleta)** V I Safronov *Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 87-91 8 refs In Russian

Safronov's analytical imitation method (1972) is used to investigate the bending-torsional self oscillations of a wing system that has at least two degrees of freedom It is shown that wing-flutter self-oscillations may undergo synphase self-synchronization B J

A78-32267 # **Quality assurance in the fabrication of products in aviation technology (K obespecheniiu kachestva izgotovleniia izdelii aviatsionnoi tekhniki)** A S Shevelev *Aviatsionnaia Tekhnika,* vol 20, no 4, 1977, p 103-108 In Russian

The paper investigates the problem of establishing relationships between geometrical and physicomechanical functional parameters and technical factors during the machining of aircraft parts by means of allowance-removal from surfaces The allowance is considered under two aspects as a determinate design-variable and as a random variable This allows refinement of structural formulas for the allowances as well as calculation of operational dimensions Consideration is given to the effect of nonuniformity of the allowance on part quality B J

A78-32268 # **Automatic sustainment of resonance conditions in the multipoint excitation of flight-vehicle vibrations (Avtomaticheskoe podderzhivanie uslovii rezonansa pri mnogotochechnom vozbuzhdenii kolebanii letatel'nykh apparatov)** E A Zharov and V I Smyslov *Aviatsionnaia Tekhnika*, vol 20, no 4, 1977, p 111-114 7 refs In Russian

Resonance tests involving multipoint excitation of flight vehicles are performed to measure the frequencies, natural modes, and damping coefficients required in dynamic-strength and aeroelasticity computations A specific feature of such tests is the sustainment of resonance conditions In the present paper, a system which will automatically sustain the resonance conditions is described, and the characteristics of the system's elements are examined Some test results obtained with the system are reviewed V P

A78-32269 # **Optimization of the design parameters of finned pilotless flight vehicles (Ob optimizatsii proektnykh parametrov operennykh bespilotnykh letatel'nykh apparatov)** N G Zaripov *Aviatsionnaia Tekhnika*, vol 20, no 4, 1977, p 115-118 5 refs In Russian

The paper deals with the problem of optimizing the parameters of finned rockets during the preliminary design phase, when the dimensions of the airframe and the power characteristics of the propulsion system have not been definitively established The problem of minimizing the relative fuel mass is solved using a minimax approach The limiting values of the control parameters are determined for specific conditions at the end of the trajectory, which are given in the form of inequalities V P

A78-32270 # **Optimization of linear stabilization systems of flight vehicles on the basis of orthogonal filters (K optimizatsii lineinykh sistem stabilizatsii letatel'nykh apparatov na osnove optogonal'nykh fil'trov)** A I Kaverin *Aviatsionnaia Tekhnika*, vol 20, no 4, 1977, p 118-122 6 refs In Russian

Optimization of rocket stabilization systems involves difficulties associated with satisfying the stability conditions for an optimal system (factorization and separation of spectral characteristics and transfer functions) and with the actual implementation of optimal filters The problem is further aggravated when several disturbances are applied to the system In the present paper, it is shown that these difficulties can be surmounted by approximating the required optimal characteristics of the filter by known orthogonal functions with unknown coefficients, and determining the coefficients from the condition of least rms error The rms error is minimized on a digital computer Numerical calculations are carried out for a system with a fourth-order filter, minimizing the rms error with respect to six parameters V P

A78-32272 # **Optimal control of the longitudinal motion of a helicopter on the basis of an operational algorithm (Optimal'noe upravlenie prodol'nym dvizheniem vertoleta na osnove operatsionnogo algorithma)** B F Mishnev *Aviatsionnaia Tekhnika*, vol 20, no 4, 1977, p 128-131 In Russian

For a helicopter, automatic pitch control during landing approach is associated with difficulties arising due to considerable changes in the helicopter's aerodynamic performance during this maneuver Linear description of flight dynamics during landing approach does not provide a satisfactory agreement between the model and the actual process In view of this, an attempt is made to develop an automatic pitch control system on the basis of a sufficiently complete nonlinear description of helicopter dynamics An operational algorithm for solving the synthesis problem for an optimal automatic pitch control system is proposed, and its adaptation of an onboard digital computer is examined The transient response of the synthesized system is analyzed V P

A78-32273 # **Aircraft takeoff from dirt airstrips (O vzlete samoletov s gruntovykh aerodromov)** V I Pentiukhov *Aviatsionnaia Tekhnika*, vol 20, no 4, 1977, p 131-136 In Russian

The motion of an aircraft rolling on toroidal wheels along soft plastic ground is analyzed An expression for calculating the depth of penetration of the wheels, the resistance to rolling, and the take-off distance as a function of the state of the ground and the load acting on the wheels is derived within the framework of Babkov et al (1959) theory of the motion of wheeled vehicles along unpaved ground V P

A78-32275 # **Optimization of the structure of a multibulkhead large-aspect-ratio wing (Optimizatsiia konstruktsii mnogostenochnogo kryla bol'shogo udlineniia)** A P Timofeev *Aviatsionnaia Tekhnika*, vol 20, no 4, 1977, p 139-142 In Russian

A method of minimum-weight design is proposed for the system of bulkheads in a large-aspect-ratio monocoque wing The optimal law for varying the thickness of the upper and lower panels is formulated The strength of the structure is analyzed within the framework of beam theory Stresses in structural members operating in the plastic range are calculated, along with the permissible stresses in compressed elements A formal-search algorithm for solving the optimization problem is proposed V P

A78-32296 # **Lifting force of a plane H-polarized electromagnetic wave (Pod'emnaia sila ploskoi H-poliarizovannoi elektromagnitnoi volny)** A I Nosich and V P Shestopalov (Khar'kovskii Gosudarstvennyi Universitet, Kharkov, Ukrainian SSR) *Pis'ma v Zhurnal Tekhnicheskoi Fiziki*, vol 4, Jan 26, 1978, p 114 117 In Russian

An incident electromagnetic wave generates in the body a mechanical force which acts in the direction of propagation of the incident wave It appears that for certain combinations of the body's configuration, the wavelength and the polarization of the incident plane wave, a lifting force is generated which acts perpendicularly to the propagating incident wave, and whose absolute value is drastically increased by the specific high frequency resonance of the (scattering) body In the present paper, the lifting force is calculated which acts on an ideally conducting circular cylinder with a longitudinal slit, situated in the field of a plane H-polarized wave V P

A78-32308 **On the possibility of classifying radar targets with a coherently measured echo signal (Über eine Klassifizierungsmoglichkeit von Radarzielen mittels koharent gemessener Echosignale).** K von Schlachta Berlin, Technische Universitat, Fachbereich Elektrotechnik, Dr -Ing Dissertation, 1977 96 p 38 refs In German

A Neyman-Pearson test is used to classify radar targets by typical signal fluctuation differences with different surveillance radars Numerical calculations and stored radar signals were employed to evaluate the test results The radar signatures of aircraft (both jet and propeller) were described by optimal test functions calculated from standard probability functions Attention is given to a binary fluctuation test, which was able to provide the correct classification of aircraft and bird echoes D M W

A78-32327 # **An intermittent high Reynolds number wind tunnel** J L Stollery (Cranfield Institute of Technology, Cranfield, Beds , England) and A V Murthy (National Aeronautical Laboratory, Bangalore, India) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers

New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 1-5 (AIAA 78-766)

The paper suggests a simple method of generating intermittent reservoir conditions for an intermittent, cryogenic wind tunnel This can be done by operating some existing types of short-duration tunnels 'in reverse' Two examples are considered (1) a modification of the Ludwieg Tube, and (2) the Isentropic Light Piston Tunnel The sizes of tunnels required to meet the European and American specifications for a high Reynolds number tunnel with a 10 second running time are given together with proposals for a more modest National or University facility with a one second test time (Author)

A78-32328 # **The induction driven tunnel T2 at ONERA-CERT - Flow qualities, testing techniques and examples of results** R Michel, A Mignosi, and C Quemard (ONERA, Centre d'Etudes et de Recherches de Toulouse, Toulouse, France) In Aerodynamic Testing Conference, 10th, San Diego, Calif, April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 6-13 (AIAA 78-767)

A new transonic facility, conceived as a pilot unit by ONERA for the large European High Reynolds Number Tunnel project, is operating since 1975 at the ONERA Research Center in Toulouse After a brief recall of the main characteristics of this wind tunnel T2, a description is given of the testing techniques which have been developed for studies of flows around models Two examples of applications are concerned with the definition of viscous and non viscous flows over an aerofoil and over a tapered swept wing model Pressure measurements, wall flow visualizations, probing of boundary layers and wakes, bring detailed elements for controlling calculation methods involving a coupling between viscous and potential flows (Author)

A78-32329 * # **A critical examination of expansion tunnel performance** C G Miller (NASA, Langley Research Center, Space Systems Div, Hampton, Va) In Aerodynamic Testing Conference, 10th, San Diego, Calif, April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 14-29 20 refs (AIAA 78 768)

An experimental study of the performance of the expansion tunnel for various test gases and range of quiescent acceleration section and nozzle pressure, nozzle geometric area ratio, and nozzle axial station has been performed Flow diagnostics used to examine expansion tunnel flow characteristics were time histories and profiles of pitot pressure and axial component of flow velocity The purpose of this study was to determine experimentally what limitations might restrict predicted operational flexibility and the advantages and disadvantages of this mode of operation as compared to the expansion tube Results are presented which demonstrate the expansion tunnel offers several advantages over the expansion tube, but the severity of the disadvantages of the tunnel makes the expansion tube mode of operation the more desirable for performing hypersonic-hypervelocity aerothermodynamic studies of proposed entry configurations (Author)

A78-32330 * # **The shock tube as a device for testing transonic airfoils at high Reynolds numbers** W J Cook (Iowa State University of Science and Technology, Ames, Iowa), L L Presley, and G T Chapman (NASA, Ames Research Center, Aerodynamics Research Branch, Moffett Field, Calif) In Aerodynamic Testing Conference, 10th, San Diego, Calif, April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 30-39 16 refs Grant No NsG-2152 (AIAA 78-769)

A performance analysis of gas-driven shock tubes shows that transonic airfoil flows with chord Reynolds numbers in the range of 100 million can be generated behind the primary shock in a large shock tube A study of flow over simple airfoils has been carried out at low and intermediate Reynolds numbers to assess the testing technique Results obtained from schlieren photos and airfoil pressure measurements show that steady transonic flows similar to those observed for the airfoils in wind tunnels can be generated within the available testing time in a shock tube with either properly-contoured test section walls or a properly-designed slotted-wall test section The study indicates that the shock tube is a useful facility for studying two-dimensional high Reynolds number transonic airfoil flows (Author)

A78-32331 * # **Status and operational characteristics of the National Transonic Facility** O W Nicks and L W McKinney (NASA, Langley Research Center, Hampton, Va) In Aerodynamic Testing Conference, 10th, San Diego, Calif, April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 40-42 (AIAA 78-770)

The article discusses the development and capabilities of the National Transonic Facility which is planned for operation in 1981 The fan-drive, cryogenic-pressurized, closed-return facility will have operating parameters of 0 1-1 2 Mach, 1-9 bars pressure, 78-340 K, 150 dB sound pressure, and plus or minus 0 001 rms turbulence intensity These operating conditions have been selected on the basis of several current and future aircraft and space transportation systems The facility will provide full-scale testing conditions for calculating subsonic drag, airloads, and stability and control information Data for pre-test conditions, on-line information, and post-test analysis will be computer-processed S C S

A78-32332 * # **Design and subscale tests of a diffuser system for a Mach 4 scramjet test facility** E H Andrews, Jr (NASA, Langley Research Center, High-Speed Aerodynamics Div, Hampton, Va) In Aerodynamic Testing Conference, 10th, San Diego, Calif, April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 43-47 9 refs (AIAA 78-771)

A fixed-geometry diffuser system was designed for use in Mach 4 free-jet tests of a hydrogen-burning modular scramjet engine The scramjet engine has a rectangular cross section that blocks up to 33 percent of the existing tunnel nozzle exit area and swept leading edges of the scramjet produce an asymmetric downward flow that sharply increases when the scramjet inlet unstarts Effects of these conditions on the operation of the diffuser system are not accurately predictable An experimental investigation has therefore been conducted in unheated air using a subscale model of the tunnel-scramjet-diffuser system to substantiate the design Test results showed that the preliminary design had to be modified to obtain an acceptable configuration of the nozzle exit, test cabin, and diffuser that would provide shock-free flow at the scramjet inlet for simulated Mach 4 flight at altitudes from 16,764 to 20,422 meters (Author)

A78-32333 # **Supersonic aerothermal testing - A new requirement** L L Trimmer and R K Matthews (ARO, Inc, Arnold Air Force Station, Tenn) In Aerodynamic Testing Conference, 10th, San Diego, Calif, April 19 21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 48-50 (AIAA 78 773)

Aerothermal testing refers to the combination of aerodynamic and thermodynamic effects on flight hardware Various available aerothermal test techniques are compared, including flight testing, track tests, radiant heating tests, wind tunnel wedge techniques, conventional wind tunnels, and high enthalpy facilities Salient features for an aerothermal test facility are identified as long or continuous test times, duplicated flight conditions, the ability to accommodate full-scale flight hardware, high quality aerodynamic flow, extensive instrumentation, rapid test and data turnaround, and cost-effectiveness Optimal nozzle parameters for providing a wide range of testing capabilities are proposed Mach number 4 0, test section diameter 60 cm, and altitude duplication of 16,500-30,000 m S C S

A78-32334 # **The AEDC Range K facility for erosion testing** C J Welsh, J R Blanks, and C P Enis (ARO, Inc, Arnold Air Force Station, Tenn) In Aerodynamic Testing Conference, 10th, San Diego, Calif, April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 51-57 (AIAA 78-775)

The AEDC Hyperballistic Range K facility, which was initially designed as an aerodynamic range, has been equipped with a model track guidance system This track system restricts a gun-launched test article to a straight-line trajectory through different types of controlled erosive test environments, followed by an intact recovery

of the model The straight-line model trajectory decreases appreciably the problems of providing erosive fields and the required quality of model photography associated with erosion testing The capability of model recovery is particularly significant in that post-flight model inspection and measurements are permitted A description of the facility hardware and instrumentation is given along with a discussion of the types of erosion testing for which the facility could be quite useful (Author)

A78-32340 # **Wind tunnel model and measuring techniques for the investigation of three-dimensional turbulent boundary layers** H -P Kreplin, H. U Meier, and A Maier (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Stromungsmechanik, Gottingen, West Germany) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 93-97 9 refs (AIAA 78-781)

A wind tunnel model and improved measuring techniques for the investigation of three-dimensional laminar and turbulent boundary layers are described The tests will be carried out on an ellipsoid model in the 3 m x 3 m Low Speed Wind Tunnel of the DFVLR-AVA Informations about hot wire and surface hot film probes for measuring the mean and fluctuating components of the velocity as well as the magnitude and direction of the wall shear stress are given To ensure that stationary boundary layers can be studied, the dynamic response of the model in the wind tunnel is measured by means of accelerometers (Author)

A78-32342 # **A constant aerodynamic parameter testing technique with automatic wind tunnel control** R L Palko and A D Lohr (ARO, Inc , Arnold Air Force Station, Tenn) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 105-115 (AIAA 78-784)

A constant aerodynamic parameter testing technique with automatic wind tunnel control has been developed in the Propulsion Wind Tunnel Facility at the Arnold Engineering and Development Center The technique was developed in the 1-ft transonic Aero dynamic Wind Tunnel (PWT-1T) to verify the feasibility of closed loop testing at constant aerodynamic parameters in the 4-ft transonic Aerodynamic and the 16-ft transonic Propulsion Wind Tunnels The feasibility of setting constant lift coefficients and constant buffet intensities with variable Mach number was demonstrated over a Mach number range from 0 4 to 1 1 The verification required development of an automatic pitch and Mach number control in PWT-1T Description of the constant parameter technique, automatic Mach number control system, control algorithm, and the wind tunnel verification of the closed-loop system operation are presented (Author)

A78-32343 # **A computer-controlled video instrumentation technique for wind tunnel testing of full-scale lifting parachutes** R H Croll and C W Peterson (Sandia Laboratories, Albuquerque, N Mex) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 116-122 Research supported by the U S Department of Energy (AIAA 78-785)

A computerized video instrumentation method is developed for yielding time-resolved information on the relative motion between a lifting parachute and forebody located in a wind tunnel The instrumentation consists of a small television camera used to track the positions of battery-powered lights located inside the parachute canopy The positions of the lights are processed by an on-line minicomputer and transformed into yaw, pitch and roll angles Data are obtained at a rate of 30 times per second and stored in a disk memory along with values of the axial force and rolling movement exerted on the forebody by the parachute S C S

A78-32344 # **Semispan wind tunnel test of a computer-controlled self-optimizing flexible technology wing** E S Levinsky (General Dynamics Corp , Convair Div , San Diego, Calif) and R L Palko (ARO, Inc , Arnold Air Force Station, Tenn) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 123-135 5 refs Research supported by the U S Air Force and ARO, Inc , Contract No N00014 76-C-0742 (AIAA 78-786)

A closed loop, computer-controlled interactive testing technique has been demonstrated in the 16-foot Transonic Propulsion Wind Tunnel at the Arnold Engineering Development Center using a Self-Optimizing Flexible Technology (SOFT) wing semispan model that adapts its shape conformally to maximize or minimize various merit functions (e g , minimum drag) subject to both equality and inequality constraints (e g , fixed lift, maximum twist, etc) The model, which employs twelve independent hydraulic actuator systems to vary airfoil shape at two spanwise stations, was used for both conventional and optimization testing Although six of seven optimization problems attempted were convergent, further improvement in reliability and skin smoothness is required Photogrammetric techniques were used to measure wing shape under airload (Author)

A78-32345 # **Experiments on supercritical flows in a self-correcting wind tunnel** R J Vidal and J C Erickson, Jr (Calspan Corp , Buffalo, N Y) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 136-141 8 refs Contracts No N00014-72-C-0102, No N00014-77 C 0052, No F40600 76-C-0011

The Calspan Self-Correcting Wind Tunnel is a two-dimensional facility in which the flow field in the vicinity of the walls is actively controlled, and a theoretical evaluation is used in conjunction with flow-field measurements to confirm that wall interference has been minimized The facility is described and the results of experiments with a 6% blockage model are presented to show that iterative application of wall control effectively eliminates the interference Experiments were performed at conditions where the flow at the walls was supercritical, and a new operating procedure is described for these conditions A method is reported for designing self-correcting test sections This method is based upon a detailed analysis of the flow in the auxiliary suction system and test section The results of the analysis illustrate the tradeoffs available in design studies and in sizing models (Author)

A78-32346 # **The Boeing Aerodynamic Labs data system** W F Hoffmann (Boeing Commercial Airplane Co , Seattle, Wash) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 142-144 (AIAA 78-789)

An advanced data system is in development for the Boeing Aerodynamic Labs Functional modules support tasks of wind tunnel testing, providing on-line interactive control of a test (man-in-the-loop), acquisition of raw test data, processing of the raw data to fully corrected standard forms, and analyzing of the data using a wind tunnel oriented data analysis language for test time decisions and fast reporting Graphical data are provided by high quality graphics scopes, hardcopies, by electrostatic plotters The system, operational in 1979, will support the transonic tunnel and multiple test sites through two data systems having a total of 300 data channels (Author)

A78-32356 # **A technique for vorticity measurement in unsteady flow** J E Keesee, M S Francis, and J D Lang (USAF, Frank J Seiler Research Laboratory, Colorado Springs, Colo) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 239-248 8 refs USAF sponsored research (AIAA 78-801)

A technique is described for determining spatial vorticity distributions in non-stationary fluid flows exhibiting a periodic, time varying mean velocity field The method requires the integration of velocity field data about a spatial array of closed contours to infer the distribution of vorticity using the generalized definition of circulation A digital data acquisition scheme is suggested for the handling and processing of large quantities of data encountered in typical applications The method was used to determine the flow characteristics in portions of an unsteady separated region generated by an oscillating spoiler on an airfoil surface Several data display alternatives are discussed (Author)

A78-32357 # **Further experimental evaluation of the electrostatic roll sensor at Mach 2 3 and 3 5** R E Lee, B Kann, and J Knott (U S Naval Surface Weapons Center, Silver Spring, Md) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19 21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 249-252 NAVAIR Task AD3W-350D/004B, NAVSEA Task SF32-399-592, NAVSEA Task SF32-302-41B (AIAA 78-802)

The electrostatic sensor is a radioactive alpha particle emitter which ionizes the immediate air environment In the atmosphere the ionization produces a current which can be related to the orientation of the sensor and the earth's electrostatic field direction The current is also affected by the air flow about the sensor This paper describes the results of further supersonic wind-tunnel experiments to optimize the sensor cavity depth, to determine the effectiveness of high speed flow shielding, to determine the influence of free stream Mach number and to evaluate a digital automatic gain control circuit for processing the sensor output signal for roll orientation determination (Author)

A78-32359 * # **A parametric experimental study of the interference effects and the boundary-condition coefficient of slotted wind-tunnel walls** J L Everhart and R W Barnwell (NASA, Langley Research Center, Hampton, Va) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 258-264 10 refs (AIAA 78-805)

An experimental study of slotted upper and lower walls in a two-dimensional transonic wind tunnel with solid sidewalls is reported Results are presented for several slot spacings and slot openness ratios The experimental data are pressure measurements which were made on an airfoil model and on a sidewall near one of the slotted walls The slotted-wall boundary-condition coefficient, which relates the pressure and streamline curvature near the wall, is determined from the wall pressure measurements The measured wall-induced interference is correlated with the experimental values for the boundary-condition coefficient This correlation is compared with theory (Author)

A78-32360 # **An empirical correction for wind tunnel wall blockage in two-dimensional transonic flow** J A Blackwell, Jr (Lockheed-Georgia Co , Marietta, Ga) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 265-275 12 refs (AIAA 78-806)

An empirical method for correcting two-dimensional transonic flow results for wind tunnel wall blockage effects has been developed The empirical method utilizes velocity calculations based on linear theory with free-air boundaries evaluated at vertical positions representative of the wind tunnel walls and experimental velocity data obtained near the tunnel walls above and below the model Derivation of the empirical method is presented in detail Experimental results on 10% and 20% thick supercritical airfoils obtained at transonic speeds and over a wide range of wind tunnel wall porosities are used to establish the validity of the empirical correction (Author)

A78-32363 # **Model support system interference on zero-lift drag at transonic speeds.** M S Swamy, S Ahmed, and G S Sreenath (National Aeronautical Laboratory, Bangalore, India) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 293-296 (AIAA 78-809)

In this paper the support system interference on the zero-lift drag of an axisymmetric and an aircraft type models is discussed Two different techniques were adopted for the two models tested to evaluate the support sting interference It is found from these tests that the presence of a rear sting support would result in a reduction in the zero-lift drag of as much as 20 to 50 percent of the true value This apparent reduction in drag is found to be a strong function of the free stream Mach number close to unity Detailed pressure measurements over the aft-body of the axisymmetric model suggests that due to the positive pressure field imposed by the sting over the boat-tail region of the model the free stream Mach number at which the shocks appear in the boat-tail region will be higher when the sting is present than that without it This will result in an increased drag divergence Mach number for the model in the presence of the sting It is argued that because of this reason the sting effect on zero-lift drag strongly depends on the Mach number close to unity (Author)

A78-32364 # **Determination of high attitude wall corrections in a low speed wind tunnel** F W Peitzman (Northrop Corp , Hawthorne, Calif) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 297-300 (AIAA 78-810)

An investigation was conducted to determine the validity of wall corrections currently in use at high angles of attack, and develop improved corrections when necessary Literature survey and theory study did not yield a method considered acceptable for use An experimental investigation was performed using models of identical configuration but different scale This investigation revealed that the conventional low attitude wall corrections are adequate at low attitudes (under alpha = 40 deg), and the continuity equation using model planform area provides good correlation at alpha = 90 deg Between 40 deg and 90 deg, correction techniques were developed to provide correlation between the two models (Author)

A78-32365 * # **Condensation and its growth down the test-section of the Langley 0 3-m transonic cryogenic tunnel** R M Hall (NASA, Langley Research Center, Subsonic-Transonic Aerodynamics Div , Hampton, Va) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 301-304 6 refs (AIAA 78-811)

Four total pressure probes were used to measure the growth of condensation down the test section of the Langley 0 3-m tunnel, and the condensation data were employed to verify a mathematical model which assumes condensation results from heterogeneous nucleation on preexisting seed particles The onset of effects occurs throughout the test section at the same total temperature but the magnitude of the effects increases with increasing length down the test section Condensation is important because it determines the minimum operating temperature of transonic cryogenic wind tunnels M L

A78-32366 # **Applications of wind tunnels to investigations of wind-engineering problems** J E Cermak (Colorado State University, Fort Collins, Colo) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 305-320 63 refs NSF Grant No ENG-76-03135 (AIAA 78-812)

Physical modeling of the atmospheric boundary layer has been

made possible by design and construction of special low-speed wind tunnels This development enables natural winds at a particular site to be simulated for a wide range of meteorological conditions Through measurements on small-scale models and use of appropriate similarity criteria the simulated natural winds can be used to obtain a wide variety of wind-effect data for planning and design purposes Techniques for determination of mean wind forces, fluctuating pressures on exterior surfaces and dynamic response of structures are described Applications to determination of air-pollutant concentrations near power-plant sites and methane concentrations resulting from LNG spills, to location of snow-drifts and to measurement of wind characteristics for improvement of pedestrian comfort, and for evaluation of flight safety during landing and takeoff are also discussed and illustrated by specific examples (Author)

A78-32367 # **An experimental facility for wind engineering research** P M Sforza, W Stasi, and L Gotkin (New York, Polytechnic Institute, Farmingdale, N Y) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 321-329 12 refs Contract No E(49-18)-2358 (AIAA 78-813)

Experimental research in wind engineering must rely on testing in a controlled laboratory environment as well as field testing in the uncontrolled natural wind A facility for such research, developed in the Aerodynamics Laboratories of the Polytechnic Institute of New York, is described This facility includes both a field test station and a laboratory test station for atmospheric boundary layer research The utilization of this complex is discussed in terms of an ongoing project on wind energy conversion to illustrate the various capabilities that have been developed Applications of this facility to other problems in wind engineering are also described (Author)

A78-32368 * # **Moving ground simulation by tangential blowing** J E Hackett and R A Boles (Lockheed-Georgia Co , Marietta, Ga) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 330-335 5 refs Contracts No NAS2-6690, No NAS2-8745, No NAS2-9155 (AIAA 78-814)

Belt-type moving ground equipment, used for ground-effect simulation in STOL and VTOL tests, can be inconvenient and costly, especially in larger tunnels In most cases such difficulties may be avoided by employing tangential blowing at the ground surface, from a single slot The paper reviews several powered model tests using both moving ground and tangential blowing and describes the slot configuration, and the test techniques which were developed Ground skin friction is monitored to set blowing levels and no model-dependent calculations are needed It is also shown that application to center-tunnel testing can delay tunnel flow breakdown very considerably (Author)

A78-32371 * # **A new technique for reducing test section noise in supersonic wind tunnels** J B Anders, P C Stainback, and I E Beckwith (NASA, Langley Research Center, High-Speed Aerodynamics Div , Hampton, Va) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 354-364 25 refs (AIAA 78-817)

A new technique is presented for obtaining a low-noise test environment in a high-speed wind tunnel This technique utilizes the fact that the primary noise source for high supersonic/hypersonic wind tunnels is radiated noise from the turbulent, tunnel-wall boundary layer Because of the high directionality of sound in supersonic flows this test section noise originates far upstream on the walls of the nozzle at the 'acoustic origin' It is shown that tailoring the nozzle contour to reduce the acoustic origin Mach number significantly reduces the noise level in the upstream half of the nozzle test rhombus Experimental noise measurements are presented from a conventional, Mach 5 nozzle and are compared with measurements from a rapid-expansion, Mach 5 nozzle (Author)

A78-32372 # **The use of fluidized beds for heating air for wind tunnels** V Zakkay, G Miller (New York University, Westbury, N Y), and S Panunzio In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 365-375 Contract No EF-76-C-01-2256 (AIAA 78-818)

A method is presented herein whereby air passing through heat exchanger tubes is heated by the particles of a fluidized bed This scheme, which has been used successfully in the coal industry for generating steam in boilers, could be modified and adopted for the purpose of generating high temperature air for driving wind tunnels Fluidized bed combustion can utilize any fossil fuel and therefore substantial cost saving can be derived if coal is utilized The analysis presented indicates this method may be superior to regular pebble bed storage heaters which were developed for pre-heating air in the early 50's This is due to the fact that such a process results in a substantially higher film coefficient and a cleaner product (the high-temperature air) (Author)

A78-32373 # **Optimum design of wind tunnel contractions** M N Mikhail and W J Rainbird (Dilworth, Secord, Meagher and Associates, Ltd , Toronto, Canada) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 376-384 17 refs (AIAA 78-819)

A method of design of low speed wind tunnel contractions is presented An optimum contraction is considered to be the shortest one that satisfies flow quality requirements in the test section, i e , avoids any boundary layer separation and supplies flow to the test section with a specified degree of uniformity For the solution of the governing inviscid flow equations in an axisymmetric duct of arbitrary shape, a numerical scheme has been developed based on the method of lines The boundary-layer behavior is studied using both Stratford's criterion for turbulent separation and a 'lag-entrainment' integral method It is shown that by optimizing duct wall curvature distribution, it is possible to reduce contraction length to about one half of that presently used in practice for a given test section flow quality For example, a contraction with an area ratio of eight, for a large wind tunnel, can be as short as one inlet radius The present method relates the shape and length of the contraction closely to the degree of flow quality required in the test section, to the contraction ratio, to the inlet flow Reynolds number, and to the viscous flow conditions in the settling chamber upstream of the contraction inlet (Author)

A78-32381 # **Sting effects as determined by the measurement of pitch-damping derivatives and base pressures at Mach number 3** B L Uselton (ARO, Inc , Arnold Air Force Station, Tenn) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 451-466 41 refs (AIAA 78-830)

A research program was initiated for the purpose of investigating some of the problem areas in regard to support interference The critical sting length at alpha = 0 was determined by the measurement of pitch-damping derivatives for laminar, transitional, and turbulent boundary layers at the model base Data were obtained at a freestream Mach number of 3 on a blunted 7-deg cone The results showed that the critical sting length with respect to sting interference on pitch-damping data was two model diameters and was independent of the type of boundary layer at the model base The effects of sting length on base pressure and wedge plates on sting interference were also investigated (Author)

A78-32386 * # **New rotation-balance apparatus for measuring airplane spin aerodynamics in the wind tunnel** G N Malcolm (NASA, Ames Research Center, Moffett Field, Calif) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 495-502 7 refs (AIAA 78-835)

An advanced rotation-balance apparatus has been developed for the Ames 12-ft pressure tunnel to study the effects of spin rate, angles of attack and sideslip, and, particularly, Reynolds number on the aerodynamics of fighter and general aviation aircraft in a steady spin Angles of attack to 100 deg and angles of sideslip to 30 deg are possible with spin rates to 42 rad/sec (400 rpm) and Reynolds numbers to 30 million/m on fighter models with wing spans that are typically 0 7 m A complete description of the new rotation-balance apparatus, the sting/balance/model assembly, and the operational capabilities is given (Author)

A78-32388 # **Ejector-powered engine simulators for small-scale wind tunnel models of high performance aircraft** R J Matz and G D Smith (ARO, Inc , Arnold Air Force Station, Tenn) In Aerodynamic Testing Conference, 10th, San Diego, Calif , April 19-21, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978 10 p 12 refs (AIAA 78-826)

Ejector-powered engine simulators (EPES), capable of simultaneously providing engine inlet and exhaust effects in small-scale wind tunnel models of high-performance aircraft, are being investigated at AEDC Experimental results obtained from EPES driven with high-pressure unheated air and analytical results obtained from a simple theoretical model are presented to show the relative importance of ejector system components on EPES performance The performance of two EPES units designed and calibrated for wind tunnel evaluation in an existing 0 06-scale B-1 model is discussed, along with problems encountered in application of EPES to existing wind tunnel models Preliminary results from the wind tunnel tests are presented which indicate that the EPES unit does a reasonable job of duplicating engine-induced flow effects The results indicate that application of EPES units for simultaneous inlet and exhaust simulation in high-performance aircraft wind tunnel models is a viable test technique, although additional development work is needed in several areas (Author)

A78-32396 * **A spectroradiometer for airborne remote sensing** H -Y Chiu (NASA, Goddard Institute for Space Studies, New York, N Y) and W Collins (NASA, Goddard Institute for Space Studies, Columbia University, New York, N Y) *Photogrammetric Engineering and Remote Sensing,* vol 44, Apr 1978, p 507-517 11 refs NASA-supported research

A remote sensing system for use in light aircraft is discussed with attention to its applications in measuring geologic zones of alteration, vegetation canopies, and the spectral properties of water bodies A parallel electro-optical input spectroradiometer configuration with 500 channels operating in the 400-1100 nm region is described A resolution of 18 meters square from an altitude of 600 m at 200 kmh is obtained with 4-digit spectral radiance data at 2 5 spectra/sec on a 9-track tape in computer compatible format D M W

STAR ENTRIES

N78-20050*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
SUMMARY OF NASA LANDING GEAR RESEARCH
Bruce D Fisher Robert K Sleeper and Sandy M Stubbs Mar 1978 34 p refs
(NASA-TM-78679) Avail NTIS HC A03/MF A01 CSCL 01C

The landing gear is summarized Research relative to tire tread powered wheel taxiing, air cushion landing systems and crosswind landing gear is discussed in some detail An airplane ground-handling simulator was developed to provide a research tool for investigating, in perfect safety directional control and braking problems of airplanes on slippery runways in the presence of crosswinds One example of its application is to explore airplane control problems during high speed turnoffs from main runways onto taxiways The simulation development was performed in a visual-motion simulator A discussion of some of the significant developments is presented Author

N78-20058 Illinois Inst of Tech Chicago
AN EXPERIMENTAL INVESTIGATION OF OSCILLATING FLOWS OVER AN AIRFOIL Ph D Thesis
Lakshmendra Shanker Saxena 1977 225 p
Avail Univ Microfilms Order No 7800881

The basic features of unsteady flow fields generated by sinusoidally oscillating airstreams over a stationary airfoil at fixed angles of attack close to the angle of static stall were studied with focus on the dynamic stall of helicopter rotors Hot-wire surveys of the velocity field above the airfoil (NACA 0012 profile) and surface pressure measurements around the airfoil were used with data from heated surface film gages and flow visualization achieved through silk tufts Reduced frequencies of 0 18 and 0 9 were used at amplitude ratios of 0 18 and Reynolds number of 250 000 Periodic sampling and averaging techniques were used to obtain instantaneous boundary layer and wake mean velocity profiles and pressure coefficient distributions at different instants of the freestream oscillation cycle Dissert Abstr

N78-20060+ Societe Bertin et Cie, Villeurbanne (France)
AERODYNAMIC FLUID-FIBER INTERACTIONS Final Report [ETUDE DES INTERACTIONS AERODYNAMIQUES FLUIDE-FIL]
B Biot and G Lovat Apr 1977 118 p refs In FRENCH
(Contract DGRST-74-7-0695)
(NT-77-CN-1) Avail NTIS HC A06

The aerodynamic friction of textile fibers in a parallel uniform flow was studied at speeds up to 150 m/s The flow turbulence has a negligible influence on smooth fibers and an appreciable influence on textured fibers The confinement of the flow in a tube modifies the laws obtained for infinite vanes In the case of smooth fibers the tube tends to impose on the fiber the evolution of the friction law as a function of the Reynolds law For textured fibers the friction augments with the confinement Translational motion of the fiber leads to an increase of the friction coefficient ESA

N78-20061*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
SUBSONIC ROLL DAMPING OF A MODEL WITH SWEPT-BACK AND SWEPT-FORWARD WINGS
Richmond P Boyden Mar 1978 36 p refs
(NASA-TM-78677) Avail NTIS HC A03/MF A01 CSCL 01A

The aerodynamic roll damping and the yawing moment due to roll rate characteristics were investigated at subsonic speeds for a model with either sweptback or swept forward wings The tests were made in the Langley high speed 7 by 10 foot tunnel for Mach numbers between 0 3 and 0 7 The configuration with a 60 deg sweptback wing had positive damping in roll up to the maximum test angle of attack of almost 20 deg The 32 deg swept forward wing configuration had positive damping in roll at the lower angles of attack, but there was a decrease in damping and negative damping in roll was measured at the highest angles of attack Author

N78-20063*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING 3 PRESSURE AND SPANWISE LOAD DISTRIBUTIONS FOR A SEMISPAN MODEL AT MACH 0 30
Lawrence C Montoya Peter F Jacobs and Stuart G Flechner Washington Jun 1977 102 p refs Prepared in cooperation with NASA Dryden Flight Res Center
(NASA-TN-D-8478 L-11370) Avail NTIS HC A06/MF A01 CSCL 01A

Pressure and spanwise load distributions on a first-generation jet transport semispan model at a Mach number of 0 30 are given for the basic wing and for configurations with an upper winglet only, upper and lower winglets and a simple wing-tip extension To simulate second-segment-climb lift conditions leading- and/or trailing-edge flaps were added to some configurations Author

N78-20064*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING 1 LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A SEMISPAN MODEL AT SUBSONIC SPEEDS
Peter F Jacobs, Stuart G Flechner and Lawrence C Montoya Washington Jun 1977 50 p refs Prepared in cooperation with NASA Dryden Flight Res Center
(NASA-TN-D-8473 L-11354) Avail NTIS HC A03/MF A01 CSCL 01A

The effects of winglets and a simple wing-tip extension on the aerodynamic forces and moments and the flow-field cross flow velocity vectors behind the wing tip of a first generation jet transport wing were investigated in the Langley 8-foot transonic pressure tunnel using a semi-span model The test was conducted at Mach numbers of 0 30, 0 70 0 75 0 78, and 0 80 At a Mach number of 0 30 the configurations were tested with combinations of leading- and trailing-edge flaps Author

N78-20065*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING 2: PRESSURE AND SPANWISE LOAD DISTRIBUTIONS FOR A SEMISPAN MODEL AT HIGH SUBSONIC SPEEDS
Lawrence C Montoya, Stuart G Flechner and Peter F Jacobs Washington Jul 1977 211 p refs Prepared in cooperation with NASA Dryden Flight Res Center
(NASA-TN-D-8474 L-11026) Avail NTIS HC A10/MF A01 CSCL 01A

Pressure and spanwise load distributions on a first-generation jet transport semispan model at high subsonic speeds are presented for the basic wing and for configurations with an upper winglet only upper and lower winglets, and a simple wing-tip extension Selected data are discussed to show the general trends and effects of the various configurations Author

N78-20067*# Virginia Univ , Charlottesville Dept of Mechanical and Aerospace Engineering
UNSTEADY LOADS DUE TO PROPULSIVE LIFT CONFIGURATIONS PART A INVESTIGATION OF SCALING LAWS
Final Report
Jeffrey B Morton and John K Haviland Mar 1978 57 p refs
(Grant NGR-47-005-219-03)
(NASA-CR-156120, UVA/528095/MAE78/115-Pt-A) Avail NTIS HC A04/MF A01 CSCL 01A

This study covered scaling laws, and pressure measurements made to determine details of the large scale jet structure and to verify scaling laws by direct comparison The basis of comparison was a test facility at NASA Langley in which a JT-15D exhausted over a boilerplater airfoil surface to reproduce upper surface blowing conditions A quarter scale model was built of this facility using cold jets A comparison between full scale and model pressure coefficient spectra presented as functions of Strouhal numbers showed fair agreement however, a shift of spectral peaks was noted This was not believed to be due to Mach number or Reynolds number effects, but did appear to be traceable to discrepancies in jet temperatures A correction for jet temperature was then tried similar to one used for far field noise prediction This was found to correct the spectral peak discrepancy Author

N78-20068*# Virginia Univ Charlottesville Dept of Mechanical and Aerospace Engineering
UNSTEADY LOADS DUE TO PROPULSIVE LIFT CONFIGURATIONS PART B PRESSURE AND VELOCITY MEASUREMENTS IN A THREE DIMENSIONAL WALL JET
Final Report
G D Catalano, J B Morton and R R Humphris Mar 1978 34 p refs Sponsored in part by NSF
(Grant NGR-47-005-219-03)
(NASA-CR-156121 UVA/526033/MAE78/101-Pt-B UVA/528095/MAE78/115-Pt-B) Avail NTIS HC A03/MF A01 CSCL 01A

The effects of increasing the velocity ratio lambda sub j were explored The quantities measured include the width of the mixing region the mean velocity field turbulent intensities and time scales In addition wall and static pressure velocity correlations and coherences are presented The velocity measurements were made using a laser Doppler velocimeter with a phase locked loop processor The fluctuating pressures were monitored using condenser type microphones Author

N78-20069*# Virginia Univ Charlottesville Dept of Mechanical and Aerospace Engineering
UNSTEADY LOADS DUE TO PROPULSIVE LIFT CONFIGURATIONS PART C DEVELOPMENT OF EXPERIMENTAL TECHNIQUES FOR INVESTIGATION OF UNSTEADY PRESSURES BEHIND A COLD MODEL JET
J K Haviland and James C Schroeder Mar 1978 147 p refs
(Grant NGR-47-005-219-03)
(NASA-CR-156122 UVA/528095/MAE78/113-Pt-C) Avail NTIS HC A07/MF A01 CSCL 01A

As part of an overall study of the scaling laws for the fluctuating pressures induced on the wings and flaps of STOL aircraft by jet engine impingement, an experimental investigation was made of the near field fluctuating pressures behind a cold circular jet both when it was free and when it was impinging on a flat plate Miniature static pressure probes were developed for measurements in the free jet and on the flat plate which were connected by plastic tubing to 1/8 inch microphones and acted as pressure transducers Using a digital correlator together with an FFT program on the CDC 6400 computer, spectral densities, relative amplitudes phase lags and coherences were also obtained for the signals from pairs of these probes and were used to calibrate these probes directly against microphones This system of instrumentation was employed to obtain single point rms and third octave surveys of the static pressures in the free jet and on the surface of the plate Author

N78-20070*# Virginia Univ , Charlottesville Dept of Mechanical and Aerospace Engineering
UNSTEADY LOADS DUE TO PROPULSIVE LIFT CONFIGURATIONS PART C DEVELOPMENT OF EXPERIMENTAL IMENTAL FACILITY FOR THE INVESTIGATION OF SCALING EFFECTS ON PROPULSIVE LIFT CONFIGURATIONS
J K Haviland and William W Herling Mar 1978 112 p refs
(Grant NGR-47-005-219-03)
(NASA-CR-156123, UVA/528095/MAE78/114-Pt-D) Avail NTIS HC A06/MF A01 CSCL 01A

The design and construction of an experimental facility for the investigation of scaling effects in propulsive lift configurations are described The facility was modeled after an existing full size NASA facility which consisted of a coaxial turbofan jet engine with a rectangular nozzle in a blown surface configuration The flow field of the model facility was examined with and without a simulated wing surface in place at several locations downstream of the nozzle exit plane Emphasis was placed on obtaining pressure measurements which were made with static probes and surface pressure ports connected via plastic tubing to condenser microphones for fluctuating measurements Several pressure spectra were compared with those obtained from the NASA facility and were used in a preliminary evaluation of scaling laws Author

N78-20071*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
SUBSONIC LONGITUDINAL AND LATERAL-DIRECTIONAL STATIC AERODYNAMIC CHARACTERISTICS OF A GENERAL RESEARCH FIGHTER CONFIGURATION EMPLOYING A JET SHEET VORTEX GENERATOR
Jarrett K Huffman Charles H Fox, Jr and Henry Ziegler (Northrup Corp) Jan 1978 189 p refs
(NASA-TM-74049) Avail NTIS HC A09/MF A01 CSCL 01A

A configuration concept for developing vortex lift, which replaces the physical wing strake with a jet sheet generated fluid strake was investigated on a general research fighter model The vertical and horizontal location of the jet sheet with respect to the wing leading edge was studied over a momentum coefficient range from 0 to 0 24 in the Langley 7- by 10-foot high speed tunnel over a Mach number range from 0 3 to 0 8 The angle of attack range studied was from -2 to 30 deg at sideslip angles of 0, -5, and 5 deg Test data are presented without analysis Author

N78-20072*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
TRANSONIC STATIC AND DYNAMIC STABILITY CHARACTERISTICS OF A FINNED PROJECTILE CONFIGURATION
Richmond P Boyden Cuyler W Brooks Jr and Edwin E Davenport Apr 1978 84 p refs
(NASA-TM-74058 L-11966) Avail NTIS HC A05/MF A01 CSCL 01A

Static and dynamic stability tests were made of a finned projectile configuration with the aft-mounted fins arranged in a cruciform pattern The tests were made at free stream Mach numbers of 0 7 0 9, 1 1 and 1 2 in the Langley 8-foot transonic pressure tunnel Some of the parameters measured during the tests were lift drag pitching moment, pitch damping, and roll damping Configurations tested included the body with undeflected fins, the body with various fin deflections for control and the body with fins removed Theoretical estimates of the stability derivatives were made for the fins on configuration Author

N78-20073*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
SUBSONIC LONGITUDINAL AND LATERAL-DIRECTIONAL STATIC AERODYNAMIC CHARACTERISTICS FOR A MODEL WITH SWEPT BACK AND SWEPT FORWARD WINGS
Jarrett K Huffman and Charles H Fox, Jr Feb 1978 43 p refs
(NASA-TM-74093) Avail NTIS HC A03/MF A01 CSCL 01A

A general research fighter model was tested in the Langley 7- by 10-foot high speed tunnel at a Mach number of 0 3 With a conventional empennage the model was tested with the wing in a 60 deg swept back configuration and in a 32 deg swept forward configuration The 32 deg swept forward configuration was also tested with a strake Very limited data was obtained with a wing in a 50 deg swept back configuration and a 7 deg swept forward configuration The angle of attack range was from approximately -4 deg to 48 deg at sideslip angles of 0 deg -5 deg, and 5 deg Author

N78-20074*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
ONSET OF CONDENSATION EFFECTS WITH A NACA 0012-64 AIRFOIL TESTED IN THE LANGLEY 0 3-METER CRYOGENIC TUNNEL
Robert M Hall Mar 1978 84 p refs
(NASA-TM-78666) Avail NTIS HC A05/MF A01 CSCL 01A

A 0 137m airfoil was tested in a 0 3m transonic cryogenic tunnel at free stream Mach numbers of 0 75, 0 85, and 0 95 over a total pressure range from 1 2 to 5 0 atmospheres The onset of condensation effects were found to correlate more with the amount of supercooling in the free stream than it did with the supercooling in the region of maximum local Mach number over the airfoil Effects in the pressure distribution over the airfoil were generally seen to appear over its entire length at nearly the same total temperature Both observations suggest the possibility of heterogeneous nucleation occurring in the free stream The potential operational benefits of the supercooling realized are presented in terms of increased Reynolds number capability at a given tunnel total pressure reduced drive fan power if Reynolds number is held constant and reduced liquid nitrogen consumption if Reynolds number is again constant Depending on total pressure and free stream Mach number, these three benefits are found to respectively vary from 7 to 19%, 11 to 25%, and 9 to 20% Author

N78-20075*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
THEORETICAL ANALYSIS OF AERODYNAMIC CHARACTERISTICS OF TWO HELICOPTER ROTOR AIRFOILS
Charles E K Morris, Jr and William T Yeager Jr (USARTL Hampton Va) Mar 1978 29 p refs
(NASA-TM-78680) Avail NTIS HC A03/MF A01 CSCL 01A

An analytical study was conducted to predict the aerodynamic characteristics of two helicopter rotor airfoils Documentation of the predictive process covers the development of empirical factors used in conjunction with computer programs for airfoil analysis Tables of lift, drag and pitching-moment coefficient for each airfoil were prepared for two dimensional, steady flow conditions at Mach numbers from 0 3 to 0 9 and Reynolds numbers of 7,700,000 to 23 000 000, respectively Author

N78-20076*# Boeing Commercial Airplane Co Seattle, Wash
A CRITICAL EVALUATION OF THE PREDICTIONS OF THE NASA-LOCKHEED MULTIELEMENT AIRFOIL COMPUTER PROGRAM Final Report, Jul. 1976 - Jan 1978
G W Brune and J W Manke Mar 1978 67 p refs
(Contract NAS1-14522)
(NASA-CR-145322, D6-45100) Avail NTIS HC A04/MF A01 CSCL 01A

Theoretical predictions of several versions of the multielement airfoil computer program are evaluated The computed results are compared with experimental high lift data of general aviation airfoils with a single trailing edge flap and of airfoils with a leading edge flap and double slotted trailing edge flaps Theoretical and experimental data include lift pitching moment profile drag and surface pressure distributions, boundary layer integral parameters skin friction coefficients and velocity profiles Author

N78-20077*# Boeing Commercial Airplane Co , Seattle Wash
AN IMPROVED VERSION OF THE NASA-LOCKHEED MULTIELEMENT AIRFOIL ANALYSIS COMPUTER PROGRAM Final Report
G W Brune and J W Manke Mar 1978 204 p refs
(Contract NAS1-14522)
(NASA-CR-145323 D6-45099) Avail NTIS HC A10/MF A01 CSCL 01A

An improved version of the NASA-Lockheed computer program for the analysis of multielement airfoils is described The predictions of the program are evaluated by comparison with recent experimental high lift data including lift, pitching moment profile drag and detailed distributions of surface pressures and boundary layer parameters The results of the evaluation show that the contract objectives of improving program reliability and accuracy have been met Author

N78-20078*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
SIMPLIFIED SONIC-BOOM PREDICTION
Harry W Carlson Mar 1978 50 p refs
(NASA-TP-1122, L-11794) Avail NTIS HC A03/MF A01 CSCL 20A

Sonic boom overpressures and signature duration may be predicted for the entire affected ground area for a wide variety of supersonic airplane configurations and spacecraft operating at altitudes up to 76 km in level flight or in moderate climbing or descending flight paths The outlined procedure relies to a great extent on the use of charts to provide generation and propagation factors for use in relatively simple expressions for signature calculation Computational requirements can be met by hand-held scientific calculators or even by slide rules A variety of correlations of predicted and measured sonic-boom data for airplanes and spacecraft serve to demonstrate the applicability of the simplified method Author

N78-20079*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
WIND-TUNNEL INVESTIGATION AT MACH NUMBERS FROM 1 90 TO 2 86 OF A CANARD-CONTROLLED MISSILE WITH RAM-AIR-JET SPOILER ROLL CONTROL
A B Blair Jr Mar 1978 104 p refs
(NASA-TP-1124 L-11873) Avail NTIS HC A06/MF A01 CSCL 01A

The efficacy of using a ram-air-jet spoiler roll control device on a typical canard-controlled missile configuration was investigated For roll control comparisons, conventional aileron controls on the tail fins were also tested The results indicate that the roll control of the ram-air-jet spoiler tail fins at the highest free-stream Mach number compared favorably with that of the conventional 11-70 area-ratio tail fin ailerons, each deflected 10 deg The roll control of the tail fin ailerons decreased while that of the ram-air-jet spoiler increased with free-stream Mach number The addition of the ram-air-jet spoiler tail fins or flow-through tip chord nacelles on the tail fins resulted in only small changes in basic missile longitudinal stability The axial force coefficient of the operating ram-air-jet spoiler is significantly larger than that of conventional ailerons and results primarily from the total pressure behind a normal shock in front of the nacelle inlets Author

N78-20080*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
EFFECT OF COOLING-HOLE GEOMETRY ON AERODYNAMIC PERFORMANCE OF A FILM-COOLED TURBINE VANE TESTED WITH COLD AIR IN A TWO-DIMENSIONAL CASCADE
John F Kline Roy G Stabe and Thomas P Moffitt Mar 1978 49 p refs
(NASA-TP-1136, E-9174) Avail NTIS HC A03/MF A01 CSCL 01A

The effect of the orientation and cooling-hole size on turbine-vane aerodynamic losses was evaluated The contribution of individual vahe regions to the overall effect was also investigated Test configurations were based upon a representative configuration having 45 spanwise rows of holes spaced about the entire vane profile Nominal hole diameters of 0 0254 and 0 0356 cm and nominal hole orientations of 35 deg 45 deg and 55 deg from the local vane surface and 0 deg 45 deg and 90 deg from the main-stream flow direction were investigated Flow conditions and aerodynamic losses were determined by vane-exit surveys of total pressure static pressure, and flow angle Author

N78-20081*# National Aeronautics and Space Administration Langley Research Center Langley Station Va

EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING 5 STABILITY CHARACTERISTICS OF A FULL-SPAN WING WITH A GENERALIZED FUSELAGE AT HIGH SUBSONIC SPEEDS

Peter F Jacobs Mar 1978 71 p refs
(NASA-TP-1163 L-11982) Avail NTIS HC A04/MF A01 CSCL 01A

The effects of winglets on the static aerodynamic stability characteristics of a KC-135A jet transport model at high subsonic speeds are presented The investigation was conducted in the Langley 8 foot transonic pressure tunnel using 0 035-scale wing panels mounted on a generalized research fuselage Data were taken over a Mach number range from 0 50 to 0 95 at angles of attack ranging from -12 deg to 20 deg and sideslip angles of 0 deg 5 deg and -5 deg The model was tested at two Reynolds number ranges to achieve a wide angle of attack range and to determine the effect of Reynolds number on stability Results indicate that adding the winglets to the basic wing configuration produces small increases in both lateral and longitudinal aerodynamic stability and that the model stability increases slightly with Reynolds number The winglets do increase the wing bending moments slightly but the buffet onset characteristics of the model are not affected by the winglets Author

N78-20083# Auburn Univ Ala Dept of Aerospace Engineering

ANALYSIS AND COMPARISON OF SEVERAL METHODS FOR COMPUTING AERODYNAMIC COMPRESSIBILITY AND INTERFERENCE EFFECTS UP TO CRITICAL MACH NUMBERS Final Report

Fred W Martin James Purvis John E Burkhalter and Brent D Martin Eglin AFB Fla AFAL Sep 1977 62 p refs
(Contract F08635-77-C-0002)
(AD-A050267 AFATL-TR-77-112) Avail NTIS HC A04/MF A01 CSCL 20/4

Analytical approaches are considered which might be used to improve and extend current aerodynamic analysis to include the compressibility effects up to and including critical Mach numbers The Rayleigh-Janzen solution is considered for both small disturbance and exact potential flows A simple numerical method is presented and compared with both experimental results and the results of other analytical methods for potential flow Author (GRA)

N78-20086# Avco Systems Div Wilmington Mass

HYPERSONIC HEAT TRANSFER TEST PROGRAM IN THE VKI LONGSHOT FACILITY Final Report, 1 Nov 1976 - 31 Oct 1977

V DiCristina 21 Dec 1977 33 p
(Contract F49620-77-C-0035 Grant AFOSR-2942-76)
(AD-A050295 AVSD-0393-77-CR AFOSR-78-0111TR) Avail NTIS HC A03/MF A01 CSCL 20/4

The purpose of these tests was to measure local pressure and heat transfer distributions on an ogive body configuration over a range of Mach number and Reynolds number conditions Both smooth and rough body data were obtained at three degrees angle of attack Author (GRA)

N78-20087# Naval Ship Research and Development Center Bethesda Md Aviation and Surface Effects Dept

ANALYSIS OF EMPIRICALLY DETERMINED AERODYNAMIC AND RAM COEFFICIENTS FOR A POWER-AUGMENTED-RAM WING-IN-GROUND EFFECT Final Report, Jun - Oct 1977

David G Rousseau Oct 1977 22 p refs
(AD-A049636, DTNSRDC/ASED-396) Avail NTIS HC A02/MF A01 CSCL 01/3

With the advent of a theory for power-augmented-ram wing-in-ground-effect vehicle performance there is a need for detailed comparison with test data This report presents a comparison of test data with theory in particular the determination of the effects of changes in vehicle geometry and cruising height on flight performance Good correlation between theory and experiment has been achieved for lift and pitching moment and correlation with drag is promising for some geometries Author (GRA)

N78-20088# Toronto Univ (Ontario) Inst for Aerospace Studies

RESEARCH ON VARIOUS ASPECTS OF ATMOSPHERIC FLIGHT Final Technical Report, 1971 - 1976

J H Deleeuw and L D Reid Nov 1976 35 p refs
(Grant AF-AFOSR-2091-71)
(AD-A033681, AFOSR-76-1422TR) Avail NTIS HC A03/MF A01 CSCL 04/1

This research has studied aerodynamic problems in upper atmospheric flight and the disturbed flight of aircraft due to low level turbulence during the approach phase Individual project summaries include (1) Calculations have been made for low speed sphere drag in transition flow, experiments confirm the theoretical predictions (2) An electron beam Doppler profile apparatus has been used to delineate the shape of the distribution function in a heat transfer problem indicating its progressive nonequilibrium nature as the degree of rarefaction increased (3) An electron beam fluorescence instrument has been designed for rocketborne use to measure upper atmospheric concentrations of nitrogen, molecular oxygen atomic oxygen, rotational and vibrational temperatures a number of launches have been made on Black Brant rockets from Fort Churchill (AD 033 680) (4) A laser-Doppler instrument has been constructed and checked out as a means of remotely measuring turbulence in the atmospheric boundary layer, and (5) Wind tunnel measurements in a controlled turbulent shear flow have been made along representative flight paths for STOL vehicles to provide an input to predict dispersions of the landing point GRA

N78-20091# Imperial Coll of Science and Technology London (England) Dept of Aeronautics

ENGINEERING CALCULATION METHODS FOR TURBULENT FLOW, VOLUME 1

P Bradshaw, T Cebeci (Douglas Aircraft Comp Long Beach Calif) and J H Whitelaw Sep 1977 123 p refs 3 Vol
(IC-Aero-77-102-Vol-1) Avail NTIS HC A06/MF A01

Lecture notes for a short post-experience course held in October 1977 are presented The 16 lectures are intended as a general review of the state-of-the-art of designers and research workers in aerospace mechanical and civil engineering and the environmental sciences The lectures consider turbulence phenomena exact equations empirical turbulence models numerical procedures and applications The 5 lectures in this volume following an introduction, deal with conservation equations and boundary conditions for 2-D incompressible flow zero-equation, 2-equation stress models, stress-equation modeling and scalar models, introductory numerical methods for thin shear layer equations and their boundary and initial conditions and inviscid/viscid interactions Author (ESA)

N78-20092# Imperial Coll of Science and Technology, London (England) Dept of Aeronautics

ENGINEERING CALCULATION METHODS FOR TURBULENT FLOW, VOLUME 2

P Bradshaw T Cebeci (Douglas Aircraft Comp Long Beach Calif) and J H Whitelaw Sep 1977 104 p refs 3 Vol
(IC-Aero-77-102-Vol-2) Avail NTIS HC A06/MF A01

Lecture notes for a short post-experience course held in October 1977 are presented The 16 lectures are intended as a general review of the state-of-the-art of designers and research workers in aerospace, mechanical and civil engineering, and the environmental sciences The lectures consider turbulence phenomena exact equations empirical turbulence models numerical procedures, and applications In this volume 6 lectures are collected on corner flows and slender shear layers recirculating flows, laser-Doppler anemometry, hot-wire anemometry standard boundary layer problems for external 2-D and axisymmetric flows, and inverse boundary layer problems Author (ESA)

N78-20093# Imperial Coll of Science and Technology London (England) Dept of Aeronautics

ENGINEERING CALCULATION METHODS FOR TURBULENT FLOW, VOLUME 3

P Bradshaw, T Cebeci (Douglas Aircraft Comp, Long Beach Calif), and J H Whitelaw Sep 1977 100 p refs 3 Vol (IC-Aero-77-102-Vol-3) Avail NTIS HC A05/MF A01

Lecture notes for a short post-experience course held in October 1977 are presented The 16 lectures are intended as a general review of the state-of-the-art of designers and research workers in aerospace, mechanical and civil engineering, and the environmental sciences The lectures consider turbulence phenomena exact equations empirical turbulence models numerical procedures and applications In this volume 4 lectures are presented on calculation of 2-D unsteady and 3-D steady flows stability and transition turbomachinery, and combustion Author (ESA)

N78-20094*# American Airlines Inc, Tulsa Okla Maintenance and Engineering Center

A NEW METHOD FOR ESTIMATING CURRENT AND FUTURE TRANSPORT AIRCRAFT OPERATING ECONOMICS Contractor Report, Jan. 1976 - Oct 1977

Mar 1978 278 p refs Revised (Contract NAS1-14284) (NASA-CR-145190, D6-42877-Rev) Avail NTIS HC A13/MF A01 CSCL 05C

A methodology was developed by which the operating cost associated with variations in aircraft design and technology characteristics can be assessed The assessment method produced a base line estimate of the operating cost elements relating to such design specification features as seat capacity avionic equipment design range and design definition features such as maximum takeoff gross weight and number of engines The methodology was applied to assess the operating cost of one potential future advanced technology transport aircraft An analysis was included to show the relative sensitivity of the operating cost to design parameters Author

N78-20095# Air Force Civil Engineering Center Tyndall AFB Fla

AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD, MALMSTROM AFB, MONTANA

Larry T Clark and Richard D Smedley, Jr Sep 1977 21 p refs (AD-A049637 AFCEC-M-9-77) Avail NTIS HC A02/MF A01 CSCL 01/2

The bird/aircraft strike hazard (BASH) at Malmstrom Air Force Base, Montana, was surveyed during the period 26 August-2 September 1977 Special emphasis was placed on local gull activities which contribute significantly to the bird strike potential Recommendations aimed at reducing the airfield bird strike potential are part of this report Author (GRA)

N78-20096# Air Force Inst of Tech, Wright-Patterson AFB Ohio Graduate Education Div

AN ECONOMIC ANALYSIS OF A GOVERNMENT SPONSORED, COMMERCIAL CONVERTIBLE AIRCRAFT M S Thesis

Robert J Morgan and Stanley L Mead Sep 1977 236 p refs (AD-A047633 AFIT-LSSR-21-77B) Avail NTIS HC A11/MF A01 CSCL 01/3

The purpose of the study was to examine the time interval and associated discounted program costs of a government sponsored convertible aircraft Through the use of a computer model, the researchers examined the relationship of deflated Gross National Product growth, historical air commerce trends and simulated changes in the composition of the U S air carrier fleet resulting from the demand for air transportation Further, the study examined the impact of wide-bodied aircraft lower hold cargo capability on attaining 100 wide-bodied cargo capable aircraft by 1990 as well as reimbursement by airlines for initial government sponsorship costs when convertible aircraft are transitioned to a freighter mode GRA

N78-20098*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

FLIGHT TEST RESULTS OF THE STRAPDOWN HEXAD INERTIAL REFERENCE UNIT (SIRU) VOLUME 3· APPENDICES A-G

Ronald J Hruby and William S Bjorkman (Analytical Mechanics Associates Inc Mountain View Calif) Jul 1977 104 p (NASA-TM-73224 A-6974) Avail NTIS HC A06/MF A01 CSCL 17G

Results of flight tests of the Strapdown Inertial Reference Unit (SIRU) navigation system are presented The fault tolerant SIRU navigation system features a redundant inertial sensor unit and dual computers System software provides for detection and isolation of inertial sensor failures and continued operation in the event of failures Flight test results include assessments of the system s navigational performance and fault tolerance Selected facets of the flight tests are also described in detail and include some of the following (1) flight test plans and ground track plots (2) navigation residual plots (3) effects of approximations in navigation algorithms (4) vibration spectrum of the CV-340 aircraft, and (5) modification of the statistical FDICR algorithm parameters for the flight environment Author

N78-20099# Electromagnetic Compatibility Analysis Center Annapolis Md

THE IMPACT OF A PROPOSED ACTIVE BCAS ON ATCRBS PERFORMANCE IN THE WASHINGTON, D C, 1981 ENVIRONMENT Final Report

Norman Theberge (ITT Res Inst Annapolis) Sep 1977 49 p (Contract DOT-FA70WAI-175) (AD-A048589/6, ECAC-PR-77-037, FAA-RD-77-140) Avail NTIS HC A03/MF A01 CSCL 17/7

A computer model of the proposed active Beacon Collision Avoidance System (BCAS) was developed to investigate the impact of BCAS on the Air Traffic Control Radar Beacon System (ATCRBS) ground system Predictions were made for the early 1981 Washington D C environment Two ground environments were simulated, an all-ATCRBS environment and a 25%/75% Discrete Address Beacon System (DABS)/ATCRBS mix Airborne fruit rates and the effect of BCAS/DABS mode power programming on interference were also predicted Author

N78-20100*# Ohio Univ Athens Avionics Engineering Center

STAND-ALONE DEVELOPMENT SYSTEM USING A KIM-1 MICROCOMPUTER MODULE

James D Nickum Mar 1978 13 p refs (Grant NGR-36-009-017) (NASA-CR-156067, NASA-TM-56) Avail NTIS HC A02/MF A01 CSCL 17G

A small microprocessor-based system designed to contain all or most of the interface hardware designed to be easy to access and modify the hardware to be capable of being strapped to the seat of a small general aviation aircraft, and to be independent of the aircraft power system is described The system is used to develop a low cost Loran C sensor processor but is designed such that the Loran interface boards may be removed and other hardware interfaces inserted into the same connectors This flexibility is achieved through memory-mapping techniques into the microprocessor Author

N78-20101# Electromagnetic Compatibility Analysis Center Annapolis Md
INTERFERENCE ANALYSIS BETWEEN TRSB MICROWAVE LANDING SYSTEM AND ADJACENT C-BAND RADARS Final Report
Ved Nanda (ITT Res Inst Annapolis) Jan 1978 66 p
(Contracts DOT-FA70WAI-175 F19628-76-C-0017 AF Proj 649E)
(AD-A049882 ECAC-PR-76-004 FAA-RD-77-110) Avail NTIS HC A04/MF A01 CSCL 01/5

The electromagnetic compatibility between the Time Reference Scanning Beam (TRSB) Microwave Landing System (MLS) and adjacent C-band radar systems is investigated Distance constraints required for compatible operation between these systems were established for the three proposed MLS plans of frequency assignment Author

N78-20102*# Boeing Commercial Airplane Co Seattle Wash
COCKPIT DISPLAYED TRAFFIC INFORMATION STUDY, PART 2
Sep 1977 250 p refs Sponsored in part by FAA
(Contract NAS1-13267)
(NASA-CR-156115 AD-A049870 D6-42968-Pt-2 FAA-EM-77-18-Pt-2) Avail NTIS HC A11/MF A01 CSCL 01/5

The planning base for conducting a flight test evaluation of an Electronic Horizontal Situation Indicator (EHSI) incorporating the position of other air traffic as derived from ground sensors was provided A system concept for an airborne information display utilizing ground derived ATC and ATC related information was defined and an outline of a simulation and flight test program which includes the NASA 515 aircraft the Langley Research Center traffic simulation and other aircraft and simulations were prepared Testing in a busy terminal area was also planned Author

N78-20103# Technische Universitaet, Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
AIR TRAFFIC SAFETY IN THE AIRPORT NEAR RANGE [BEITRAEGE ZUR VERKEHRSSICHERUNG IM FLUGHAFEN-NAHBEREICH]
Mar 1977 106 p refs In GERMAN
(TUBS/SFB58/M4) Avail NTIS HC A06/MF A01

Topics in the field of airport near range air traffic safety are presented The computerized simulation of a flight safety system for the near range is discussed, covering air traffic, control, navigation and collision avoidance The design of a frequency synthesizer for a quartz oscillator, to provide an onboard frequency standard in a time-synchronous collision avoidance system is reported A model is described which was developed for representing the statistical selection and distance measurement process in the nonsynchronous SECANT collision avoidance system

N78-20104 Technische Universitaet Brunswick (West Germany)
SIMULATION AND DEVELOPMENT POSSIBILITIES OF THE MANUAL CONTROL CONCEPT IN THE NEAR RANGE AND CONTROL ZONE [UEBER DIE SIMULATION UND DIE ENTWICKLUNGSMOEGLICHKEITEN DES MANUELLEN KONTROLLKONZEPTES IN NAHVERKERHSBEREICH UND KONTROLLZONE]
D Brunner *In its* Air Traffic Safety in the Airport Near Range Mar 1977 p 3-22 refs In GERMAN

Avail NTIS HC A06/MF A01

Possibilities for improving flight safety in the near range by a stepwise tighter combination of flight safety control, navigation, and collision avoidance were investigated The current short range traffic was reproduced by simulation of air space structure air traffic, and manual control The effects of some control measures were examined and a system concept for safety and guidance of air traffic was developed The simulation comprises, as an essential part a collision protection system integrated into the flight safety system This system autonomously recognizes collision hazards and calculates avoidance maneuvers taking into account the flight safety situation occurring ESA

N78-20105 Technische Universitaet, Brunswick (West Germany)
PROGRAM FOR SIMULATION OF AIR TRAFFIC AND AIR SPACE STRUCTURE OF THE FRANKFURT NEAR RANGE, A PLANNING CONTROL AND A COLLISION AVOIDANCE SYSTEM WITH SITUATION DEPENDENT AVOIDANCE MANEUVERS [PROGRAMM ZUR SIMULATION DES LUFTVERKEHRS UND DER LUFTRAUMSTRUKTUR DES NAHBEREICHES FRANKFURT, EINER PLANUNGSKONTROLLE UND EINES KOLLISIONSSCHUTZSYSTEMS MIT SITUATIONSBEDINGTEN AUSWEICHMANOEVER]
D Brunner *In its* Air Traffic Safety in the Airport Near Range Mar 1977 p 23-53 In GERMAN

Avail NTIS HC A06/MF A01

The computerized simulation of a flight safety system in an airport near range is discussed The underlying concept is based on the present manual flight safety control of the intensively used Frankfurt near range and comprises further developments combining intricate control navigation and collision avoidance The air traffic simulation covers both simulation of traffic in the near range and components of the flight safety system mentioned The Frankfurt near range air space was selected in order to permit comparison of real traffic with that simulated ESA

N78-20106 Technische Universitaet Brunswick (West Germany)
DEVELOPMENT OF A BINARY FREQUENCY SYNTHESIS AS CONTROL ELEMENT FOR FREQUENCY CORRECTION IN TIME-SYNCHRONOUS COLLISION SYSTEMS WITHOUT ONBOARD ATOMIC FREQUENCY STANDARD AVOIDANCE [ENTWICKLUNG EINER BINAEREN FREQUENZSYNTHESE ALS STELLGLIED ZUR FREQUENZKORREKTUR IN ZEIT-SYNCHRONEN KOLLISIONSSCHUTZSYSTEMEN OHNE ATOMFREQUENZNORMAL AN BORD]
P Plumeyer *In its* Air Traffic Safety in the Airport Near Range Mar 1977 p 54-70 In GERMAN

Avail NTIS HC A06/MF A01

The design of a frequency synthesizer for a quartz oscillator is reported to provide an onboard frequency standard in a time-synchronous collision avoidance system The frequency synthesis is binary controlled and allows correction of the quartz frequency The synthesis circuit satisfies two conditions high spectral cleanliness of the output signal, and a fast response for commutation of the correction signal The combination of these conditions was facilitated by the elaboration of optimal frequency plans for the individual circuit stages, allowing separation of signal and noise bounds by using relatively broadband filters ESA

N78-20107 Technische Universitaet, Brunswick (West Germany)
DESIGN OF A COLLISION AVOIDANCE SYSTEM MODEL WITH STATISTICAL INTERROGATION [AUFBAU EINES MODELLS EINES KOLLISIONSSCHUTZSYSTEMS MIT STATISTISCHER ABFRAGE]
P Form, P Plumeyer and H-R Boecker *In its* Air Traffic Safety in the Airport Near Range Mar 1977 p 71-103 In GERMAN
Avail NTIS HC A06/MF A01

A model was developed to represent the statistical selection and distance measurement processes in the nonsynchronous SECANT collision avoidances system The relation, between traffic density, warning time, and response range are analyzed The effect of two correlation modes on interference pulse rates is demonstrated A calculation is presented of the statistical processes in the correlators, the most important result of which is the determination of the distribution function for readings of the correlator counters ESA

N78-20108*# National Aeronautics and Space Administration Langley Research Center Langley Station Va

TECHNICAL AND ECONOMIC EVALUATION OF ADVANCED AIR CARGO SYSTEMS

Allen H Whitehead, Jr Feb 1978 38 p refs Presented at Forum on Airfreight Contribution in Securing Markets Abroad Aeroport de Paris, France, 17-18 Nov 1977

(NASA-TM-78672) Avail NTIS HC A03/MF A01 CSCL 01C

The current air cargo environment and the relevance of advanced technology aircraft in enhancing the efficiency of the 1990 air cargo system are discussed NASA preliminary design studies are shown to indicate significant potential gains in aircraft efficiency and operational economics for future freighter concepts Required research and technology elements are outlined to develop a better base for evaluating advanced design concepts Current studies of the market operation are reviewed which will develop design criteria for a future dedicated cargo transport Design features desirable in an all-freighter design are reviewed NASA-sponsored studies of large, distributed-load freighters are reviewed and these designs are compared to current wide-body aircraft These concepts vary in gross takeoff weight from 0 5 Gg (one million lbs) to 1 5 Gg (three million lbs) and are found to exhibit economic advantages over conventional design concepts

Author

N78-20109*# Michigan Univ , Ann Arbor Dept of Aerospace Engineering

AEROELASTIC ANALYSIS AND GROUND VIBRATION SURVEY OF THE NASA, GRUMMAN AMERICAN YANKEE MODIFIED FOR SPIN TESTING Final Report, 7 Aug. 1975 - 30 Jun. 1977

Richard A Kroeger Sep 1977 263 p refs

(Grant NsG-1229)

(NASA-CR-156119) Avail NTIS HC A12/MF A01 CSCL 01C

A complete ground vibration and aeroelastic analysis was made of a modified version of the Grumman American Yankee The aircraft had been modified for four empennage configurations a wing boom was added, a spin chute installed and provisions included for large masses in the wing tip to vary the lateral and directional inertia Other minor changes were made which have much less influence on the flutter and vibrations Neither static divergence nor aileron reversal was considered since the wing structure was not sufficiently changed to affect its static aeroelastic qualities The aircraft was found to be free from flutter in all of the normal modes explored in the ground shake test The analysis demonstrated freedom from flutter up to 214 miles per hour

Author

N78-20110*# Kansas Univ Center for Research, Inc , Lawrence

A STUDY OF LOW-COST RELIABLE ACTUATORS FOR LIGHT AIRCRAFT PART A CHAPTERS 1-8 Final Report, 15 Jun 1977 - 15 Mar 1978

Han Eijsink and Mark Rice Apr 1978 162 p refs 2 Vol

(Grant NsG-1421)

(NASA-CR-156142) Avail NTIS HC A08/MF A01 CSCL 01C

An analysis involving electro-mechanical, electro-pneumatic, and electro-hydraulic actuators was performed to study which are compatible for use in the primary and secondary flight controls of a single engine light aircraft Actuator characteristics under investigation include cost reliability weight force volumetric requirements, power requirements, response characteristics and heat accumulation characteristics The basic types of actuators were compared for performance characteristics in positioning a control surface model and then were mathematically evaluated in an aircraft to get the closed loop dynamic response characteristics Conclusions were made as to the suitability of each actuator type for use in an aircraft

Author

N78-20111*# Kansas Univ Center for Research, Inc , Lawrence

A STUDY OF LOW-COST RELIABLE ACTUATORS FOR LIGHT AIRCRAFT PART B: APPENDICES Final Report

Han Eijsink and Mark Rice Apr 1978 165 p refs 2 Vol

(Grant NsG-1421)

(NASA-CR-156143, KU-FRL-351-Pt-B) Avail NTIS HC A08/MF A01 CSCL 01C

Computer programs written in FORTRAN are given for time response calculations on pneumatic and linear hydraulic actuators The programs are self-explanatory with comment statements Program output is also included

Author

N78-20112*# Boeing Commercial Airplane Co , Seattle, Wash Preliminary Design Dept

STUDY OF ADVANCED COMPOSITE STRUCTURAL DESIGN CONCEPTS FOR AN ARROW WING SUPERSONIC CRUISE CONFIGURATION, TASK 3 Final Report

Jan 1978 381 p refs

(Contract NAS1-12287)

(NASA-CR-145192, D6-42438-4) Avail NTIS HC A17/MF A01 CSCL 01C

A structural design study was conducted to assess the relative merits of structural concepts using advanced composite materials for an advanced supersonic aircraft cruising at Mach 2 7 The configuration and structural arrangement developed during Task I and II of the study was used as the baseline configuration Allowable stresses and strains were established for boron and advanced graphite fibers based on projected fiber properties available in the next decade Structural concepts were designed and analyzed using graphite polyimide and boron polyimide, applied to stiffened panels and conventional sandwich panels The conventional sandwich panels were selected as the structural concept to be used on the wing structure The upper and lower surface panels of the Task I arrow wing were redesigned using high-strength graphite polyimide sandwich panels over the titanium spars and ribs The ATLAS computer system was used as the basis for stress analysis and resizing the surface panels using the loads from the Task II study without adjustment for change in aeroelastic deformation The flutter analysis indicated *a decrease in the flutter speed compared to the baseline titanium* wing design The flutter analysis indicated a decrease in the flutter speed compared to the baseline titanium wing design The flutter speed was increased to that of the titanium wing, with a weight penalty less than that of the metallic airplane

Author

N78-20113*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

A SIMPLE METHOD FOR ESTIMATING MINIMUM AUTOROTATIVE DESCENT RATE OF SINGLE ROTOR HELICOPTERS

Peter D Talbot and Laurel G Schroers (Army R & T Labs Moffett Field Calif) Mar 1978 17 p refs

(NASA-TM-78452, A-7134) Avail NTIS HC A02/MF A01 CSCL 01C

Flight test results of minimum autorotative descent rate are compared with calculations based on the minimum power required for steady level flight Empirical correction factors are derived that account for differences in energy dissipation between these two flight conditions A method is also presented for estimating the minimum power coefficient for level flight for any helicopter for use in the empirical estimation procedure of autorotative descent rate

Author

N78-20114*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center Edwards Calif

DEVELOPMENT OF SYSTEMS AND TECHNIQUES FOR LANDING AN AIRCRAFT USING ONBOARD TELEVISION

Shu W Gee Peter C Carr, William R Winter, and John A Manke Feb 1978 24 p refs

(NASA-TP-1171 H-973) Avail NTIS HC A02/MF A01 CSCL 01C

A flight program was conducted to develop a landing technique with which a pilot could consistently and safely land a remotely piloted research vehicle (RPRV) without outside visual reference except through television Otherwise, instrumentation was standard Such factors as the selection of video parameters, the pilot s understanding of the television presentation, the pilot's

ground cockpit environment, and the operational procedures for landing were considered About 30 landings were necessary for a pilot to become sufficiently familiar and competent with the test aircraft to make powered approaches and landings with outside visual references only through television When steep approaches and landings were made by remote control the pilot s workload was extremely high The test aircraft was used as a simulator for the F-15 RPRV, and as such was considered to be essential to the success of landing the F-15 RPRV Author

N78-20115*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
GROUND DISTANCE COVERED DURING AIRBORNE HORIZONTAL DECELERATION OF AN AIRPLANE
William H Phillips Apr 1978 13 p refs
(NASA-TP-1157 L-12008) Avail NTIS HC A02/MF A01 CSCL 01C

The distance an airplane floats with respect to the ground during deceleration at constant altitude is analyzed taking into account the effects of a constant wind By use of suitable nondimensionalizing parameters data applicable to all airplanes are presented by means of a single family of curves Author

N78-20116*# Boeing Commercial Airplane Co Seattle, Wash
STUDY OF ADVANCED COMPOSITE STRUCTURAL DESIGN CONCEPTS FOR AN ARROW WING SUPERSONIC CRUISE CONFIGURATION Final Report
M J Turner and D L Grande Apr. 1978 122 p refs
(Contract NAS1-12287)
(NASA-CR-2825, D6-42438-5) Avail NTIS HC A06/MF A01 CSCL 01C

Based on estimated graphite and boron fiber properties, allowable stresses and strains were established for advanced composite materials Stiffened panel and conventional sandwich panel concepts were designed and analyzed using graphite/polyimide and boron/polyimide materials The conventional sandwich panel was elected as the structural concept for the modified wing structure Upper and lower surface panels of the arrow wing structure were then redesigned, using high strength graphite/polyimide sandwich panels retaining the titanium spars and ribs from the prior study The ATLAS integrated analysis and design system was used for stress analysis and automated resizing of surface panels Flutter analysis of the hybrid structure showed a significant decrease in flutter speed relative to the titanium wing design The flutter speed was increased to that of the titanium design by selective increase in laminate thickness and by using graphite fibers with properties intermediate between high strength and high modulus values Author

N78-20117*# McDonnell-Douglas Corp St Louis, Mo
THERMAL DESIGN FOR AREAS OF INTERFERENCE HEATING ON ACTIVELY COOLED HYPERSONIC AIRCRAFT Final Report
R L Herring and J E Stone Jan 1978 169 p refs
(Contract NAS1-14140)
(NASA-CR-2828) Avail NTIS HC A08/MF A01 CSCL 01C

Numerous actively cooled panel design alternatives for application in regions on high speed aircraft that are subject to interference heating effects were studied Candidate design concepts were evaluated using mass producibility reliability and inspectability/maintainability as figures of merit Three design approaches were identified as superior within certain regimes of the matrix of design heating conditions considered Only minor modifications to basic actively cooled panel design are required to withstand minor interference heating effects Designs incorporating internally finned coolant tubes to augment heat transfer are recommended for moderate design heating conditions At severe heating conditions an insulated panel concept is required Author

N78-20118*# Douglas Aircraft Co Inc Long Beach, Calif
EXPANSION OF FLIGHT SIMULATOR CAPABILITY FOR STUDY AND SOLUTION OF AIRCRAFT DIRECTIONAL CONTROL PROBLEMS ON RUNWAYS Final Report
G W Kibbee Apr 1978 106 p refs
(Contract NAS1-13981)
(NASA-CR-2970 MDC-J7727) Avail NTIS HC A06/MF A01 CSCL 01C

The development, evaluation, and evaluation results of a DC-9-10 runway directional control simulator are described An existing wide bodied flight simulator was modified to this aircraft configuration The simulator was structured to use either of two antiskid simulations (1) an analog mechanization that used aircraft hardware, or (2) a digital software simulation After the simulation was developed it was evaluated by 14 pilots who made 818 simulated flights These evaluations involved landings rejected takeoffs and various ground maneuvers Qualitatively most pilots evaluated the simulator as realistic with good potential especially for pilot training for adverse runway conditions Author

N78-20119# Air Force Flight Dynamics Lab , Wright-Patterson AFB, Ohio
PRESSURE CYCLING FATIGUE TESTS OF F-111 CREW MODULE GLASS TRANSPARENCIES Final Report, 1 Jun 1969 - 1 Jun 1971
George R Holderby Mar 1977 49 p
(AD-A049625 AFFDL-TR-77-12) Avail NTIS HC A03/MF A01 CSCL 01/3

The F-111 Crew Module Transparencies Fatigue Test Program was initiated to resolve questions on the effects of complete pressure reversals combined with thermal cycling on the fatigue life of the transparencies A ship-set of transparencies was mounted in a crew escape module and subjected to a simulated flight heating, cooling and pressure environment The test specimens successfully completed four lifetimes of testing and had residual static strength in excess of the design ultimate load of the escape module An ambient temperature fatigue test was added to the program to investigate the propagation characteristics of debonded areas in the transparency edge members which were occurring in service A ship-set of transparencies with debonded areas large enough to require replacement under applicable technical orders was mounted in an escape module and subjected to simulated subsonic flight usage The test specimens successfully completed four life times of testing with no failures of the glass and only very small growth of some of the debonded areas Author (GRA)

N78-20120# Brooks and Perkins Inc Livonia Mich
GONDOLA SYSTEM FOR HELICOPTER TRANSPORT OF EXTERNAL CARGO Final Report, Nov 1975 - Jun 1977
Sep 1977 41 p refs
(Contract DAAJ02-76-C-0007)
(AD-A047560, USAAMRDL-TR-77-28) Avail NTIS HC A03/MF A01 CSCL 15/5

This report covers the design the development and the static testing of 8x8x10- and 20-foot gondolas The technical feasibility and performance data provided will permit further study of the transportation of these systems by helicopter The maximum gross weights of the 10- and 20-foot units are 15,000 and 30 000 pounds respectively The structure has a rigid porous floor, an open superstructure and ISO corner fittings It is designed to be acquired and released by container handling devices or handled by forklifts The gondola system is intermodal and consists of a basic center unit (8x8x20 feet) and two end units (8x8x10 feet) that are all modules that can be coupled to make 8x8x40-foot and 8x8x20-foot assemblies Author (GRA)

N78-20121# Boeing Vertol Co Philadelphia Pa
LIMITATIONS OF THE UTTAS HELICOPTER IN PERFORMING TERRAIN FLYING WITH EXTERNAL LOADS Final Report, Jul 1976 - Apr 1977
Irvin B Alansky James M Davis and Theodore S Garnett, Jr Sep 1977 113 p refs
(Contract DAAJ02-76-C-0027)
(AD-A047568 D210-11226-1 USAAMRDL-TR-77-22) Avail NTIS HC A06/MF A01 CSCL 01/2

Quantitative limitations of the UTTAS helicopter performing terrain flying with external loads have been developed using a fully coupled total force and moment simulation math model of the helicopter and external load Load sway motion and susceptibility to PIO in night/instrument meteorological conditions were identified as the prime source of these limitations Masking requirements were determined for various external load configurations including a 105mm howitzer and an A-22 ammo bag Incorporation of a dual hook suspension or load stabilization coupled with a shortened sling suspension offers the best potential for alleviating the limits identified, while providing improved masking requirements and reduction in pilot workload In addition, the levels of maneuverability possible with the present state-of-the-art visionic systems (including FLIR and NVG), were defined for terrain flying during night operations Author (GRA)

N78-20122# Kaman Avidyne, Burlington Mass
CORRELATION STUDY OF THE UH-1B HELICOPTER BLAST TEST RESULTS FROM THE DICE-THROW EVENT Final Report, 1 Oct 1976 - 31 May 1977
Garabed Zartarian, Eldine L Cole, and William N Lee 1977 222 p refs
(Contract DAAD05-76-C-0772)
(AD-A050463 KA-TR-138, BRL-352) Avail NTIS HC A10/MF A01 CSCL 01/3

This report summarizes the results of a correlation study conducted in conjunction with the UH-1B helicopter blast test during the DICE THROW event The processed structural and motion response data from the hovering and droned helicopter are presented They are correlated with corresponding analytical predictions based primarily on the helicopter code HELP and the aircraft structural code NOVA-2 The monitored blast-induced responses include (1) the flapwise bending moments and the flapping angles of both the tail and main rotor blade systems, (2) the lateral bending moments at two fin and two tail boom stations (3) the overall rigid-body motions of the vehicle consisting of the altitude variations, the attitude and angular rate variations in the yaw, pitch, and roll degrees-of-freedom, and (4) the strains at selected points on a tail boom panel, a stiffener and a longeron Considering the qualities of the available input data for the analyses and of the measurements the experimental results are generally in reasonable agreement with the predictions from the HELP code The NOVA-2 predictions for panel stiffener, and longeron strains fare poorly when compared with experiment In some instances significant differences are found between experiment and analysis Whenever possible, the reasons for the disagreements are identified and discussed
Author (GRA)

N78-20123# Bell Helicopter Co, Fort Worth, Tex
AH-1S HIGH-SURVIVABLE TRANSMISSION SYSTEM Final Report, Oct. 1976 - Aug. 1977
David J Richardson Oct 1977 143 p refs
(Contract DAAJ02-76-C-0006, DA Proj 1F2-63208-DB-52)
(AD-A047558, BHT-699-099-059, USAAMRDL-TR-77-30) Avail NTIS HC A07/MF A01 CSCL 01/3

The objective of the work performed on this program was to demonstrate that the AH-1S main transmission system modified with internal component improvements but without an emergency lubrication system could operate for 30 minutes following the loss of lubrication The internal component improvements were based upon work done under a previous Eustis Directorate program conducted by Bell Helicopter Textron Four different, modified versions of the AH-1S transmission configuration were tested under this program All loss-of-lube testing was conducted at 950 input horsepower (84 percent of maximum continuous power rating of the AH-1S) and 6600 input rpm The first transmission configuration tested ran 7 minutes under loss-of-lube conditions before failure of the main input spiral bevel pinion occurred The second transmission configuration ran 21 minutes before the lower planetary stage failed The third transmission configuration ran 19 minutes before a lower planetary stage failure occurred The fourth transmission configuration ran 26 5 minutes before again a lower planetary stage failure occurred It appears that a 30-minute loss-of-lube capability has been achieved for all transmission components except the lower planetary stage
Author (GRA)

N78-20124# United Technologies Corp Stratford Conn Sikorsky Aircraft Div
HELICOPTER FREEWHEEL UNIT DESIGN GUIDE Final Report, 1974 - Mar 1977
J Kish Oct 1977 239 p refs
(Contract DAAJ02-74-C-0028)
(AD-A047559, USAAMRDL-TR-77-18) Avail NTIS HC A11/MF A01 CSCL 01/3

This report is intended to aid the transmission designer in selecting an overrunning clutch for use in a helicopter transmission Preliminary sizing as well as detailed stress analysis procedures are presented for all aspects of spring, sprag, and ramp roller clutch designs An example of the procedure for each clutch is included Operation up to 20 000 rpm is feasible if the design procedures presented herein are followed Author (GRA)

N78-20125# Naval Postgraduate School Monterey Calif
THE FEASIBILITY OF THE JET-FLAP ROTOR AS A LIFT GENERATOR FOR VERTICAL TAKEOFF AND LANDING AIRCRAFT M S Thesis
John Charles Ball Dec 1977 134 p refs
(AD-A050214) Avail NTIS HC A07/MF A01 CSCL 01/3

The objectives of this study were first to determine the effectiveness of the jet-flap rotor relative to other lift generators and second to examine the potential effectiveness of the jet-flap rotor in a tactical VTOL aircraft It was found that the jet-flap rotor has a high theoretical potential, but at present is the least-developed of the lift generators considered The jet-flap rotor was found to be unattractive as a means of providing vertical lift except when a long hover duration is necessary With regard to weight considerations alone the jet-flap rotor was found to be inadvisable for use in a tactical VTOL aircraft However, its benign downwash characteristics could make the jet-flap rotor advantageous if high downwash velocities and temperatures could not be tolerated Author (GRA)

N78-20127# Dornier-System G m b H Friedrichshafen (West Germany)
MODERN WING TECHNOLOGY FOR GENERAL AVIATION AIRCRAFT Final Report
M Lotz, B Huinink W Haberland E Hoffmann, and W Staeudlin Bonn Bundesmin fuer Forsch u Technol Nov 1977 135 p refs In GERMAN ENGLISH summary
(Contract BMFT-LFK-7530)
(BMFT-FB-W-77-14) Avail NTIS HC A07/MF A01, ZLDI Munich DM 28,35

The design and construction of a wing of modern technology (MWT) for general aviation aircraft is reported as well as testing of this wing on a modified Dornier Skyservant The results of investigations of aerodynamic and structural design and trade-off concerning the application of the MWT on general aviation aircraft are presented The aerodynamic design of the test-wing shows the clear superiority of the MWT wing section compared to conventional NACA-wing sections mainly with regard to maximum lift and L/D at high lift coefficients Wind tunnel investigations, made with the complete experimental model aircraft, partly exceeded theoretical expectations The result of the flight mechanics investigations shows that in comparison with the original Skyservant version, limitations of the flight-envelope will be necessary because of the modified wing, more powerful engines and the use of the original empennage The effect of applying MWT to general aviation aircraft was demonstrated on two basic production aircraft Results showed remarkable improvements of flight and mission performance (take-off run, climb, and range), relatively small improvements in initial costs and an obvious reduction of direct operational costs
Author (ESA)

N78-20128*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
A ROTOR-MOUNTED DIGITAL INSTRUMENTATION SYSTEM FOR HELICOPTER BLADE FLIGHT RESEARCH MEASUREMENTS
Vernie H Knight, Jr, William S Haywood, Jr and Milton L Williams Apr 1978 49 p refs
(NASA-TP-1146, L-11956) Avail NTIS HC A03/MF A01 CSCL 01D

A rotor mounted flight instrumentation system developed for helicopter rotor blade research is described The system utilizes high speed digital techniques to acquire research data from miniature pressure transducers on advanced rotor airfoils which are flight tested on an AH-1G helicopter The system employs microelectronic pulse code modulation (PCM) multiplexer digitizer stations located remotely on the blade and in a hub mounted metal canister As many as 25 sensors can be remotely digitized by a 2 5 mm thick electronics package mounted on the blade near the tip to reduce blade wiring The electronics contained in the canister digitizes up to 16 sensors, formats these data with serial PCM data from the remote stations and transmits the data from the canister which is above the plane of the rotor Data are transmitted over an RF link to the ground for real time monitoring and to the helicopter fuselage for tape recording The complete system is powered by batteries located in the canister and requires no slip rings on the rotor shaft
Author

N78-20130*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
TWO-DIMENSIONAL COLD-AIR CASCADE STUDY OF A FILM-COOLED TURBINE STATOR BLADE 4 COMPARISON OF EXPERIMENTAL AND ANALYTICAL AERODYNAMIC RESULTS FOR BLADE WITH 12 ROWS OF 0 076-CENTIMETER-(0 030-INCH-) DIAMETER HOLES HAVING STREAMWISE EJECTION ANGLES
Herman W Prust, Jr Mar 1978 30 p refs
(NASA-TP-1151 E-9187) Avail NTIS HC A03/MF A01 CSCL 21E

Previously published experimental aerodynamic efficiency results for a film cooled turbine stator blade are compared with analytical results computed from two published analytical methods One method was used as published the other was modified for certain cases of coolant discharge from the blade suction surface For coolant ejection from blade surface regions where the surface static pressures are higher than the blade exit pressure both methods predict the experimental results quite well However, for ejection from regions with surface static pressures lower than the blade exit pressure, both methods predict too small a change in efficiency The modified method gives the better prediction
Author

N78-20132*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
SIMULATED FLIGHT EFFECTS ON NOISE CHARACTERISTICS OF A FAN INLET WITH HIGH THROAT MACH NUMBER
Howard L Wesoky Donald A Dietrich and John M Abbott Apr 1978 45 p refs
(NASA-TP-1199 E-9253) Avail NTIS HC A03/MF A01 CSCL 21E

An anechoic wind tunnel experiment was conducted to determine the effects of simulated flight on the noise characteristics of a high throat Mach number fan inlet Comparisons were made with the performance of a conventional low throat Mach number inlet with the same 50 8 cm fan noise source Simulated forward velocity of 41 m/sec reduced perceived noise levels for both inlets the largest effect being more than 3 db for the high throat Mach number inlet The high throat Mach number inlet was as much as 7 5 db quieter than the low throat Mach number inlet with tunnel airflow and about 6 db quieter without tunnel airflow Effects of inlet flow angles up to 30 deg were seemingly irregular and difficult to characterize because of the complex flow fields and generally small noise variations Some modifications of tones and directivity at blade passage harmonics resulting from inlet flow angle variation were noted
Author

N78-20133*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
TWO-DIMENSIONAL COLD-AIR CASCADE STUDY OF A FILM-COOLED TURBINE STATOR BLADE 5 COMPARISON OF EXPERIMENTAL AND ANALYTICAL AERODYNAMIC RESULTS FOR BLADE WITH 12 ROWS OF 0.038-CENTIMETER-(0 015 INCH) DIAMETER COOLANT HOLES HAVING STREAMWISE EJECTION ANGLES
Herman W Prust, Jr Apr 1978 23 p refs
(NASA-TP-1204 E-9342) Avail NTIS HC A02/MF A01 CSCL 21E

Published experimental aerodynamic efficiency results were compared with results predicted from two published analytical methods This is the second of two such comparisons One of the analytical methods was used as published, the other was modified for certain cases of coolant discharge from the blade suction surface The results show that for 23 cases of single row and multirow discharge covering coolant fractions from 0 to about 9 percent the difference between the experimental and predicted results was no greater than about 1 percent in any case and less than 1/2 percent in most cases
Author

N78-20134# Naval Air Propulsion Test Center, Trenton, N J
EFFECTIVENESS OF THE REAL TIME FERROGRAPH AND OTHER OIL MONITORS AS RELATED TO OIL FILTRATION
Daniel Popgoshev and Raymond Valori Nov 1977 69 p refs
(AD-A049334 NAPC-PE-2) Avail NTIS HC A04/MF A01 CSCL 11/8

A development model of an oil monitor known as the Real Time (R T) Ferrograph was evaluated on a bench tester to determine its effectiveness in detecting rolling contact fatigue or scoring type failures, especially as influenced by various levels of oil filtration Comparisons of the R T Ferrograph are made with spectrometric oil analysis a light scattering and attenuation device an X-ray fluorescence device a particle counter and the analytical Ferrograph Results of the testing showed the R T Ferrograph to be effective in detecting failures when the oil filtration level was above 40 micrometers In addition it correlates well with the other oil monitors at these filtration levels Below the 40 micrometer oil filtration level the R T Ferrograph was found to be ineffective
Author (GRA)

N78-20135# RAND Corp , Santa Monica, Calif
LIFE-CYCLE ANALYSIS OF AIRCRAFT TURBINE ENGINES Interim Report
J R Nelson Nov 1977 122 p refs
(Contract F49620-77-C-0023)
(AD-A050349, R-2103-AF) Avail NTIS HC A06/MF A01 CSCL 21/5

The report presents a methodology enabling the weapon system planner to acquire early visibility of cost magnitudes, proportions and trends associated with a new engine s life cycle, and to identify drivers' that increase cost and can have the effect of lowering capability Later in the life cycle, logistics managers can use the methodology and the feedback it produces for more effective system management The procedure followed was to develop a theoretical framework for each phase of the life cycle, collect and analyze data for each phase, develop parametric cost-estimating relationships (CERs) for each phase, use the CERs in examples to ascertain behavior and obtain insights into cost magnitudes proportions and trends, and to identify cost-drivers and their effects and examine commercial experience for cost data and operational and maintenance practices that could be profitable for the Air Force
Author (GRA)

N78-20136*# Lockheed-California Co Burbank
ROTORCRAFT LINEAR SIMULATION MODEL VOLUME 1: ENGINEERING DOCUMENTATION Final Report, Nov 1976 - Jan 1978
J S Reaser Jan 1978 185 p ref 3 Vol
(Contract NAS2-9374)
(NASA-CR-152079-Vol-1 LR-28200-Vol-1) Avail NTIS HC A09/MF A01 CSCL 01C

A rotorcraft small perturbation linear model is described Rotor flap inplane and feathering degrees of freedom as well as control and augmentation systems are defined in addition to the classical vehicle six degrees of freedom The primary application was intended to be an analytic tool to assess the handling qualities of a dynamically combined main rotor and body The modeling method retained the higher frequency response properties which aided in evaluating control and stability augmentation systems
Author

N78-20137*# Lockheed-California Co Burbank
ROTORCRAFT LINEAR SIMULATION MODEL VOLUME 2: COMPUTER IMPLEMENTATION Final Report, Nov 1976 - Jan 1978
J S Reaser and D H Saiki Jan 1978 77 p *ref* 3 Vol
(Contract NAS2-9374)
(NASA-CR-152079-Vol-2 LR-28200-Vol-2) Avail NTIS HC A05/MF A01 CSCL 01C

A computer program used to process the equations is presented, and a full description of equation implementation is given The model was implemented in the IBM 360 and CDC series computer systems M V

N78-20138*# Lockheed-California Co Burbank
ROTORCRAFT LINEAR SIMULATION MODEL VOLUME 3 USER'S MANUAL Final Report, Nov 1976 - Jan 1978
J S Reaser Jan 1978 68 p ref 3 Vol
(Contract NAS2-9374)
(NASA-CR-152079-Vol-3 LR-28200-Vol-3) Avail NTIS HC A04/MF A01 CSCL 01C
For abstract see N78-20137

N78-20139*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
SIMULATOR EVALUATION OF A FLIGHT-PATH-ANGLE CONTROL SYSTEM FOR A TRANSPORT AIRPLANE WITH DIRECT LIFT CONTROL
Wendell W Kelley Mar 1978 33 p refs
(NASA-TP-1116, L-11947) Avail NTIS HC A03/MF A01 CSCL 01C

A piloted simulator was used to evaluate the flight path angle control capabilities of a system that employs spoiler direct lift control The system was designated the velocity vector control system and was compared with a baseline flight path angle control system which used elevator for control The simulated airplane was a medium jet transport Research pilots flew a manual instrument landing system glide slope tracking task and a variable flight path angle task in the landing configuration to obtain comparative performance data Author

N78-20140*# *National Aeronautics and Space Administration* Hugh L Dryden Flight Research Center, Edwards, Calif
FLIGHT EVALUATION OF THE TRANSONIC STABILITY AND CONTROL CHARACTERISTICS OF AN AIRPLANE INCORPORATING A SUPERCRITICAL WING
Neil W Matheny and Donald H Gatlin Feb 1978 61 p refs
(NASA-TP-1167, H-916) Avail NTIS HC A04/MF A01 CSCL 01C

A TF-8A airplane was equipped with a transport type supercritical wing and fuselage fairings to evaluate predicted performance improvements for cruise at transonic speeds A comparison of aerodynamic derivatives extracted from flight and wind tunnel data showed that static longitudinal stability, effective dihedral, and aileron effectiveness, were higher than predicted The static directional stability derivative was slower than predicted The airplane's handling qualities were acceptable with the stability augmentation system on The unaugmented airplane exhibited some adverse lateral directional characteristics that involved low Dutch roll damping and low roll control power at high angles of attack and roll control power that was greater than satisfactory for transport aircraft at cruise conditions Longitudinally, the aircraft exhibited a mild pitchup tendency Leading edge vortex generators delayed the onset of flow separation moving the pitchup point to a higher lift coefficient and reducing its severity Author

N78-20141*# Draper (Charles Stark) Lab, Inc Cambridge Mass
RELIABLE DUAL-REDUNDANT SENSOR FAILURE DETECTION AND IDENTIFICATION FOR THE NASA F-8 DFBW AIRCRAFT Final Report, Jun 1975 - May 1977
James C Deckert, Mukund N Desai John J Deyst, Jr, and Alan S Willsky (MIT, Cambridge) Feb 1978 216 p refs
(Contract NAS1-13914)
(NASA-CR-2944, R-1077) Avail NTIS HC A10/MF A01 CSCL 01C

A technique was developed which provides reliable failure detection and identification (FDI) for a dual redundant subset of the flight control sensors onboard the NASA F-8 digital fly by wire (DFBW) aircraft The technique was successfully applied to simulated sensor failures on the real time F-8 digital simulator and to sensor failures injected on telemetry data from a test flight of the F-8 DFBW aircraft For failure identification the technique utilized the analytic redundancy which exists as functional and kinematic relationships among the various quantities being measured by the different control sensor types The technique can be used not only in a dual redundant sensor system but also in a more highly redundant system after FDI by conventional voting techniques reduced to two the number of unfailed sensors of a particular type In addition the technique can be easily extended to the case in which only one sensor of a particular type is available Author

N78-20142*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
STUDY OF THE USE OF A NONLINEAR, RATE-LIMITED FILTER ON PILOT CONTROL SIGNALS
James J Adams Apr 1978 41 p refs
(NASA-TP-1147, L-11762) Avail NTIS HC A03/MF A01 CSCL 01C

The use of a nonlinear, rate limited filter for rejecting the remnant (noise) in a pilot's control signal was studied through both an analytical study using pilot models and a simulation study using experienced test pilots The nonlinear filter was compared with a linear filter and with no filter for both attitude and altitude control tasks The results show that the nonlinear filter does promote rapid, steady maneuvering better than either the linear filter or the no filter condition In addition, if the rate limit in the nonlinear filter is set so that it is too restrictive a pilot induced unstable altitude oscillation can result Author

N78-20143*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
PILOT-MODEL ANALYSIS AND SIMULATION STUDY OF EFFECT OF CONTROL TASK DESIRED CONTROL RESPONSE
James J Adams Joseph Gera, and Joel B Jaudon Apr 1978 46 p refs
(NASA-TP-1140) Avail NTIS HC A03/MF A01 CSCL 01C

A pilot model analysis was performed that relates pilot control compensation, pilot aircraft system response, and aircraft response characteristics for longitudinal control The results show that a higher aircraft short period frequency is required to achieve superior pilot aircraft system response in an altitude control task than is required in an attitude control task These results were confirmed by a simulation study of target tracking It was concluded that the pilot model analysis provides a theoretical basis for determining the effect of control task on pilot opinions Author (GRA)

N78-20144*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
TESTPLT. INTERACTIVE COMPUTER PROCEDURE FOR WIND-TUNNEL-DATA MANAGEMENT, RETRIEVAL, COMPARISON, AND PLOTTING
Harry H Heyson Feb 1978 89 p
(NASA-TM-78663) Avail NTIS HC A05/MF A01 CSCL 14B

A method of maintaining retrieving, comparing and plotting wind-tunnel data by means of an interactive remote computer terminal is described The software associated with the method consists of two procedure files, three computer programs, and a submittal file, all of which are discussed The procedure was based on maintaining the basic wind-tunnel data files in the Langley standard interface tape (SIFT) format The SIFT format was not part of the present development Those features of the format essential to the present use were described The entire method was illustrated by sample executions from a remote terminal Author

N78-20147# Army Construction Engineering Research Lab Champaign Ill
DEVELOPMENT OF A PAVEMENT MAINTENANCE SYSTEM VOLUME 1 AIRFIELD PAVEMENT CONDITION RATING Final Report, Jul 1974 - Jul 1976
Mohamed Y Shahin Michael I Darter and Starr D Kohn Dec 1977 232 p refs Supersedes AFCEC-TR-76-27 2 Vol
(MIPR FQ-8952-76-66005)
(AD-A048884, CERL-TR-C-76-Vol-1 CEEDO-TR-77-44-Vol-1 AFCEC-TR-76-27) Avail NTIS HC A11/MF A01 CSCL 01/5

This report describes the development and verification of a pavement condition index (PCI) for rating the condition of jointed concrete and asphalt-or tar-surfaced airfield pavements The PCI, which measures airfield pavement structural integrity and surface operational condition is calculated based on measured pavement distress types severities, and densities obtained during an inspection of the pavement GRA

N78-20148*# Air Force Civil and Environmental Engineering Office, Tyndall AFB Fla
SMOKE ABATEMENT FOR DOD TEST CELLS Final Report, 20 Nov 1976 - 30 May 1977
Bradford C Grems, III Jul 1977 109 p refs
(AF Proj 2103)
(AD-A050223, CEEDO-TR-77-40) Avail NTIS HC A06/MF A01 CSCL 06/6

The Department of Defense owns and operates nearly 200 jet engine test cells Occasionally visible exhaust smoke is emitted from these structures Several pollution control agencies, most notably the state of California have expressed interest in limiting test cell smoke emissions A review committee composed of various Air Force and Navy representatives recommended further study of fuel additives as a means of achieving this goal They recognized additives as the most promising near term solution to the test cell smoke problem Ferrocene appeared to be the best of existing additives Studies were undertaken to determine the environmental impact toxicological hazards and engine effects associated with routine ferrocene use Four types of Navy turbine engines were tested for ten hours each using ferrocene These tests indicated that engines suffered no harm attributable to ferrocene but that the additive must be certified for each engine type on a individual basis Emission measurements made during the tests showed that most pollutants are virtually unchanged in quantity and character by ferrocene use and that particulate matter is actually reduced GRA

N78-20481*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
INVESTIGATION OF A HIGH SPEED DATA HANDLING SYSTEM FOR USE WITH MULTISPECTRAL AIRCRAFT SCANNERS
W Lane Kelly and Barry D Meredith Mar 1978 42 p
(NASA-TM-78689) Avail NTIS HC A03/MF A01 CSCL 14B

A buffer memory data handling technique for use with multispectral aircraft scanners is presented which allows digital data generated at high data rates to be recorded on magnetic tape A digital memory is used to temporarily store the data for subsequent recording at slower rates during the passive time of the scan line, thereby increasing the maximum data rate recording capability over real-time recording Three possible implementations are described and the maximum data rate capability is defined in terms of the speed capability of the key hardware components The maximum data rates can be used to define the maximum ground resolution achievable by a multispectral aircraft scanner using conventional data handling techniques Author

N78-20524# Air Force Flight Dynamics Lab Wright-Patterson AFB, Ohio
ESTIMATING TIMES TO EARLY FAILURES USING FINITE DATA TO ESTIMATE THE WEIBULL SCALE PARAMETER Final Report, Sep 1976 - Mar 1977
Robert L Neulieb Sep 1977 22 p refs
(AD-A050263 AFFDL-TR-77-89) Avail NTIS HC A02/MF A01 CSCL 14/4

Parameters for a Weibull distribution of times to failure must be estimated from a finite set of test points Much effort has been expended identifying the shape parameter for different materials This report investigates determining probabilities of early failures when estimating the scale parameter from a finite number of tests Author (GRA)

N78-20534*# Kansas Univ Center for Research, Inc Lawrence
EXPERIMENTAL AND FINITE ELEMENT INVESTIGATION OF THE BUCKLING CHARACTERISTICS OF A BEADED SKIN PANEL FOR A HYPERSONIC AIRCRAFT Ph D Thesis. Final Report
William H Siegel Apr 1978 139 p refs
(Grant NsG-4006)
(NASA-CR-144863) Avail NTIS HC A07/MF A01 CSCL 20K

As part of NASA s continuing research into hypersonics and 85 square foot hypersonic wing test section of a proposed hypersonic research airplane was laboratory tested The project reported on in this paper has carried the hypersonic wing test structure project one step further by testing a single beaded panel to failure The primary interest was focused upon the buckling characteristics of the panel under pure compression with boundary conditions similar to those found in a wing mounted condition Three primary phases of analysis are included in the report These phases include experimental testing of the beaded panel to failure, finite element structural analysis of the beaded panel with the computer program NASTRAN, a summary of the semiclassical buckling equations for the beaded panel under purely compressive loads Comparisons between each of the analysis methods are also included Author

N78-20551# Stuttgart Univ (West Germany) Inst fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen
ANALYSIS AND SYNTHESIS OF OPERATIONAL LOADS [ANALYSE UND SYNTHESE VON BETRIEBSBELASTUNGEN]
J H Argyris, W Aicher, and H J Ertelt Feb 1976 71 p refs In GERMAN
(ISD-193) Avail NTIS HC A04/MF A01

The method for the analysis and synthesis of operational loads dealt with is based on the possibility of subjecting the test piece to a practically arbitrary load sequence This method was proposed for the basis for standardization of aircraft structure fatigue tests using microcomputers In order to obtain this standardization system-dependent errors were eliminated from available flight data, a data reduction was carried out, matrices of transition probabilities were drawn up and synthetic maximum load sequences were produced on punched tape and magnetic tape respectively for test facilities without direct computer control ESA

N78-20631# Defence Research Establishment, Ottawa (Ontario) Electrical Power Sources Div
NICKEL/CADMIUM AIRCRAFT BATTERIES BATTERY ALARM UNIT
K Feldman and R M Hayashi Apr 1977 19 p refs
(AD-A039521, DREO-TN-77-7) Avail NTIS HC A02/MF A01 CSCL 10/3

Malfunctions in nickel/cadmium aircraft batteries which may lead to dangerous thermal problems are usually preceded by small atypical decreases in voltage of a single failing cell Early detection of this decrease can provide time for suitable measures to be taken before other cells are damaged and catastrophic consequences occur Also detection during battery shop operations can facilitate the screening out of defective cells The battery alarm unit described in this paper was developed at DREO and is a simple device which monitors the cell voltages by comparing the voltage in one half of the battery with that of the other half Only three connections to the battery are required Atypical voltage changes in a single cell, of the order of 50 mV may be detected The precise sensitivity may be varied by varying resistor values in the input network The instrument has been found useful in the battery shop both for warning of failing cells in batteries being charged and for attracting attention to

cells which show low capacity while being discharged Presumably the instrument could be equally useful as an early warning device on aircraft For such applications consideration must be given to questions of procedure, configuration and airworthy mechanical design Also experience in the field is required on which to base decisions on the optimum sensitivity and whether aircraft and battery shop applications require the same sensitivities
Author (GRA)

N78-20632# Defence Research Establishment Ottawa (Ontario) Electrical Power Sources Div
NICKEL/CADMIUM AIRCRAFT BATTERIES: RAPID ELECTROLYTE EXCHANGE TECHNIQUE
K Feldman and R M Hayashi Apr 1977 15 p refs
(AD-A039335 DREO-TN-77-8) Avail NTIS HC A02/MF A01 CSCL 10/3

The potassium hydroxide electrolyte in nickel/cadmium aircraft batteries may become increasingly more contaminated by carbonate with battery use When the carbonate concentration exceeds certain limits it is advisable to exchange the electrolyte However, most of the electrolyte in a cell is soaked into the separator materials and plate pores, and is held in the pack, so only a small portion of it may be poured out Repeated removal and replacement of these small amounts can accomplish the desired exchange if the clean added electrolyte is adequately mixed with the contaminated electrolyte each time In the normal procedures, mixing is accomplished by discharging and recharging the battery after each small exchange and hence is very time consuming This paper discusses the various factors involved and presents a vacuum technique for mixing the added with the retained electrolyte in each cell The method presented reduces the time required for the above operation from a week or more to a day or two Author (GRA)

N78-20635# Defence Research Establishment, Ottawa (Ontario) Electrical Power Sources Div
NICKEL/CADMIUM AIRCRAFT BATTERIES SINGLE SENSOR TEMPERATURE MONITORING
Keiva Feldman and Robert M Hayashi Mar 1977 12 p refs
(AD-A037722 DREO-TN-77-3) Avail NTIS HC A02/MF A01 CSCL 10/3

Most of the failures of nickel/cadmium batteries in aircraft are triggered by the development of a short circuit in a single cell in the battery An experiment was conducted to determine whether the use of a single temperature sensor on an intercell link would be adequate to warn of a short circuit in a cell located elsewhere in the battery The results indicate that this would not be adequate GRA

N78-20636# Defence Research Establishment, Ottawa (Ontario)
NICKEL/CADMIUM AIRCRAFT BATTERIES MULTICHANNEL GASSING-RATE METER
Keiva Feldman and Ronald L Haines Mar 1977 24 p ref
(AD-A039735, DREO-TN-77-5) Avail NTIS HC A02/MF A01 CSCL 10/3

The instrument described is used to assess the state of health of separators in nickel/cadmium aircraft batteries and thus to permit removal from service of those cells which may be expected to fail catastrophically in the near future Twenty channels are provided to permit simultaneous observation of all cells in a complete battery Each channel measures the rate of emission of gas from one cell during overcharge by means of the pressure build up in a chamber from which the gas escapes via a suitable orifice Construction, calibration, and cleaning are discussed Author (GRA)

N78-20917*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
COMPARISON OF MEASURED AND CALCULATED HELICOPTER ROTOR IMPULSIVE NOISE
Wayne Johnson and Albert Lee (Beam Eng Inc) Mar 1978 29 p refs
(Contract NAS2-9399)
(NASA-TM-78473 A-7355) Avail NTIS HC A03/MF A01 CSCL 20A

The thickness noise theory is discussed Two full-scale rotors were tested in a wind tunnel with several tips involving changes in chord thickness and sweep Impulsive noise data reduction procedures used are described The calculated and measured impulsive noise peak pressures as a function of advancing tip Mach number are compared showing good correlation for all rotors considered Author

N78-20918*# Beam Engineering Inc, Sunnyvale, Calif
ACOUSTICAL EFFECTS OF BLADE TIP SHAPE CHANGES ON A FULL SCALE HELICOPTER ROTOR IN A WIND TUNNEL
Albert Lee Apr 1978 59 p refs
(Contract NAS2-9399)
(NASA-CR-152082) Avail NTIS HC A04/MF A01 CSCL 20A

Four tip shapes were tested They were rectangular swept, tapered, and swept-tapered The measured data covered a wide range of operating conditions The range of advancing tip Mach numbers were between 0 72 to 0 96, and the advance ratios were from 0 2 to 0 375 At low and moderate advancing tip Mach number, the data in the dbA scale appear to indicate the swept tip is the quietest swept tapered the second, tapered third and rectangular the most noisy Above an advancing tip Mach number of about 0 89, a distinct acoustical pulse can be observed, which dominates the acoustical waveform The pulse shape is symmetric at moderate tip Mach number, changing to a sawtooth shape at high advancing tip Mach numbers Based on the amplitude of the impulsive noise it appears the swept-tapered tip is the quietest tapered tip the second swept tip third and square tip the most noisy The data presented in this report should be useful as data bases for modeling and evaluating helicopter impulsive noise Author

N78-20919*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
CONCORDE NOISE-INDUCED BUILDING VIBRATIONS, JOHN F KENNEDY INTERNATIONAL AIRPORT
W H Mayes R DeLoach D G Stephens J M Cawthorn, H K Holmes R B Lewis B G Holliday W T Miller, and D W Ward Feb 1978 67 p refs
(NASA-TM-78676 Rept-2) Avail NTIS HC A04/MF A01 CSCL 20A

The outdoor/indoor noise levels and associated vibration levels resulting from aircraft and nonaircraft events were recorded at eight homesites and a school In addition, limited subjective tests were conducted to examine the human detection/annoyance thresholds for building vibration and rattle caused by aircraft noise Presented herein are the majority of the window and wall vibration data recorded during Concorde and subsonic aircraft overflights Author

N78-20920*# United Technologies Research Center, East Hartford, Conn
A METHOD FOR CALCULATING EXTERNALLY BLOWN FLAP NOISE Final Report
Martin R Fink Mar 1978 130 p refs
(Contract NAS3-17863)
(NASA-CR-2954 R77-911739-17) Avail NTIS HC A07/MF A01 CSCL 20A

Several basic noise components were described These components are (1) compact lift dipoles associated with the wing and flaps, (2) trailing edge noise associated with the last trailing edge and (3) quadrupole noise associated with the undeflected exhaust jet and the free jet located downstream of the trailing edge These noise components were combined to allow prediction of directivity and spectra for under the wing (UTW) slotted flaps with conventional or mixer nozzles UTW slotless flaps upper surface blowing (USB) slotless flaps, and engine in front of the wing slotted flaps A digital computer program listing was given for this calculation method Directivities and spectra calculated by this method were compared with free field data for UTW and USB configurations The UTRC method best predicted the details of the measured noise emission, but

the ANOP method best estimated the noise levels directly below these configurations Author

N78-21045# Naval Postgraduate School Monterey Calif
A LIFE CYCLE COST STUDY OF CONTRACTOR VERSUS ORGANIC SUPPORT OF AIRCRAFT PROGRAMS M S Thesis
John Joseph McMenamin Jr Dec 1977 54 p refs
(AD-A049438) Avail NTIS HC A04/MF A01 CSCL 05/3

This thesis conducts a cost comparison between contractor and organic support for the CH-53 Aircraft in two major operating cost areas training and aircraft overhaul A life cycle cost approach is used and cost differentials are found for the twenty year life expectancy of the CH-53 system The intent of the study was not to criticize or change the existing system but rather to provide cost data and planning insight for future aircraft systems Author (GRA)

N78-21047*# McDonnell-Douglas Corp Long Beach, Calif
A THREE-DIMENSIONAL POTENTIAL-FLOW PROGRAM WITH A GEOMETRY PACKAGE FOR INPUT DATA GENERATION Technical Report, 7 May 1976 - 22 Aug 1977
N Douglas Halsey Mar 1978 67 p refs
(Contract NAS1-14402)
(NASA-CR-145311 MDC-J7733) Avail NTIS HC A04/MF A01 CSCL 01A

Information needed to run a computer program for the calculation of the potential flow about arbitrary three dimensional lifting configurations is presented The program contains a geometry package which greatly reduces the task of preparing the input data Starting from a very sparse set of coordinate data the program automatically augments and redistributes the coordinates, calculates curves of intersection between components and redistributes coordinates in the regions adjacent to the intersection curves in a suitable manner for use in the potential flow calculations A brief summary of the program capabilities and options is given as well as detailed instructions for the data input a suggested structure for the program overlay, and the output for two test cases Author

N78-21048*# National Aeronautics and Space Administration Washington D C
AIRFOIL PROFILE IN A NONUNIFORM FLOW
Jan Polasek Mar 1978 53 p refs Transl into ENGLISH from Rev Roum Sci Tech Ser Mecan Appl (Romania) v 9 no 3 1964 p 617-666 Transl by Scientific Translation Service Santa Barbara Calif Original doc prep by Government Research Inst for Heat Technology, Prague (Czechoslovakia)
(Contract NASw-2791)
(NASA-TM-75272) Avail NTIS HC A04/MF A01 CSCL 01A

A theory of airfoil section past two dimensional nonuniform flow is developed The theory is based on representation of airfoil section by vortex and source distributions and it can be used for calculation of aircraft wings in homogeneous and inhomogeneous flow as well as for calculation of straight and radial blade and vane-cascades Author

N78-21049*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
SUBSONIC LONGITUDINAL AND LATERAL-DIRECTIONAL STATIC AERODYNAMIC CHARACTERISTICS FOR A CLOSE-COUPLED WING-CANARD MODEL IN BOTH SWEPT BACK AND SWEPT FORWARD CONFIGURATIONS
Jarrett K Huffman and Charles H Fox Jr Feb 1978 60 p refs
(NASA-TM-74092) Avail NTIS HC A04/MF A01 CSCL 01A

A general research fighter model was tested in the Langley 7 by 10-foot high speed tunnel at a Mach number of 0 3 The close-coupled wing-canard combination was tested with both lifting surfaces in a 60 deg swept back configuration and in a 32 deg swept forward configuration The angle-of-attack range was from approximately -4 deg to 48 deg at sideslip angles of zero deg, -5 deg The data is presented without analysis in order to expedite publication Author

N78-21050*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
A VECTORIZATION OF THE JAMESON-CAUGHEY NYU TRANSONIC SWEPT-WING COMPUTER PROGRAM FLO-22-V1 FOR THE STAR-100 COMPUTER
Robert E Smith Joan I Pitts, and Jules J Lambiotte Mar 1978 32 p refs
(NASA-TM-78665) Avail NTIS HC A03/MF A01 CSCL 01A

The computer program FLO-22 for analyzing inviscid transonic flow past 3-D swept-wing configurations was modified to use vector operations and run on the STAR-100 computer The vectorized version described herein was called FLO-22-V1 Vector operations were incorporated into Successive Line Over-Relaxation in the transformed horizontal direction Vector relational operations and control vectors were used to implement upwind differencing at supersonic points A high speed of computation and extended grid domain were characteristics of FLO-22-V1 The new program was not the optimal vectorization of Successive Line Over-Relaxation applied to transonic flow, however it proved that vector operations can readily be implemented to increase the computation rate of the algorithm Author

N78-21051*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
EFFECT OF LEADING-EDGE CONTOUR AND VERTICAL-TAIL CONFIGURATION ON THE LOW-SPEED STABILITY CHARACTERISTICS OF A SUPERSONIC TRANSPORT MODEL HAVING A HIGHLY-SWEPT ARROW WING
Vernard E Lockwood Mar 1978 53 p refs
(NASA-TM-78683) Avail NTIS HC A04/MF A01 CSCL 01A

A low-speed investigation was made on a highly-swept arrow-wing model to determine the effect of wing leading-edge contour and vertical-tail configuration on the aerodynamic characteristics in pitch and sideslip The investigation was made with the trailing-edge flaps deflected over a range of angles of attack from 8 deg to 32 deg The tests were made at a Mach number of 0 13, which corresponds to a Reynolds number of about 3,000,000 based on the wing reference chord Author

N78-21052*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
COMPARISON OF AERODYNAMIC DATA MEASURED IN AIR AND FREON-12 WIND-TUNNEL TEST MEDIUMS
William H Weller (Army Res and Technol Labs) Mar 1978 56 p refs
(NASA-TM-78671) Avail NTIS HC A04/MF A01 CSCL 01A

An experimental investigation was carried out to measure two dimensional static aerodynamic characteristics of a 65 sub I-213 airfoil in air and Freon-12 (dichlorodifluoromethane) test mediums at corresponding test conditions The purpose of the tests was to compare measurements in the two test mediums and to evaluate reported methods of converting Freon-12 data to equivalent air values The test article was a two dimensional wing instrumented to measure chordwise surface pressure distributions The parameters considered were Mach numbers from 0 6 to 1 0, angles of attack of zero deg and 1 deg, and Reynolds numbers based on model chord from 2,000,000 to 21,000,000 The agreement between data measured in the two test mediums is further improved by application of the transonic or area ratio similarity laws Where flow conditions are characterized by surface shocks or stall, the effects of flow separation may not be identically reflected in the Freon-12 data, even when converted in accordance with existing similarity laws Author

N78-21053*# Vought Corp , Hampton, Va Technical Center
LOW-SPEED AERODYNAMIC CHARACTERISTICS FROM WIND-TUNNEL TESTS OF A LARGE-SCALE ADVANCED ARROW-WING SUPERSONIC-CRUISE TRANSPORT CONCEPT
Paul M Smith Apr 1978 102 p refs
(Contract NAS1-13500)
(NASA-CR-145280) Avail NTIS HC A06/MF A01 CSCL 01A

Tests have been conducted to extend the existing low speed aerodynamic data base of advanced supersonic-cruise arrow wing configurations Principle configuration variables included wing leading-edge flap deflection wing trailing-edge flap deflection, horizontal tail effectiveness and fuselage forebody strakes A limited investigation was also conducted to determine the low speed aerodynamic effects due to slotted trailing-edge flaps Results of this investigation demonstrate that deflecting the wing leading-edge flaps downward to suppress the wing apex vortices provides improved static longitudinal stability, however, it also results in significantly reduced static directional stability The use of a selected fuselage forebody strakes is found to be effective in increasing the level of positive static directional stability Drooping the fuselage nose which is required for low-speed pilot vision, significantly improves the lateral-directional trim characteristics Author

N78-21054# Aeronautical Research Labs Melbourne (Australia)
A BRIEF EXAMINATION OF THE FLOW EXTERNAL TO AN F-111 INTAKE AT MACH 1 6
Murdoch Culley Jul 1975 39 p refs
(ARL/ME-Note-357) Avail NTIS HC A03/MF A01

A one-thirtieth scale wind tunnel model of the forward fuselage and intakes of an F-111 aircraft was used to investigate qualitatively, at Mach 1 6, the interference flows which occur in the vicinity of the intakes The intake configuration employed was based on the SWIP design, pre-cursor to the Triple Plow I configuration fitted to the Australian F-111c aircraft The intake mass flow was varied between supercritical and subcritical, with the model attitude varying between 0 and 9 degrees incidence and plus or minus 4 5 degrees of yaw The test Reynolds number, based on the model's intake diameter, was 80,000 The fuselage boundary layer was observed to be distorted by cross flows established through model incidence and yaw, causing it to thicken locally upstream of the intakes The fuselage boundary-layer splitter plate fitted to prevent the fuselage boundary-layer interacting with the intake shock system as well as to prevent its ingestion by the intakes was unable to digest the model boundary-layer This caused a severe three dimensional separation upstream of the splitter plate which interfered with the wing flow because of a shock generated at the fuselage separation Author

N78-21055*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
NUMERICAL STUDY OF TRANSONIC FLOW OVER OSCILLATING AIRFOILS USING THE FULL POTENTIAL EQUATION
Koji Isogai Apr 1978 41 p refs
(NASA-TP-1120 L-11984) Avail NTIS HC A03/MF A01 CSCL 01A

The behavior of unsteady aerodynamic loadings on airfoils oscillating in transonic flow has been investigated numerically with particular attention given to supercritical airfoil sections A previously developed finite difference method, which is based on the full potential equation and which uses a quasi-conservative scheme for proper capture of a shock wave motion, was employed for the present study The unsteady aerodynamic pressure and load distributions on several different airfoil sections are presented with particular emphasis on the effects of free-stream Mach number, reduced frequency, and mean angle of attack These parameters are demonstrated to have a significant effect on the behavior of the unsteady aerodynamic loadings Comparisons of the present calculations with the exact inviscid solution and with the experimental results are also presented Author

N78-21058*# Pratt and Whitney Aircraft Group East Hartford Conn
MEAN VELOCITY, TURBULENCE INTENSITY AND TURBULENCE CONVECTION VELOCITY MEASUREMENTS FOR A CONVERGENT NOZZLE IN A FREE JET WIND TUNNEL Final Report
C J McColgan and R S Larson Apr 1978 31 p refs
(Contract NAS3-17866)
(NASA-CR-2949 PWA-5506) Avail NTIS HC A03/MF A01 CSCL 01A

The effect of light on the mean flow and turbulence properties of a 0 056 m circular jet were determined in a free jet wind tunnel The nozzle exit velocity was 122 m/sec and the wind tunnel velocity was set at 0 12 37 and 61 m/sec Measurements of flow properties including mean velocity, turbulence intensity and spectra and eddy convection velocity were carried out using two linearized hot wire anemometers Normalization factors were determined for the mean velocity and turbulence convection velocity Author

N78-21059*# Nevada Univ , Las Vegas
UNSTEADY TWO DIMENSIONAL AIRLOADS ACTING ON OSCILLATING THIN AIRFOILS IN SUBSONIC VENTILATED WIND TUNNELS
Joseph Fromme and Michael Golberg May 1978 139 p refs (Grant NsG-2140)
(NASA-CR-2967) Avail NTIS HC A07/MF A01 CSCL 01A

The numerical calculation of unsteady two dimensional airloads which act upon thin airfoils in subsonic ventilated wind tunnels was studied Neglecting certain quadrature errors Bland's collocation method is rigorously proved to converge to the mathematically exact solution of Bland s integral equation and a three way equivalence was established between collocation, Galerkin s method and least squares whenever the collocation points are chosen to be the nodes of the quadrature rule used for Galerkin s method A computer program displayed convergence with respect to the number of pressure basis functions employed, and agreement with known special cases was demonstrated Results are obtained for the combined effects of wind tunnel wall ventilation and wind tunnel depth to airfoil chord ratio and for acoustic resonance between the airfoil and wind tunnel walls A boundary condition is proposed for permeable walls through which mass flow rate is proportional to pressure jump Author

N78-21060# Naval Ship Research and Development Center, Bethesda Md Aviation and Surface Effects Dept
EFFECT OF TURBULENT JET MIXING ON THE STATIC LIFT PERFORMANCE OF A POWER AUGMENTED RAM WING
William J H Smithey, Basil S Papadales Jr , and Harvey R Chaplin Sep 1977 19 p refs
(AD-A049620, DTNSRDC/ASED-389) Avail NTIS HC A01/MF A01 CSCL 20/4

Calculation procedures are developed using axisymmetric and two dimensional turbulent jet theory for predicting the static lift performance of a two dimensional power augmented ram wing The resulting lift prediction is found to be in good agreement with experimental data Author (GRA)

N78-21061# Naval Postgraduate School Monterey Calif
UNSTEADY, SURFACE PRESSURE AND NEAR-WAVE HOTWIRE MEASUREMENTS OF A CIRCULATION CONTROL AIRFOIL M S Thesis
Karl Aurel Kail IV Sep 1977 142 p refs
(AD-A050025) Avail NTIS HC A07/MF A01 CSCL 20/4

The large lift coefficient changes attainable with Circulation Control Airfoils through small changes in boundary layer blowing suggest rotary wing cyclic control can be obtained through modulation of the blowing Static pressure distributions were obtained to assess the unsteady behavior of a Circulation Control Rotor in a two-dimensional flow A constant-radius hotwire wake traversing mechanism was constructed to augment the pressure data and to study the flow phenomena occurring in the region of Coanda jet separation Through correlation of turbulence intensity data with pressure data it was discovered that the point of Coanda jet separation could be located using the hotwire The objective of these tests was accordingly expanded to include correlation of the location of separation with flow parameter variation GRA

N78-21062# Aeronautical Research Inst of Sweden Stockholm Aerodynamics Dept
TRANSONIC WIND TUNNEL TESTS ON TWO-DIMENSIONAL AEROFOIL SECTIONS. DETERMINATION

OF PRESSURE DISTRIBUTION AND DRAG FOR AN AEROFOIL WITH A MODIFIED NACA 65 SUB2-215 SECTION IN FFA WIND TUNNEL S5, PART 2 Interim Report

Goeran Ehn 1977 138 p refs
(Contracts F-INK-11-12-83343 F-INK-11-12-02871
F-INK-07-11966/02871, F-INK-07-21898
F-INK-82223-76-001-21-001)
(FFA-TN-AU-725) Avail NTIS HC A07/MF A01

A two-dimensional airfoil model was investigated in FFA S5 0 25 sq m wind tunnel with a modified NACA 652-215 section The modifications consisted of a decrease in the mean line chamber and a change of the thickness distribution over the rear part of the airfoil compared to the nominal section The Reynolds number based on the airfoil chord length was in the range 2 million < or = Re < or = 2 3 million Models with the same section were tested earlier at the National Aeronautical Establishment Canada at Reynolds numbers in the range 5 million < or = Re < or = 35 million By means of tests with different locations of transition trips it was attempted to establish to what degree a simulation of these high Reynolds' number flow conditions could be achieved in wind tunnel S5 The test program included airfoil pressure distribution measurements and wake drag measurements in the Mach number range 0 6 < or = free stream Mach < or = 0 75 for angles of attack of alpha = 0 deg 1 5 deg 20 deg and 40 deg Sublimation tests and flow visualization tests were also performed

Author (ESA)

N78-21063# National Transportation Safety Board Washington, D C

SPECIAL STUDY EMERGENCY LOCATOR TRANSMITTERS, AN OVERVIEW

26 Jan 1978 33 p refs
(NTSB-AAS-78-1) Avail NTIS HC A03/MF A01

A review of emergency locator transmitter (ELT) problems and efforts to solve these problems, and a survey of the current situation was conducted Statistical data from the National Transportation Safety Board and the Air Force Rescue Coordination Center for 1975 and 1976 is used in this study Numerous discussions were held with a substantial segment of the ELT and search and rescue community including those organizations specifically addressing the current ELT problems Further an intensive review of the ELT resource literature was completed including technical papers general articles, and communications from many of those organizations concerned with the ELT and search and rescue

Author

N78-21064# National Transportation Safety Board, Washington D C

AIRCRAFT ACCIDENT REPORT SOUTHERN AIRWAYS INC, DC-9-31, N1335U, NEW HOPE, GEORGIA, APRIL 4, 1977

26 Jan 1978 109 p
(NTSB-AAR-78-3) Avail NTIS HC A06/MF A01

The National Transporation Safety Board determined that the probable cause of this accident was the total and unique loss of thrust from both engines while the aircraft was penetrating an area of severe thunderstorms The loss of thrust was caused by the ingestion of massive amounts of water and hail which in combination with thrust lever movement induced severe stalling in and major damage to the engine compressors Major contributing factors included the failure of the company s dispatching system to provide the flightcrew with up-to-date severe weather information pertaining to the aircraft's intended route of flight, the captain's reliance on airborne weather radar for penetration of thunderstorm areas, and limitations in the Federal Aviation Administration s air traffic control system which precluded the timely dissemination of real-time hazardous weather information to the flightcrew

Author

N78-21066# Arinc Research Corp Annapolis Md

INVESTIGATION TO SUPPORT PHASE 1 OF THE USAF MIDAIR PREVENTION SYSTEMS PROGRAM (MAPS) Final Report, Jun - Oct 1977

F Crum K Haspert S Koualski N Sullivan and J Underwood Oct 1977 105 p refs
(Contract F09603-77-A-3104)
(AD-A049743 ASD-TR-77-76 Rept-1942-01-1-1676) Avail NTIS HC A06/MF A01 CSCL 01/2

The objectives of the study presented in this report were to further define USAF requirements and objectives in reducing midair collisions establish organizational relationships and participation in midair prevention efforts investigate possible alternative methods to reduce USAF midair collisions and further define follow-on phases of the Midair Prevention Systems (MAPS) program that the USAF could undertake to reduce midair collision potential This report provides background information and analysis on the midair collision experiences of the USAF from 1968 through June 1977 and the near midair collision experiences from 1975 through June 1977 The midair and near midair collision information is analyzed from many different aspects such as altitude type flight plan category of aircraft mission activity commands and phase of flight Midair collision programs were identified and actions that could be taken by the USAF to reduce midair collision potential are specified This report also identifies various organizations that would be involved with the USAF midair problem and identifies their relationships in attempting to reduce the midair potential The report also discusses the FAA and civilian viewpoints and activities as they relate to midair collision prevention

Author (GRA)

N78-21068# Radio Corp of America Van Nuys Calif Electromagnetic and Aviation Systems Div

BEARING STUDY PROGRAM Final Report

Ernest Jellinek Walter Kram M Levinsen O M Woodward, and Bernard Case Apr 1974 429 p refs
(Contract N62269-73-C-0906)
(AD-A049767 RCA-EASD-TP-2146) Avail NTIS HC A19/MF A01 CSCL 01/2

A study was conducted to assess the feasibility and define the system accuracy and equipment required to add a bearing measurement subsystem to the SECANT Collision Avoidance System (CAS) The results indicate the feasibility of achieving the accuracy required to serve useful functions Equipment configurations required for Proximity Warning Indicator and CAS applications were evolved and are presented in detail in this study The approach utilizes a ring array antenna consisting of vertical monopoles interconnected by stripline It has a high accuracy outer ring of 16 monopoles, an inner ring of 4 monopoles for resolving ambiguities and a central reference monopole The array receives the signals transmitted by any of the equipment types in the SECANT family and the relative bearing is determined by measuring the phase difference between the signals in the reference monopole and in the rings Random errors are minimized by integration of the high pulse rate, frequency hopped signals Predicted overall error is 1 degree one sigma with a bias component of 0 8 degree and a random component of 0 5 degree An antenna array was constructed and tests in an anechoic chamber confirmed the validity of the design approach

GRA

N78-21071# Advisory Group for Aerospace Research and Development, Paris (France)

APPLICATIONS OF ADVANCES IN NAVIGATION TO GUIDANCE AND CONTROL

Feb 1978 279 p refs Partly in ENGLISH and FRENCH Presented at the 24th Technical Meeting of the Guidance and Control Panel Stuttgart, 10-13 May 1977
(AGARD-CP-220, ISBN-92-835-0211-6) Avail NTIS HC A13/MF A01

Conference proceedings on the application of advances in navigation to guidance and control are reported Topics discussed include (1) improvements in inertial navigation systems and their applications (2) improvements in radar and radio navigation aids and their applications (3) specific functions and system concepts (4) new major systems, and (5) system improvements and concepts

N78-21073# Singer Co Little Falls N J Kearfott Div
NEW TECHNIQUES FOR LOW COST STRAPDOWN INERTIAL SYSTEMS
P M Brodie and C R Giardina *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 13 p refs

Avail NTIS HC A13/MF A01

A number of techniques which can be employed to make a redundant strapdown configuration feasible is addressed The major topics discussed are concept of self contained redundancy, and modular reliability comparisons J C S

N78-21074# Societe Nationale Industrielle Aerospatiale, Toulouse (France)
INERTIAL SMOOTHING AND EXTRAPOLATION OF ILS BEAMS APPLICATION TO THE AIRBUS A 300 B
J Irvoas, D Buisson, P Lloret (SAGEM Paris), and X Lagarde (SAGEM, Paris) *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 49 p refs In ENGLISH and FRENCH

Avail NTIS HC A13/MF A01

The hybrid radio inertial guidance system described in this report performs the following functions (1) smoothing of the aircraft's flight path during an ILS automatic approach, (2) a very marked reduction in the lateral movements of the aircraft around its center of gravity and in the deflection of the control surface due to LOC beam noise (3) the continuance of guidance in the event of failure of the LOC receiver, (4) in the event of serious or sudden failures which interfere with guidance of the aircraft, the LISS system dispenses with the need for LOC signals and reduces any deviation movements of the aircraft The system requires only a relatively low performance inertial unit, although one with a higher performance would improve the overall system Author

N78-21077# Rohde and Schwartz Munich (West Germany)
UHF DF TRIANGULATION SYSTEM FOR CONTROL AND GUIDANCE OF MILITARY AIRCRAFT
Bernhard F Ernst *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 7 p

Avail NTIS HC A13/MF A01

A system for the guidance of aircraft from ground stations is discussed The system consists essentially of a network of direction finders and is intended to complement rather than replace conventional radars and other landing aids normally installed at airports As a guidance technique a network of direction finders offers the advantage of surface coverage or it permits a form of surface navigation The system has a further advantage of particular significance in emergency situations such as may follow an error in navigation or a loss of fuel nothing more than an operational radio set need be available on board the aircraft before use can be made of the DF guidance network This feature can also be useful in the guidance of military aircraft since as practice has shown, maneuvers at low level can often take the aircraft outside the airspace covered by ground-based radars Author

N78-21078# Standard Electrik Lorenz A G Stuttgart (West Germany)
PRECISE ENROUTE NAVIGATION BASED ON GROUND-DERIVED TECHNIQUES
G Blaschke and G Peuker *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 13 p refs

Avail NTIS HC A13/MF A01

A solution is offered by a ground-derived concept for azimuth measurement It is based on the standard L-band DME using also the existing airborne DME set The DME interrogation pulses of the aircraft are received at the ground via a special antenna array by DF equipment that allows immediate determination of angle of incidence This angle is sent back to the aircraft by a third pulse synchronized with the according DME reply In the aircraft a search and track system extracts the 'angle reply', the time delay of which relative to the DME reply, represents angle information The signal format is the key element of the system, allowing for simplicity of airborne equipment and flexibility of ground stations Basic error considerations show that errors due to airborne signal processing can be neglected and that the ground system can be adapted to a large extent to the special multipath environment This allows the deployment of ground stations tailored to a special site leading to very economic solutions also on the ground Implementation of airborne equipment is described followed by a more detailed presentation of ground station design (DME transponder, antenna array receiver multiple, processing method, transmitter and data encoder calibration and monitoring) Author

N78-21081# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt Brunswick (West Germany) Inst fuer Flugfuehrung
ACCURACY CONSIDERATIONS ON NEW MICROWAVE LANDING SYSTEMS (MLS) FROM AN OPERATIONAL POINT OF VIEW
Alfred Becker *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 15 p refs

Avail NTIS HC A13/MF A01

Some selected problems are dealt with related to the accuracy of the different systems from an operational point of view Some general remarks to the International Civil Aviation Organization (ICAO) Microwave Landing Systems (MLS) competition are presented, along with ICAO Accuracy Requirements on the new MLS Also presented are discussions on the performance of the system and flare guidance problems Some perspective considerations are given as an indication of possible future performance improvements Author

N78-21082# Lear Siegler, Inc Grand Rapids Mich Instrument Div
A MULTI-SENSOR IMPLEMENTATION FOR NAVIGATION, POSITION LOCATION, POSITION UPDATE, RECONNAISSANCE, AND WEAPON DELIVERY AN/ARN-101(V)
F E Pickel *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 9 p

Avail NTIS HC A13/MF A01

The AN/ARN-101(V) is a digital system developed to replace and/or functionally improve the present avionics in the USAF F-4E and RF-4C aircraft It upgrades the operational capability of the total weapon system through a multi-sensor implementation for navigation, offset aim point and target location weapon delivery and reconnaissance The navigation position locating, and position updating capabilities utilize a digital Inertial Measurement Unit (IMU) loran, fire control or mapping radar, Pave Tack TISEO (Electro-Optical Target Identification System), and Lead Computing Optical Sight System (LCOSS) interfaces Performance features include long-range and tactical navigation all-weather blind bombing adverse weather landing approach, uncanned weapon delivery profiles and automatic reconnaissance steering Author

N78-21083# Rockwell International Corp, Cedar Rapids Iowa Collins Avionics Div
A 4D APPROACH CONTROL USING VOR/DME/ILS GUIDANCE
Juergen M H Bruckner and Thomas G Sharpe *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 15 p

Avail NTIS HC A13/MF A01

A study is presented to design, develop and implement a 4D approach control system using conventional aircraft sensors and displays augmented with area navigation capability The goal was to arrive at a system capable of retrofit with most air transport aircraft Multifunction CRT (MAP) displays and inertial complementation were to be avoided The only equipment item required in the final design is a Mark 2 type RNAV system capability used specifically to automatically define the nominal multiple-ordered-leg 4D RNAV approach path The capability for

close-in ILS captures (including those from above) was also included to allow for diverse aircraft separation and noise abatement requirements Author

N78-21087# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt Brunswick (West Germany) Inst fuer Flugfuehrung

IMPROVED AIRCRAFT TRACKING USING MANEUVER STATISTICS ENROUTE AND IN THE TERMINAL AREA

Ulrich Brokof *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 9 p refs

Avail NTIS HC A13/MF A01

By means of radar tracking it is possible to estimate continuously the dynamic state of an aircraft from discrete radar data This is necessary, for instance, when investigating collision risks In this paper autocorrelation functions have been computed from acceleration data The autocorrelation function could be approximated by a model which corresponds to a periodic random variable The model itself as well as the model parameters gives an indication of how to improve radar tracking algorithm (additional parameters) A simple and an extended model are practically tested in view of predicting properties The same example is used to show how it is possible to improve radar tracking by aiding lateral acceleration with the roll angle information of the aircraft via a data link between the control centre and the aircraft Author

N78-21090# Ferranti Ltd , Edinburgh (Scotland)

NAVIGATION, GUIDANCE AND CONTROL FOR HIGH PERFORMANCE MILITARY AIRCRAFT

W H McKinlay *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 12 p refs

Avail NTIS HC A13/MF A01

The paper discusses some of the factors involved in applying advanced navigation to an aircraft operating at low altitude for reconnaissance or to locate and attack ground targets It considers the distinctions between navigation accuracy and the accuracy with which a pilot can follow a given flight profile There are references to target acquisition and the need to pre-plan the profile Recent Ferranti developments in the display of navigation information coupled with a level of automatic pre-planning are discussed Author

N78-21091# Systems Control, Inc , West Palm Beach, Fla

AREA NAVIGATION SYSTEMS AND PROCEDURES

Donald W Richardson and James S Tyler *In* AGARD Appl of Advan in Navigation to Guidance and Control Feb 1978 9 p refs

Avail NTIS HC A13/MF A01

An attempt to identify, in pragmatic user-related terms the operational significance of the overall concept of area navigation (RNAV) is presented Its purpose is to explore, over a range of users and missions, the spectrum of functions and capabilities that this generic navigation technique offers Starting with a summary of the correlation between current navigation systems both civilian and military and the concept of area navigation, the main content of the paper deals with two major issues, the current status of RNAV research, and future applications of RNAV The current status is reviewed in the light of the results of extensive operational and cost benefit studies Two illustrative examples of RNAV operational applications are discussed, namely the use of RNAV to facilitate complex noise abatement profiles, and the application of RNAV techniques to improve the efficiency of airborne search and rescue operations Author

N78-21092*# Northwestern Univ , Evanston Ill Transportation Center

FACTORS AFFECTING THE RETIREMENT OF COMMERCIAL TRANSPORT JET AIRCRAFT Progress Report

Frank A Spencer and Joseph A Swanson 15 Feb 1978 209 p refs

(Grant NsG-2149)

(NASA-CR-152115, PR-2) Avail NTIS HC A10/MF A01 CSCL 01C

A brief historical background of the technology and economics of aircraft replacement and retirement in the prejet era is presented to see whether useful insights can be obtained applicable to the jet era Significant differences between the two periods were demonstated Current technological and operational economic perspectives were investigated in detail Some conclusions are drawn to aircraft retirement policies Author

N78-21093*# Boeing Vertol Co Philadelphia Pa

RESEARCH REQUIREMENTS TO IMPROVE RELIABILITY OF CIVIL HELICOPTERS

John J Dougherty III and Lawrence D Barrett Apr 1978 114 p refs

(Contract NAS1-13624)

(NASA-CR-145335) Avail NTIS HC A06/MF A01 CSCL 01C

The major reliability problems of the civil helicopter fleet as reported by helicopter operational and maintenance personnel are documented An assessment of each problem is made to determine if the reliability can be improved by application of present technology or whether additional research and development are required The reliability impact is measured in three ways (1) The relative frequency of each problem in the fleet (2) The relative on-aircraft manhours to repair, associated with each fleet problem (3) The relative cost of repair materials or replacement parts associated with each fleet problem The data reviewed covered the period of 1971 through 1976 and covered only turbine engine aircraft Author

N78-21094*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

EFFECT OF HIGH LIFT FLAP SYSTEMS ON THE CONCEPTUAL DESIGN OF A 1985 SHORT-HAUL COMMERCIAL STOL TILT ROTOR TRANSPORT

Michael D Shovlin and Bruno J Gambucci Apr 1978 29 p refs

(NASA-TM-78474 A-7364) Avail NTIS HC A03/MF A01 CSCL 01C

The performances of a derivative concept of a 1985 STOL tilt rotor transport and of a second concept having a complex mechanical flap system similar to a short field B737 aircraft were compared for a 370 kilometer (200 nautical mile) short haul mission The flap system of the latter allowed lift to be shifted from the rotor system to the wing, permitting a 26 percent reduction in dynamic component weight while also permitting the use of a smaller wing The wing and disc loading of this concept were 5746 (120 psf) and 1915 (40 psf) newtons per square meter respectively while the wing and disc loading of the derivative concept were 4788 (100 psf) and 1197 (25 psf) newtons per square meter respectively The high lift wing tilt rotor showed slightly improved fuel usage over its entire operating range and about 6 to 8 percent improvement in direct operating costs resulting from its improved cruise efficiency and reduced weight Other advantages include improved reliability with potentially reduced maintenance and better riding quality Author

N78-21095*# Lockheed-California Co Burbank Commercial Advanced Design Div

FUEL CONSERVATION MERITS OF ADVANCED TURBOPROP TRANSPORT AIRCRAFT Final Report, Jan - Aug 1977

J D Revell and R H Tullis Aug 1977 154 p refs

(Contract NAS2-8612)

(NASA-CR-152096, LR-28283) Avail NTIS HC A08/MF A01 CSCL 01C

The advantages of a propfan powered aircraft for the commercial air transportation system were assessed by the comparison with an equivalent turbofan transport Comparisons were accomplished on the basis of fuel utilization and operating costs, as well as aircraft weight and size Advantages of the propfan aircraft, concerning fuel utilization and operating costs, were accomplished by considering (1) incorporation of propfan performance and acoustic data (2) revised mission profiles (longer design range and reduction in, and cruise speed), and (3) utilization of alternate and advanced technology engines Author

N78-21096*# Old Dominion Univ, Norfolk, Va Research Foundation

EXPERIMENTAL INVESTIGATION OF EFFECT OF JET DECAY RATE ON JET-INDUCED PRESSURES ON A FLAT PLATE Final Report

John M Kuhlman, Don S Ousterhout, and Ronald W Warcup Washington NASA Apr 1978 81 p refs

(Grant NGL-47-003-039)

(NASA-CR-2979) Avail NTIS HC A05/MF A01 CSCL 01C

An experimental study of the interaction between a lift jet and an aircraft wing for a jet VTOL aircraft was performed for the simplified model of an unheated, subsonic, circular jet exiting at right angles to a flat plate into a uniform subsonic crosswind The effects of jet dynamic pressure decay rate upon the jet location and jet induced pressure distribution on the plate were studied over a range of jet to crossflow velocity ratios of 2 2 < or = R < or = 10 Jet decay rate was varied through use of cylindrical centerbodies with flat or hemispherical tips submerged in the jet nozzle at various depths below the jet exit plane Quicker jet dynamic pressure decay caused by the presence of a centerbody, resulted in reductions in the jet induced lift loss by as much as 45 percent relative to values for jets with no centerbody These reductions in lift loss were observed at the larger values of crossflow velocity Author

N78-21097# AiResearch Mfg Co, Torrance, Calif

DESIGN, FABRICATION, AND TESTING OF A FULL-SCALE BREADBOARD IN NITROGEN GENERATOR FOR FUEL TANK INERTING APPLICATION Final Technical Report, Jun 1975 - Sep 1977

Scott A Manatt Sep 1977 130 p refs Prepared in cooperation with Dow Chemical Co Walnut Creek, Calif

(Contract DOT-FA75WA-3658)

(AD-A049459 AiResearch-77-14376, FAA-RD-77-147) Avail NTIS HC A07/MF A01 CSCL 01/3

Aircraft fuel tank ullage may contain a mixture of fuel vapor in air that presents a fire and explosion hazard This hazard can be eliminated if the air is replaced by an inert gas containing insufficient oxygen to allow ignition Fuel tank inerting systems using onboard storage of liquid nitrogen to supply the inert gas have been demonstrated by the FAA and others and have been retrofitted into some U S Air Force transport aircraft Tests by NAFEC and the Air Force have shown that fuel ullage oxygen concentration must be reduced to 9 percent or less to protect against ignition sources The use of hollow fiber permeable membranes in an onboard inert gas generator (IGG) fuel tank inerting system has been shown to be a feasible alternative to systems using stored liquid nitrogen which must be periodically replenished A program to optimize the permeable membrane geometry generate data required for system design and to design, fabricate and test full-scale breadboard permeable membrane air separation modules was conducted using the McDonnell-Douglas DC-9 aircraft as a design baseline Results of membrane development, full-scale breadboard module design and testing are reported a preliminary design is presented for a hollow fiber permeable membrane IGG system for the DC-9, and ownership considerations for the airborne system design, including a life cycle cost analysis are discussed Author (GRA)

N78-21098# Boeing Vertol Co, Philadelphia, Pa

BEARINGLESS TAIL ROTOR LOADS AND STABILITY Final Report, Mar 1975 - Jan 1976

W T Edwards and W Miao Nov 1977 289 p refs

(Contract DAAJ02-75-C-0017, DA Proj 1F2-62209-AH-76)

(AD-A049579, D210-11025-1, USAAMRDL-TR-76-16) Avail NTIS HC A13/MF A01 CSCL 01/3

Four wind tunnel model tests were conducted on a model flex-strap bearingless tail rotor for aeroelastic stability characteristics and loads In all, 12 individual rotor parameters were investigated to determine their effect on aeroelastic stability All data required to define the structural and aerodynamic characteristics of the basic model and structural data required to define the test stand and drive system are presented In addition the physical properties required to describe the various parameters are documented, thus providing a complete description of each configuration tested The effect of each test parameter on the aeroelastic stability boundaries is indicated through plots of actual measured boundaries Where available the alternating strap loads for these configurations are presented A limited amount of analysis was conducted and seemed to correlate with the test results GRA

N78-21099# Raytheon Co, Sudbury Mass

A REVIEW OF METHODOLOGIES AND CONCEPTS TO MEASURE AND EVALUATE AIRCRAFT SURVIVABILITY/VULNERABILITY Final Report

R Smith A S Soltes, J K Wetzel and L R Doyon Jan 1978 109 p refs

(Contract F33615-73-C-0678)

(AD-A050152, ER74-4435 JTCG/AS-75-S-002) Avail NTIS HC A06/MF A01 CSCL 01/3

This report is a summary of all significant studies performed by the Raytheon Company during the JTCG/AS TEAS program The studies encompass primarily three areas survivability assessment modeling, mission cost-effectiveness methodology, and survivability assessment studies In the survivability assessment modeling area, several aircraft attrition models were evaluated to determine their applicability to the TEAS effort, and modeling deficiences were identified In addition attrition modeling requirements were outlined (again with the TEAS objectives in mind) to establish a more effective baseline model, and modeling validation techniques were studied to establish model credibility A mission cost-effectiveness methodology is described to assist the Survivability Assessment Subgroup in the evaluation of the baseline aircraft Following the definition of a generalized mission effectiveness/survivability model, a cost model based on the WESIAC method was outlined and a sample problem was described to demonstrate a typical application to the TEAS program Finally survivability assessment studies were performed to provide examples of how current survivability methodologies could be applied to the study of aircraft attrition GRA

N78-21100# Naval Air Development Center, Warminster Pa Aircraft and Crew Systems Technology Directorate

A-4F BLUE ANGEL FLIGHT USAGE DATA, 1976 Final Report

K I Leikach and G A Bohannon 15 Oct 1977 70 p refs

(AD-A050164, NADC-77287-60) Avail NTIS HC A04/MF A01 CSCL 01/3

This report presents flight usage data which is used for monitoring individual Blue Angel aircraft structural fatigue life Data identify operational trends that are beneficial/detrimental to prolonging aircraft fatigue life A total of 2700 4 hours of counting accelerometer data and 363 2 hours of oscillograph data were processed and are presented This data provides the basis for flight spectra development of Blue Angel mission utilizations as well as information concerning point in the sky assumptions required for fatigue analyses Author (GRA)

N78-21101# Douglas Aircraft Co Inc, Long Beach Calif

EVALUATION OF WINDSHIELD MATERIALS SUBJECTED TO SIMULATED SUPERSONIC FLIGHT Final Report, Jun 1976 - Aug 1977

J B Hoffman Sep 1977 150 p refs

(Contract F33615-75-C-3105)

(AD-A049981, MDC-J7171 AFFDL-TR-77-92) Avail NTIS HC A07/MF A01 CSCL 01/3

Candidate laminated and monolithic transparent plastic materials for aircraft windshields subjected to supersonic aerodynamic heating and pressure are evaluated by wind tunnel testing at realistic Mach numbers and altitudes for high performance aircraft The reliability of the face-ply material is ascertained and the transparency optical effects are assessed during flight operating conditions and as a result of these conditions Author (GRA)

N78-21102# Naval Postgraduate School, Monterey, Calif

REPORT ON AIRCRAFT FATIGUE STUDIES Interim Report, 1 Jul. 1976 - 30 Sep 1977

Gerald H Lindsey 30 Sep 1977 36 p refs
(AD-A049876, NPS-67LI77091) Avail NTIS HC A03/MF A01 CSCL 01/3

This report summarizes a year of research activity on aircraft fatigue in three areas (1) The influence of minimum load levels, ground loads, order of loading and counting method on the damage calculation, (2) The method of calculating local stress in the plastic range at the stress concentration site from the recorded in-flight strain monitor and (3) The measurement of relaxation of residual stresses after they are produced locally at the point of stress concentration Substantial progress was made in all three areas and especially the first two Author (GRA)

N78-21103# Hindustan Aeronautics Ltd Bangalore (India)
MULTI-VARIATE OPTIMIZATION PROBLEMS OF FLIGHT VEHICLE SYNTHESIS
Sridhar M Ramachandra Jan 1978 42 p refs
(PB-276123/7) Avail NTIS HC A03/MF A01 CSCL 01C

Attempts were made to delineate the multitechnology, multi-variate nature of the flight vehicle and the complex interactions between the various areas involved in its synthesis Considerations arising in the choice and configuration layout of the hardware for tactical aircraft are outlined A brief mathematical formulation of a system oriented approach to design is proposed for optimizing the flight vehicle parameters GRA

N78-21104*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
RESULTS OF A SIMULATOR TEST COMPARING TWO DISPLAY CONCEPTS FOR PILOTED FLIGHT-PATH-ANGLE CONTROL
Wendell W Kelley Mar 1978 23 p refs
(NASA-TM-78692) Avail NTIS HC A02/MF A01 CSCL 01D

Results of a simulator experiment which was conducted in order to compare pilot gamma-control performance using two display formats are reported Pilots flew a variable flight path angle tracking task in the landing configuration Pilot and airplane performance parameters were recorded and pilot comments noted for each case Author

N78-21105# Rockwell International Corp Los Angeles Calif Aircraft Div
FIBER OPTICS COST ANALYSIS PROGRAM (FOCAP) Final Report, 30 Jun 1976 - 30 Jun 1977
C C Zelon J E Cassidy and R G Shipley Sep 1977 255 p refs
(Contract F33615-76-C-1260)
(AD-A049859 NA-77-729 AFAL-TR-77-190) Avail NTIS HC A12/MF A01 CSCL 20/6

The significance of this research is that it establishes methods for comparing the life cycle cost of fiber optics and wire data transfer systems on large military aircraft, and uses those methods to perform cost analyses on the data transfer subsystems Using the B-1 as an example the applicability of fiber optics to the B-1 avionics/electrical systems was identified Conceptual fiber optics data transfer systems were designed The present wire and the conceptual fiber optics designs formed a basis for computerized life cycle cost comparisons Sensitivity analyses and cost trade-offs were performed to determine cost drivers in the application of fiber optics Results show significance cost benefits can be gained by the implementation of fiber optics in data transfer subsystems having data rates in excess of 2 to 3 megabits per second GRA

N78-21107*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
RECTANGULAR CAPTURE AREA TO CIRCULAR COMBUSTOR SCRAMJET ENGINE
S Zane Pinckney Mar 1978 45 p refs
(NASA-TM-78657) Avail NTIS HC A03/MF A01 CSCL 21E

A new concept for a scramjet engine design was presented The inlet transformed a rectangular shaped capture stream into a cross section which was almost circular in shape at the inlet throat or combustor entrance The inlet inner surface was designed by the method of streamline tracing The high pressure and temperature regions of the combustor were almost circular in shape and thus the benefits of hoop stresses in relation to structural weight could be utilized to reduce combustor and engine weights The engine had a center body consisting of a 20 deg included angle cone followed by a constant diameter cylinder Fuel injection struts were arranged in a radial array and were swept 54 deg from the center body to the inlet inner surface and had values of length to maximum average thickness between 5 6 and 6 6 which were felt to be structurally reasonable Combustor wetted areas were shown to be less than those of the present fully rectangular engine concept Author

N78-21109*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
GAS PATH SEALING IN TURBINE ENGINES
Lawrence P Ludwig 1978 44 p refs Presented at AGARD Power Energetics and Propulsion Panel Meeting on Seal Technol in Gas Turbine Engines London, 6-7 Apr 1978
(NASA-TM-73890 E-9505) Avail NTIS HC A03/MF A01 CSCL 21E

A survey of gas path seals is presented with particular attention given to sealing clearance effects on engine component efficiency The effects on compressor pressure ratio and stall margin are pointed out Various case-rotor relative displacements, which affect gas path seal clearances are identified Forces produced by nonuniform sealing clearances and their effect on rotor stability are discussed qualitatively, and recent work on turbine-blade-tip sealing for high temperature is described The need for active clearance control and for engine structural analysis is discussed The functions of the internal-flow system and its seals are reviewed Author

N78-21112*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
AIRFLOW AND THRUST CALIBRATION OF AN F100 ENGINE, S/N P680059, AT SELECTED FLIGHT CONDITIONS
Thomas J Biesiadny, Douglas Lee and Jose R Rodriguez Apr 1978 27 p refs
(NASA-TP-1069, E-9257) Avail NTIS HC A03/MF A01 CSCL 21E

An airflow and thrust calibration of an F100 engine, S/N P680059 was conducted to study airframe propulsion system integration losses in turbofan-powered high-performance aircraft The tests were conducted with and without thrust augmentation for a variety of simulated flight conditions with emphasis on the transonic regime The resulting corrected airflow data generalized into one curve with corrected fan speed while corrected gross thrust increased as simulated flight conditions increased Overall agreement between measured data and computed results was 1 percent for corrected airflow and -1 1/2 percent for gross thrust The results of an uncertainty analysis are presented for both parameters at each simulated flight condition Author

N78-21114*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
THEORETICAL FLOW CHARACTERISTICS OF INLETS FOR TILTING-NACELLE VTOL AIRCRAFT
Michael A Boles Rogers W Luidens and Norbert O Stockman Apr 1978 31 p refs
(NASA-TP-1205 E-9387) Avail NTIS HC A03/MF A01 CSCL 21E

The results of a theoretical investigation of geometric variables for lift-cruise-fan tilting nacelle inlets operating at high incidence angles are presented These geometric variables are investigated for their effects on surface static to free stream pressure ratio, and the separation parameters of maximum to diffuser exit surface velocity ratio and maximum surface Mach number for low speed operating conditions The geometric parameters varied were the internal lip contraction ratio, external forebody to diffuser exit diameter ratio external forebody length to diameter ratio and internal lip major to minor axis ratio Author

N78-21115*# Rao and Associates Inc Palo Alto Calif
USE OF LEANING VANES IN A TWO STAGE FAN
G V R Rao and R V Digumarthi Nov 1975 53 p refs (Contract NAS2-8680)
(NASA-CR-152134) Avail NTIS HC A04/MF A01 CSCL 21E

The use of leaning vanes for tone noise reduction was examined in terms of their application in a typical two-stage high pressure ratio fan In particular for stages designed with outlet guide vanes and zero swirl between stages leaning the vanes of the first stage stator was studied since increasing the number of vanes and the gap between stages do not provide the desired advantage It was shown that noise reduction at higher harmonics of blade passing frequency can be obtained by leaning the vanes Author

N78-21116*# Massachusetts Inst of Tech Cambridge
NITRIC OXIDE FORMATION IN GAS TURBINE ENGINES A THEORETICAL AND EXPERIMENTAL STUDY
Ph D Thesis - Nov 1975 Final Report
Thomas Mikus, John B Heywood, and R Edward Hicks Washington NASA Apr 1978 106 p refs
(Grant NGR-22-009-378)
(NASA-CR-2977) Avail NTIS HC A06/MF A01 CSCL 21E

A modified Zeldovich kinetic scheme was used to predict nitric oxide formation in the burned gases Nonuniformities in fuel-air ratio in the primary zone were accounted for by a distribution of fuel-air ratios This was followed by one or more dilution zones in which a Monte Carlo calculation was employed to follow the mixing and dilution processes Predictions of NOX emissions were compared with various available experimental data and satisfactory agreement was achieved In particular the model is applied to the NASA swirl-can modular combustor The operating characteristics of this combustor which can be inferred from the modeling predictions are described Parametric studies are presented which examine the influence of the modeling parameters on the NOX emission level A series of flow visualization experiments demonstrates the fuel droplet breakup and turbulent recirculation processes A tracer experiment quantitatively follows the jets from the swirler as they move downstream and entrain surrounding gases Techniques were developed for calculating both fuel-air ratio and degree of nonuniformity from measurements of CO2 CO O2 and hydrocarbons A burning experiment made use of these techniques to map out the flow field in terms of local equivalence ratio and mixture nonuniformity Author

N78-21117# Air Force Systems Command Wright-Patterson AFB Ohio
FUEL PRESSURE INCREASE LIMITER
Yu M Akhmetov V I Bolshagin, A A Ryzhov V S Dyakonov and M A Medvedeva 26 Jul 1977 10 p Transl into ENGLISH from Patent (USSR) no 339672 24 May 1972 p 1-2
(AD-A049393 FTD-ID(RS)T-1249-77) Avail NTIS HC A02/MF A01 CSCL 01/3

The invention belongs to the field of the automatic control of turbojet engines in particular to fuel pressure increase limiters Known are fuel pressure increase limiters predominantly for a turbojet engine which contain a spring-opposed servopiston with a rod, the cavities of which are connected by channels with a constant pressure valve and a control slid valve The purpose of the invention is to provide the optimal rate of pressure increase To do this made in the rod are additional channels connected to both cavities of the servodrive by means of holes which are provided in its body GRA

N78-21118# Advisory Group for Aerospace Research and Development, Paris (France)
HIGH TEMPERATURE PROBLEMS IN GAS TURBINE ENGINES
Feb 1978 585 p refs Presented at the 50th Meeting of the AGARD Propulsion and Energetics Panel Ankara 19-23 Sep 1977
(AGARD-CP-229 ISBN-92-835-0209-4) Avail NTIS HC A25/MF A01

The design and operation of gas turbines at high turbine inlet temperatures are considered Emphasis is placed on turbine cooling techniques high temperature materials and coatings combustors afterburners and nozzles the effect of cooling on aerodynamic performance and prediction methods

N78-21120# Rolls-Royce Ltd Bristol (England) Aero Div
PROJECT OPTIMISATION OF MILITARY GAS TURBINES WITH RESPECT TO TURBINE LIFE
E A White and M J Holland *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 17 p

Avail NTIS HC A25/MF A01

Computerized analytical techniques developed for examining the characteristics of high pressure turbine blades under the various stresses of operation are considered Emphasis is placed on turbine service life and cooling requirements for military aircraft in terms of and developing a cost effective weapon system J M S

N78-21121# Turbomeca S A - Brevets Szydlowski, Bizanos (France)
PROBLEMS CONCERNING HIGH TEMPERATURES IN SMALL TURBOMACHINES [PROBLEMES DES HAUTES TEMPERATURES DANS LES PETITES TURBOMACHINES]
P Belaygue *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 12 p In FRENCH

Avail NTIS HC A25/MF A01

The power of small aeronautical turbomachinery is discussed in detail Problems arising from elevating temperature and pressure at the turbine entrance which affect components such as the compressor as well as the combustion chamber and the turbine were examined The aerodynamic and thermodynamic limitations that occur due to this rise in temperature and pressure are also summarized in relation to the small dimensions of the components Transl by B B

N78-21125# Motoren- und Turbinen-Union Muenchen G m b H (West Germany)
HOT CASCADE TEST RESULTS OF COOLED TURBINE BLADES AND THEIR APPLICATION TO ACTUAL ENGINE CONDITIONS
H Koehler D K Hennecke, K Pfaff, and R Eggebrecht *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 12 p refs
Avail NTIS HC A25/MF A01

Experimental results of the cooling performance of various convection and film cooled turbine blade models in a two dimensional stationary cascade are presented The Reynolds number and the cooling air/main stream mass flow ratio were varied within a range which is typical for turbine rotor blades in jet engines From the analysis of the test results basic understanding about the characteristics of cooling effectiveness and about the distribution of the hot gas side heat transfer coefficient was obtained In applying model test results to a real engine the differences between cascade and engine conditions for example the rotation and the changed radiation environment are taken into account Some engine phenomena, such as free stream turbulence which still have a largely unknown influence on heat transfer processes, are discussed Blade temperature from engine tests are compared with cascade test results and theoretical temperature distributions For a simulated engine acceleration process the temperature and the stress distributions in the mid-section of a turbine blade was computed using a time dependent finite element program The results which serve as a basis for a comparative blade live assessment show that, during the transient phase the mechanical loading of the blade by far exceeds the steady state valves Author

N78-21126# Technische Hochschule, Aachen (West Germany) Inst fuer Strahlantriebe und Turboarbeitsmaschinen
INVESTIGATIONS OF THE LOCAL HEAT TRANSFER COEFFICIENT OF A CONVECTION COOLED ROTOR BLADE

W Kuehl *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 11 p refs
Avail NTIS HC A25/MF A01

Temperature measurements made within the convection air cooled rotor blade of a gas turbine during operation are used to determine the local heat transfer coefficients of turbine blades The analytical method is described along with results which include the local gas side heat transfer and the complete temperature field within the blade Unsteady flow effects are discussed
J M S

N78-21127# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany) Inst fuer Antriebstechnik
INVESTIGATION ON TEMPERATURE DISTRIBUTION NEAR FILM COOLED AIRFOILS
H Kruse *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 13 p
Avail NTIS HC A25/MF A01

Using a practically adiabatic airfoil as a simple model of a turbine blade some typical film cooling configurations were investigated The dimensions and operating conditions were chosen so that both the Reynolds numbers and the ratio of hole diameter to boundary layer thickness would correspond to realistic values in the turbine The temperature ratio between the mainstream and the coolant was in the range of 1 25 in order to get reasonable temperature differences The temperature distributions within the gas and on the adiabatic wall were measured by means of miniaturized thermocouples Information is given on the distribution of film cooling effectiveness and on the distribution of temperature in the near region downstream of the blowing point To point out the influence of curvature near the nose of the airfoil some typical results were compared with those from flat plate measurements Author

N78-21128# Middle East Technical Univ , Ankara (Turkey) Dept of Mechanical Engineering
EROSION PREVENTION AND FILM COOLING ON VANES
M Saryal I M Chantous and A Citici *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 8 p refs

Avail NTIS HC A25/MF A01

A preliminary research on the behavior of solid particles approaching a cascade of leaf nozzles having air injected through a slit at the leading edge, was carried out The results showed a definite prevention of erosion of solid particles at the leading edge region and the blade shoulder The only vulnerable region was the pressure side trailing edge region The ability of this method to provide means for effective cooling of gas turbine blades and possibilities of pulverized coal direct firming were studied Results are summarized Author

N78-21129# Sussex Univ , Brighton (England) Dept of Mechanical Engineering
PERFORMANCE AND DESIGN OF TRANSPIRATION-COOLED TURBINE BLADING
F J Bayley *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 15 p refs

Avail NTIS HC A25/MF A01

Experimental and theoretical studies of transpiration cooled turbine blades are reviewed and a design method for such cooling system is proposed An integral boundary layer method of analysis is shown to produce good agreement between observed and predicted heat transfer coefficients over most of the blade section where the effect of the coolant flow is significant while a simple momentum-mixing theory appears adequate for assessing the effect of the coolant on the blade profile loss Author

N78-21130# Ohio State Univ , Columbus
THE INFLUENCE OF TRANSPIRATION COOLING ON TURBINE BLADE BOUNDARY LAYER
Lit S Han and Leon Winget *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 14 p refs Sponsored in part by AF
Avail NTIS HC A25/MF A01

The external boundary layer and the heat transfer distribution of a film cooled turbine blade are calculated Results are used to determine the necessary film injection rate when the airfoil shape the external gas and the desired blade temperature are specified
J M S

N78-21131# National Gas Turbine Establishment, Pyestock (England)
EXPERIMENTAL EVALUATION OF A TRANSPIRATION COOLED NOZZLE GUIDE VANE
W H Morris J B Bullard and L D Wigg *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 15 p refs

Avail NTIS HC A25/MF A01

The design and experimental evaluation of a transpiration cooled nozzle guide vane is described The thermal evaluation of the coolant system design at gas temperature up to 1615 K indicated achievment of design effectiveness levels and good uniformity of temperature distribution However the effect of transpiring flow on turbine stage efficiency was to bring about a significant loss in performance relative to an uncooled nozzle a loss of about 5 per cent in efficiency at a coolant mass flow ratio of 3 per cent was observed Application of the experimental data to transpiration cooling of nozzle guide vanes is discussed Author

N78-21132# Technische Hogeschool Delft (Netherlands) Lab voor Verbrandingsmotoren en Gas-turbines
HEAT TRANSFER CHARACTERISTICS OF THE CLOSED THERMOSYPHON SYSTEM
R W Stuart-Mitchell and J Andries *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 13 p refs

Avail NTIS HC A25/MF A01

A closed thermosyphon system of gas turbine blade cooling using liquid metals and a secondary cooling circuit in a blade root was studied Experimentally determined heat transfer characteristics were determined for a 10 6 mm diameter cylindrical closed thermosyphon with a length diameter ratio 11 6 1 and a heated-to cooled-length ratio of 1 1 using water and mercury under a uniform heat flux hot wall boundary condition Results were obtained with the thermosyphon stationary and variously angled to the vertical between 0 deg and 45 deg and mounted in a rotating arm apparatus at rotational speeds between 500 r p m and 1000 r p m The results from the rotating experiments were correlated using a Grashof Number based on the gravitational acceleration while the centrifugal acceleration was included in a third dimensionless parameter Comparison of the results from the stationary and rotating experiments shows that angling the stationary thermosyphon to the vertical does not simulate the heat transfer in the rotating thermosyphon
Author

N78-21134# Centre de Villaroche Moissy (France) Dept Combustion-Pollution-Rechauffe
A REVIEW OF TECHNIQUES FOR THE THERMAL PROTECTION OF THE WALLS OF THE COMBUSTION CHAMBER AND REHEATING DUCTS OF TURBOREACTORS [REVUE DES TECHNIQUES DE PROTECTION THERMIQUE DES PAROIS DES FOYER PRINCIPAUX ET DE RECHAUFFE DES TURBOREACTEURS]
M Buisson, J P Gaillac, and B Deroide *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 15 p refs In FRENCH
Avail NTIS HC A25/MF A01

Techniques and limitations involved in the recooling of the combustion chamber in turboreactors were reviewed A critical analysis of classical solutions such as forced convection and film recooling showed the necessity for the utilization for more elaborate procedures, which include more simplified calculations Transl by B B

N78-21135# Lucas Aerospace Ltd Burnley (England) Fabrications Div
PRACTICAL SOLUTIONS TO THE COOLING OF COMBUSTORS OPERATING AT HIGH TEMPERATURES

J Winter and H Todd *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 14 p

Avail NTIS HC A25/MF A01

Flame tube life potential for small gas turbine engine applications where high temperature operating conditions occur was studied A small annular reverse flow combustion chamber was developed which utilizes a high proportion of the incoming air for wall film cooling purposes prior to the redirection of the cooling air for combustion and mixing The concept is shown to minimize the cooling difficulties encountered on conventional small annular chambers particularly when operating at elevated turbine entry temperatures A combustor developed for a regenerative gas turbine engine where impingement cooling liners are employed to overcome problems of high metal temperatures on a low cost unit is described Author

N78-21136# Technische Hochschule Darmstadt (West Germany) Inst fuer Technische Thermodynamik

THE INFLUENCE OF COOLANT TURBULENCE INTENSITY ON FILM COOLING EFFECTIVENESS

R Best *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 14 p refs

Avail NTIS HC A25/MF A01

In pipe flow experiments cold air was injected tangentially to the tube wall of the test section through an annular slot into a hot fully developed turbulent pipe flow The adiabatic wall temperature was measured along the pipe length for different velocity ratios injection slot heights, and degrees of turbulence of coolant and main streams Simultaneously the velocity and the temperature profiles as well as the distribution of the turbulent fluctuation velocities were measured The measurements indicate that an increasing turbulence intensity of the coolant can significantly reduce film cooling effectiveness By means of turbulent fluctuation velocity measurements and a physical model the film cooling effectiveness can be calculated The derived correlations reveal cooling effectiveness with increasing turbulence There is good agreement between experiments and theoretical predictions Author

N78-21137# Centro per l Automatica E Piaggio Pisa (Italy)

HIGH TEMPERATURE H2-AIR VARIABLE GEOMETRY COMBUSTOR AND TURBINE TEST FACILITY AND MEASUREMENTS

L Martorano and D Dini *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 10 p refs

Avail NTIS HC A25/MF A01

A design concept for gas turbine H2-air combustor is presented and its potential verified by experimental data The combustor performance with a view to the use of H2-air in conventional variable geometry gas turbines was emphasized Proposals and development for varying and controlling the air flow distribution characteristics appear feasible Results are given of the first high temperature tests carried out on variable geometry combustor and turbine blading Author

N78-21138# Air Force Aero Propulsion Lab Wright-Patterson AFB Ohio

LOW FREQUENCY COMBUSTION INSTABILITY IN AUGMENTORS

F N Underwood J P Rusnak (Pratt and Whitney Aircraft West Palm Beach Fla) R C Ernst (Pratt and Whitney Aircraft, West Palm Beach, Fla), E A Petrino (Pratt and Whitney Aircraft, West Palm Beach Fla) P L Russell (Pratt and Whitney Aircraft, West Palm Beach Fla) and R Murphy Jr *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 19 p ref

Avail NTIS HC A25/MF A01

An analytical model was developed to aid in designing afterburners that are free from low frequency instability Rumble mechanisms investigated include the system airflow dynamics, combustion efficiency oscillations fuel vaporization recirculation wake energy, and turbulence upstream of the flameholders Comparisons of the model predictions with experimental data are good Author

N78-21139# Office National d Etudes et de Recherches Aerospatiales Paris (France)

NEW MATERIALS FOR HIGH TEMPERATURE TURBINES ONERA'S DS COMPOSITES CONFRONTED WITH THE BLADE PROBLEMS

Herve Bibring *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 12 p refs In FRENCH ENGLISH summary

Avail NTIS HC A25/MF A01

The needs required for a blade material in aircraft turbines operating at higher temperatures are compared with the actual performance as found on Cotac DS composites testing The structure and the properties of the more fully developed 74 and 741 types are discussed In particular the high temperature structural stability, the impact of thermal and mechanical fatigue the oxidation resistance and the coating capability are thoroughly evaluated The great benefit in operational temperature of these materials can be immediately exploited in the field of uncooled solid blades The problem of cooling passages in DS eutectic blades is also outlined Author

N78-21141# Office National d Etudes et de Recherches Aerospatiales, Paris (France)

PROTECTION OF COOLED BLADES OF COMPLEX INTERNAL STRUCTURE

Philippe Galmiche *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 9 p refs In FRENCH ENGLISH summary

Avail NTIS HC A25/MF A01

The problem of the general protection of cooled blades of complex internal structure was studied A corresponding method called the SF technique, permits the realization in a single operation of the protection of both external and internal surfaces, as well as those of the orifices of cooling air, whatever their diameter In a general way, the respective thickness of external and internal coatings may be precisely predetermined, with no parasitic particle being able to remain inside the parts after application of the protecting treatment Results obtained by application of the SF method are illustrated by the presentation and examination of various parts of advanced turbomachines which were handed over for treatment followed by tests or operational use by engine manufacturers or airlines Author

N78-21142# Advisory Group for Aerospace Research and Development, Paris (France)

COBALT-BASE ALLOYS FOR HOT CORROSION PROTECTIVE COATINGS

A Davin (CRM Liege Belgium), J M Drapier (CRM, Liege Belgium) D Coutsouradis (CRM, Liege Belgium), and L Habraken *In its* High Temp Probl in Gas Turbine Eng Feb 1978 12 p refs

Avail NTIS HC A25/MF A01

In the field of gas turbine applications the severe requirements of extended operation in marine environments or an increase in the inlet temperature limit the life of the diffusion aluminide base coatings for nickel and cobalt superalloys Protective overlay coatings such as Co/Ni-Cr-Al-Y-Ta were developed in order to satisfy the requirements of the gas turbine designers and showed an exceptional hot corrosion resistance They were optimized to obtain an acceptable compromise between hot corrosion and thermal shock resistance Experience gained with the development of such cobalt base and particularly Co-Al-Cr-Ta-Ni-Y alloys and corresponding coatings were evaluated by various techniques Author

N78-21143# Pratt and Whitney Aircraft Group West Palm Beach, Fla Government Products Div

TRENDS OF FUTURE TURBINE LIFE PREDICTION TIME PHASE AUTOMATED ANALYSIS AND TEST VERIFICATION

J L Price and I J Gershon (AFAPL) *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 11 p refs

Avail NTIS HC A02/MF A01

A review of the most significant design parameters affecting turbine durability and the structural analysis and verification techniques which are being developed for identification of structural inadequacies early in th propulsion system development cycle are reviewed Author

N78-21145# Lucas Aerospace Ltd Burnley (England) Fabrications Div
EVALUATION OF A CERAMIC COMBUSTION CHAMBER FOR A SMALL GAS TURBINE ENGINE
G Sedgwick *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 10 p refs

Avail NTIS HC A25/MF A01
A description is presented of the design component evaluation and combustion testing of a reverse flow annular combustion chamber in silicon nitride Heat transfer assessments were made of the temperature levels which components would reach during combustion testing A thermal test program was formulated which enables thermal loadings well in excess of those estimated for the actual flame tube environment to be imposed upon specimen components Thermal stress and probability of survival values were obtained using the method based on a Weibull statistical analysis using the weakest link volume critical flaw assumption Finite element and brittle failure analyses were carried out on both thermal stress test specimens and the components making up the flame tube Author

N78-21146# Massachusetts Inst of Tech Cambridge
SYSTEMATIC STUDIES OF HEAT TRANSFER AND FILM COOLING EFFECTIVENESS
J F Louis *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 36 p refs
(Contracts F33625-76-C-2018 N00014-76-C-0253)
Avail NTIS HC A25/MF A01
A review of studies in heat transfer and film cooling effectiveness was given to develop an in depth understanding of heat transfer and film cooling in gas turbines A common experimental procedure is described for heat transfer measurements under isothermal wall conditions using fast response heat transfer gauges in tests conducted in a shock tunnel and a blowdown facility The tests were conducted at flow and thermodynamic conditions modeling the operating conditions of advanced gas turbines The configurations under study were single slot single line of holes, double line of holes on a flat plate, and double line of holes on an airfoil Author

N78-21147*# General Electric Co Evendale Ohio Aircraft Engine Group
EFFECTS OF FILM INJECTION ON PERFORMANCE OF A COOLED TURBINE
James D McDonel and James E Elswerth *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 11 p refs

(Contract NAS3-16732)
Avail NTIS HC A25/MF A01
Tests were conducted in a 20 inch diameter single stage air cooled turbine designed to evaluate the effects of film cooling air on turbine aerodynamic performance A comparison was made of the experimental results and an analytical method of evaluating film injection effects on turbine performance The results are used to determine the effects of film cooling on overall engine performance for selected cycle conditions The engine performance studies are used to show the cycle benefits of increased gas temperature at various coolant flow rates Author

N78-21148# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany)
THE INFLUENCE OF JETS OF COOLING AIR EXHAUSTED FROM THE TRAILING EDGES OF A SUPERCRITICAL TURBINE CASCADE ON THE AERODYNAMIC DATA
Ortwin Lawnczeck *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 13 p refs

Avail NTIS HC A25/MF A01
In a case of a stator cascade the influence of jets of coolant air on the aerodynamic behavior was tested The jets exhaust from the trailing edges of four blades By the evaluation of wake flow measurements over two pitches the losses and the downstream flow angle were determined In addition schlieren pictures were taken The downstream velocity was varied from a subsonic over a transonic up to a supersonic flow The rate of the coolant air with respect to the primary air running through two adjacent blades was changed from zero to four percent The measurements were carried out in the wind tunnel for two dimensional cascades Author

N78-21151# Office National d Etudes et de Recherches Aerospatiales Paris (France)
MEASURING TECHNIQUES IN HIGH TEMPERATURE TURBINES
Yves LeBot Marc Charpenel, and Pierre-Jacques Michard *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 12 p refs In FRENCH ENGLISH summary

Avail NTIS HC A25/MF A01
An instrument for performing on industrial machines measurements usually limited to laboratory studies was developed Qualifications of the flow turbulence is described and an analysis of moble blade wakes by short response time pressure probes was included Flow temperature fluctuations by thermocouple or resistor probes associated to signal processing electronics and by optical pyrometry were studied Mobile blade surface temperatures were read by short response time optical pyrometry The local thermal transfer coefficient on stator blades was measured by an analysis of evolution in time of the wall temperature after sudden cutting off of cooling air The effectiveness of the wall thermal protection from results of a chromatographic analysis of gaseous samples was also calculated The main characteristics of the instrumentation are presented and illustrated by examples of application on various test facilities Author

N78-21152# Von Karman Inst for Fluid Dynamics Rhode-Saint-Genese (Belgium)
THE MEASUREMENT OF FILM COOLING EFFECTIVENESS ON TURBINE COMPONENTS IN SHORT DURATION WIND TUNNELS
J P Ville and B E Richards *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 13 p refs In ENGLISH FRENCH summary
(Grant DA-ERO-75-G-074)
Avail NTIS HC A25/MF A01
A method to measure an adiabatic wall effectiveness, n and its associated heat transfer coefficient h, of a film cooling system for turbine components in a short duration facility is described Such a facility was used to provide flow conditions selected to simulate those of advanced aircraft turbines The measurement of heat transfer rates under different coolant temperature conditions and the definition of a linear relationship between a heat transfer coefficient h, based on mainstream recovery temperature and a nondimensional coolant temperature, leads to the evaluation of n, and h sub f The measurements on a flat plate, cooled by air ejected through inclined holes at a Mach number of 0 6 unit Reynolds number of 2 4 x 10 to the 7th power per meter wall to mainstream temperature ratio of 0 76 coolant to mainstream temperature of 0 70 to 0 95 and mass velocity ratio from 0 5 to 1 5 confirm the linearity of the h theta relation and prove the ability of a short duration facility to provide useful film cooling data for blade cooling system development Author

N78-21154# Office National d Etudes et de Recherches Aerospatiales, Paris (France)
NEW COMPUTATION METHOD OF TURBINE BLADES FILM COOLING EFFICIENCY
Emile LeGrives and Jacques Jules Nicolas *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 12 p refs In FRENCH ENGLISH summary

Avail NTIS HC A25/MF A01

An analytical technique is presented for the computation of film cooling effectiveness of gas turbine blades It is based on a mathematical description of the counter rotating vortex structure associated with the injection of coolant through discrete holes The transport of mass induced by these vortices plays the major part in the mixing process of hot gas with the individual jets which defines the adiabatic effectiveness of the resulting film When merging of the jets and entrainment by turbulent diffusion effects were also taken into account data from various experiments performed on flat plate were found to be in good agreement with predictions following this approach Simple rules for computing film effectiveness with injection through several rows of holes allow an extension of the analysis to a large variety of injection patterns Author

N78-21155# Sussex Univ Brighton (England) Dept of Mechanical Engineering

THE EFFECT OF FREE-STREAM TURBULENCE UPON HEAT TRANSFER TO TURBINE BLADING

F J Bayley and R W Milligan *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 13 p ref

Avail NTIS HC A25/MF A01

An initial investigation of the separate effects of free stream turbulence intensity and frequency upon the local heat transfer to a heavily loaded gas turbine blade section is described It was shown that over the whole blade the rate of heat transfer is significantly increased by both those parameters with the pressure surface showing the greatest response and the downstream half of the suction surface the least Author

N78-21157# Pisa Univ (Italy) Dept of Engineering

CALCULATION OF TEMPERATURE DISTRIBUTION IN DISKS AND COOLING FLOW IN A TRANSIENT STATE

M Caprili and R Lazzeretti *In* AGARD High Temp Probl in Gas Turbine Eng Feb 1978 23 p refs

Avail NTIS HC A25/MF A01

The temperature distribution in irregularly shaped disks and that of the cooling fluid was determined for a transient stator The method of calculation used is described, and the stability of the numerical solution is discussed The calculation program makes it possible to evaluate the influence of the functional parameters on temperature distribution Author

N78-21159*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

A NOTE ON MULTICYCLIC CONTROL BY SWASHPLATE OSCILLATION

James C Biggers and John L McCloud III Apr 1978 11 p refs

(NASA-TM-78475 A-7367) Avail NTIS HC A02/MF A01 CSCL 01C

It was shown that for two three, or four bladed rotors simple oscillation of the nonrotating swashplate controls can produce prescribed blade pitch schedules of the sort which were suggested for vibration alleviation Equations were given which relate the swashplate motions to the resulting blade pitch schedules Author

N78-21160*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards Calif

RESULTS FROM FLIGHT AND SIMULATOR STUDIES OF A MACH 3 CRUISE LONGITUDINAL AUTOPILOT

Glenn B Gilyard and John W Smith Apr 1978 85 p refs (NASA-TP-1180 H-940) Avail NTIS HC A05/MF A01 CSCL 01D

At Mach numbers of approximately 3 0 and altitudes greater than 21 300 meters the original altitude and Mach hold modes of the YF-12 autopilot produced aircraft excursions that were erratic or divergent or both Flight data analysis and simulator studies showed that the sensitivity of the static pressure port to angle of attack had a detrimental effect on the performance of the altitude and Mach hold modes Good altitude hold performance was obtained when a high passed pitch rate feedback was added to compensate for angle of attack sensitivity and the altitude error and integral altitude gains were reduced Good Mach hold performance was obtained when the angle of attack sensitivity was removed, however the ride qualities remained poor Author

N78-21161*# Princeton Univ N J Instrumentation and Control Lab

OPTIMAL CONTROL THEORY (OWEM) APPLIED TO A HELICOPTER IN THE HOVER AND APPROACH PHASE

Gerard J Born and Tadao Kai Jan 1975 289 p refs (Contract NAS2-7187)

(NASA-CR-152135 Rept-1205) Avail NTIS HC A13/MF A01 CSCL 01C

A major difficulty in the practical application of linear-quadratic regulator theory is how to choose the weighting matrices in quadratic cost functions The control system design with optimal weighting matrices was applied to a helicopter in the hover and approach phase The weighting matrices were calculated to extremize the closed loop total system damping subject to constraints on the determinants The extremization is really a minimization of the effects of disturbances and interpreted as a compromise between the generalized system accuracy and the generalized system response speed The trade-off between the accuracy and the response speed is adjusted by a single parameter the ratio of determinants By this approach an objective measure can be obtained for the design of a control system The measure is to be determined by the system requirements Author

N78-21162# Michigan Univ Ann Arbor Dept of Aerospace Engineering

SYSTEM OPTIMIZATION BY PERIODIC CONTROL Interim Scientific Report, 1 Oct 1976 - 1 Oct 1977

Elmer G Gilbert 1977 6 p refs (Grant AF-AFOSR-3158-77)

(AD-A049522 AFOSR-78-0012TR) Avail NTIS HC A02/MF A01 CSCL 01/3

Research was conducted in two areas the theory and computation of periodic controls, and the input-output characterization of nonlinear systems The effort on periodic control was devoted almost entirely to sufficient conditions for optimality a computational study of periodic aircraft cruise the use of variational models for analyzing the effect of system nonlinearities in the presence of periodic forcing The investigation of input-output characterizations for nonlinear systems was extended to the realization problem for nonlinear systems Author (GRA)

N78-21163# Boeing Vertol Co , Philadelphia, Pa

HEAVY LIFT HELICOPTER FLIGHT CONTROL SYSTEM VOLUME 2 PRIMARY FLIGHT CONTROL SYSTEM DEVELOPMENT AND FEASIBILITY DEMONSTRATION Final Report, Jul 1971 - Jul 1975

T H Sanders and B L McManus Sep 1977 122 p refs (Contract DAAJ01-71-C-0840)

(AD-A049580 USAAMRDL-TR-77-40B-Vol-2) Avail NTIS HC A06/MF A01 CSCL 01/3

The U S Army s Heavy Lift Helicopter Advanced Technology Component Program required the design, development and inflight feasibility demonstration of an electrohydraulic flight control system referred to as fly-by-wire Total flight testing encompassed evaluation and demonstration in two parts First, a direct electrical linkage was successfully demonstrated in September 1973 Subsequently an automatic flight control system was installed and evaluated with the direct electrical linkage This volume describes the primary flight control system its design features installation test Included also is a report of a related activity to design and evaluate in laboratory tests a compatible cockpit controller subsystem in which pilot commands are converted to electrical signals Standard pilot interface features, such as magnetic brakes stick position trim and force trim are included To interface with the automatic flight control system, controller driver actuators are included GRA

N78-21164# Boeing Vertol Co , Philadelphia Pa
HEAVY LIFT HELICOPTER FLIGHT CONTROL SYSTEM VOLUME 3 AUTOMATIC FLIGHT CONTROL SYSTEM DEVELOPMENT AND FEASIBILITY DEMONSTRATION Final Report, Jul 1971 - Jul 1975
J Davis T Barnett and J Gaul Sep 1977 705 p refs
(Contract DAAJ01-71-C-0840)
(AD-A050059 USAAMRDL-TR-77-40C-Vol-3) Avail NTIS HC A99/MF A01 CSCL 01/3

The U S Army Heavy Lift Helicopter Advanced Technology Component program required the design development and feasibility demonstration of an electrohydraulic flight control system This volume details the evolution of an automatic flight control system (AFCS) operating by means of a direct electrical linkage AFCS software and hardware development and testing are discussed The results of flight clearance testing and in-flight evaluations of AFCS control laws are examined GRA

N78-21165# Air Force Civil Engineering Center Tyndall AFB Fla
RUNWAY ROUGHNESS EVALUATION LASER PROFILOMETER IMPLEMENTATION STUDY Final Report, Nov 1975 - Sep 1977
Dannie O Burk and James I Clark Oct 1977 66 p refs
(AD-A049440, AFCEC-TR-78-1) Avail NTIS HC A04/MF A01 CSCL 20/5

Runway profiles and aircraft vertical acceleration responses were analyzed to develop an evaluation methodology for runway roughness and to develop roughness standards against which runways can be evaluated Root mean square values of filtered profile data and vertical aircraft accelerations were statistically developed on a segmental basis into runway roughness standards A methodology was developed to evaluate runway profiles against these standards, and to recommend corrective construction of the profile to reduce aircraft response Profile roughness has therefore been based on a numerically relative basis The establishment of runway roughness standards and evaluation methodology is considered incomplete, and additional work is recommended in this report Author (GRA)

N78-21166# Naval Postgraduate School, Monterey Calif
A SUB-SCALE TURBOJET TEST CELL FOR DESIGN EVALUATIONS AND ANALYTICAL MODEL VALIDATION Interim Report
Holden W Hewlett P J Hickey and David W Netzer Sep 1977 48 p refs
(AD-A049862 NPS-67NT77091) Avail NTIS HC A03/MF A01 CSCL 14/2

A one-eighth scale (1/64 scale on mass flow) NARF Alameda turbojet test cell was designed and constructed The test cell is to be employed for evaluation of optimum augmentor design and pollution abatement methods and for validation of analytical models Initial evaluation of the test cell demonstrated its versatility and ease of operation as well as some deficiencies Model operating characteristics and planned investigations are discussed GRA

N78-21170# Army Construction Engineering Research Lab , Champaign, Ill
DEVELOPMENT OF A PAVEMENT MAINTENANCE MANAGEMENT SYSTEM VOLUME 2 AIRFIELD PAVEMENT DISTRESS IDENTIFICATION MANUAL Final Report, Jul 1974 - Jul 1976
Mohamed Y Shahin Michael I Darter, and Starr D Kohn Tyndall AFB, Fla Civil and Environ Eng Develop Office Dec 1977 115 p Supersedes AFCEC-TR-76-27-Vol-2
(AF MIPR-FQ8952-76-66005)
(AD-A049029, CERL-TR-C-76-Vol-2 CEEDO-TR-77-44-Vol-2, AFCEC-TR-76-27-Vol-2) Avail NTIS HC A06/MF A01 CSCL 01/5

This manual is designed to provide airfield pavement inspectors with a comprehensive reference for pavement distress identification The information is to be used in conjunction with procedures presented in Volume I of this report to determine pavement condition and maintenance and repair requirements The types of airfield pavement distress are listed alphabetically under the major categories of asphalt- or tar-surfaced pavements and jointed concrete pavements Names descriptions, severity levels photographs, and measurement or count criteria are presented for each distress type Author (GRA)

N78-21214*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
FIRE RESISTIVITY AND TOXICITY STUDIES OF CANDIDATE AIRCRAFT PASSENGER SEAT MATERIALS
L L Fewell Ed Trabold (McDonnell Douglas Corp Long Beach Calif), and H Spieth (McDonnell Douglas Corp Long Beach Calif) Mar 1978 44 p refs
(NASA-TM-78468 A-7334) Avail NTIS HC A03/MF A01 CSCL 21B

Fire resistivity studies were conducted on a wide range of candidate nonmetallic materials being considered for the construction of improved fire resistant aircraft passenger seats These materials were evaluated on the basis of FAA airworthiness burn and smoke generation tests colorfastness, limiting oxygen index and animal toxicity tests Physical mechanical, and aesthetic properties were also assessed Candidate seat materials that have significantly improved thermal response to various thermal loads corresponding to reasonable fire threats as they relate to in-flight fire situations are identified Author

N78-21223*# Douglas Aircraft Co Inc Long Beach Calif
AIRCRAFT CARGO COMPARTMENT FIRE TEST SIMULATION PROGRAM Final Report, Oct 1974 - Jan 1977
R E Blumke Jan 1977 84 p refs
(Contract NAS2-8699)
(NASA-CR-151951 MDC-J7471) Avail NTIS HC A05/MF A01 CSCL 11D

The objective of the test was to assess fire containment and fire extinguishment in the cargo by reducing the ventilation through the cargo compartment Parameters which were measured included ignition time burnthrough time, and physical damage to the cargo liner composition of selected combustible gases, temperature-time histories heat flux, and detector response The ignitor load was made of a typical cargo consisting of filled cardboard cartons occupying 50% of the compartment volume Author

N78-21234# National Bureau of Standards, Washington D C Center for Fire Research
TIME-DEPENDENT FIRE BEHAVIOR OF AIRCRAFT CABIN MATERIALS Final Report, Mar 1976 - Jun 1977
Clayton Huggett Dec 1977 42 p refs
(Contract DOT-FA76WAI-610)
(AD-A050923 FAA-RD-77-99) Avail NTIS HC A03/MF A01 CSCL 01/3

In an aircraft cabin or other inhabited compartment the early stages of fire growth are critical to life safety During this period the rate of fire growth as measured by the mass fuel consumption rate can be represented approximately as a simple exponential function of time The rates of development of hazard from temperature rise and smoke and gas accumulation can be related to the mass fuel consumption rate The growth constant k can be related to a small number of system parameters and fuel combustion properties These properties were identified and laboratory methods for their measurement are suggested In a fire situation the critical hazard (temperature smoke or gas) can be considered to be the one which first reaches a limiting human tolerance level This mode can be identified and the effects of changes in design and materials on the rate of critical hazard development can be estimated The simple exponential growth model may provide a means of predicting relative hazard with reasonable accuracy Author

N78-21326*# Michigan Univ , Ann Arbor Dept of Applied Mechanics and Engineering Science
DEFINITION OF TIRE PROPERTIES REQUIRED FOR LANDING SYSTEM ANALYSIS Final Report
S K Clark, R N Dodge, and J R Luchini Mar 1978 26 p (Grant NsG-1080)
(NASA-CR-156171 UMICH-012881) Avail NTIS HC A03/MF A01 CSCL 14D

The data bank constructed provided two basic advantages for the user of aircraft tire information First computerization of the data bank allowed mechanical property data to be stored, corrected updated, and revised quickly and easily as more reliable tests and measurements were carried out Secondly, the format of the book which can be printed from the computerized data bank can be easily adjusted to suit the needs of the users without the great expense normally associated with reprinting and editing books set by ordinary typography Author

N78-21358# McDonnell-Douglas Corp St Louis, Mo
HF RADIATION CHARACTERISTICS OF THE RH-53D HELICOPTER AND THE MARK 105 AMCM SYSTEM Final Report, 1 Nov. 1976 - 1 Feb 1977
L N Medgyesi-Mitschang Feb 1977 44 p refs
(Contract N61331-76-M4839)
(AD-A049795 MDC-Q0616) Avail NTIS HC A03/MF A01 CSCL 09/5

A computer algorithm is used to predict the power gain and phase characteristics of the Raydist receiving antenna (modified retractable hf type) used aboard the RH-53D helicopter The calculations were performed at 1 6 and 3 3 MHz for the horizontal plane Both vertical and horizontal polarizations were considered Four different tow cable configurations were investigated and their effect on the receiving antenna system were determined Author (GRA)

N78-21363# McDonnell Aircraft Co St Louis Mo
MULTIBAND ANTENNA SYSTEM FOR TACTICAL AIRCRAFT Final Report, 30 Dec 1976 - 15 Aug 1977
F W Vortmeier Sep 1977 527 p
(Contract N62269-77-C-0138)
(AD-A049699 NADC-76240-20) Avail NTIS HC A23/MF A01 CSCL 17/2

The ability to extend the frequency range of a 100 MHz to 40 MHz antenna to include the 30 MHz to 100 MHz range was examined through analysis and testing Antenna impedance patterns, power handling and gain comparison measurements were made over the extended frequency range The measurements were made on full scale as well as fifth and quarter scale models Results show that it is possible to construct an antenna that will radiate from 30 MHz to 400 MHz effectively without the need for active tuning A single input connector to the antenna is used A mechanical design study was performed to demonstrate the feasibility of locating this antenna in the vertical stabilizer of the F-4 and F-18 aircraft In the case of the F-4 retrofit possibilities were investigated and a flyable fincap antenna was fabricated The results of the mechanical study showed that it is feasible to use the antenna in the F-4 and F-18 as well as other Navy aircraft including the AV-8 Author (GRA)

N78-21402# Michigan Univ Ann Arbor Dept of Aerospace Engineering
APL RADIOMETER WIND TUNNEL TEST PROGRAM WITH SIMULATED AIRCRAFT RADOME Final Report
William W Willmarth J Maszatics (Bendix Aerospace Systems Div) and E Granholm (Bendix Aerospace Systems Div) 26 Sep 1977 38 p ref Backup document for AIAA Synoptic "Management of Turbulent Shear Layers in Separated Flow scheduled for publication in Journal of Aircraft in Aug 1978
(Contract APL/JHU-600276)
(BSR-4230, POR-3702) Avail NTIS HC A03/MF A01

Severe airflows encountered within the radiometer cavity during flight tests were examined The close proximity of the aircraft fairing seal to the radiometer windows, the effect of the radome blockage and the effects of radiometer extension, angle of attack, seal location, fences, deflectors, baffles, and a scooping nose are among the factors studied The airborne radiometer housing with a full scale model of the upper half of the radome, pod fairing, and aerodynamic seal was evaluated in terms of alleviating the severe cavity airflows Results indicate that the low mean and fluctuating flow conditions were obtained in the simulator radiometer model when exposed to a uniform flow with pitch angles between + or - 10 deg and the severe high speed upflow was caused by the blockage effect of the radome Radiometer housing configurations found to be successful in preventing the severe airflow included (1) a two foot extension of the radiometer housing (2) a one foot extension of the radiometer with either an asymmetric set of deflectors on the present nose or (3) a larger scooped shaped nose J M S

N78-21410*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
CORRELATION OF LASER VELOCIMETER MEASUREMENTS OVER A WING WITH RESULTS OF TWO PREDICTION TECHNIQUES
Danny R Hoad, James F Meyers, Warren H Young, Jr , and Timothy P Hepner Apr 1978 66 p refs
(DA Proj 1L1-61102-AH-45)
(NASA-TP-1168 L-11980) Avail NTIS HC A04/MF A01 CSCL 20D

The flow field at the center line of an unswept wing with an aspect ratio of eight was determined using a two dimensional viscous flow prediction technique for the flow field calculation, and a three dimensional potential flow panel method to evaluate the degree of two dimensionality achieved at the wing center line The analysis was made to provide an acceptable reference for comparison with velocity measurements obtained from a fringe type laser velocimeter optics systems operating in the backscatter mode in the Langley V/STOL tunnel Good agreement between laser velocimeter measurements and theoretical results indicate that both methods provide a true representation of the velocity field about the wing at angles of attack of 0 6 and 4 75 deg Author

N78-21464 Washington Univ Seattle
A PERTURBATION METHOD FOR PREDICTING AMPLITUDES OF NONLINEAR WHEEL SHIMMY Ph D Thesis
James Thomas Gordon, Jr 1977 226 p
Avail Univ Microfilms Order No 7800928

A perturbation method is presented for the stability analysis of nonlinear shimmy models Analytical expressions for the limit cycle amplitude and frequency were obtained as functions of the taxi velocity V and stability was examined The solution method was applied to aircraft landing gear shimmy models which include a nonlinear (velocity squared) damper The perturbation solution results are shown to agree well with those obtained by direct numerical integration of the nonlinear shimmy equations Dissert Abstr

N78-21471*# Michigan Univ Ann Arbor Dept of Aerospace Engineering
LIGHTWEIGHT, LOW COMPRESSION AIRCRAFT DIESEL ENGINE
T L Gaynor, M S Bottrell C D Eagle and C F Bachle Jul 1977 103 p refs
(Contract NAS3-20051)
(NASA-CR-135300) Avail NTIS HC A06/MF A01 CSCL 21G

The feasibility of converting a spark ignition aircraft engine to the diesel cycle was investigated Procedures necessary for converting a single cylinder GTS10-520 are described as well as a single cylinder diesel engine test program The modification of the engine for the hot port cooling concept is discussed A digital computer graphics simulation of a twin engine aircraft incorporating the diesel engine and Hot Fort concept is presented showing some potential gains in aircraft performance Sample results of the computer program used in the simulation are included Author

N78-21473*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
ROLLING-ELEMENT FATIGUE LIFE OF AISI M-50 AND 18-4-1 BALLS
Richard J Parker and Erwin V Zaretsky Apr 1978 19 p refs
(NASA-TP-1202, E-9350) Avail NTIS HC A02/MF A01 CSCL 13I

Rolling element fatigue studies were conducted with AISI M-50, EFR 18-4-1, and VAR 18-4-1 Groups of 12 7 mm (1/2-in) diameter balls of each material were tested in the five ball fatigue tester Test conditions included a load of 1540 N (347 lbf) giving a maximum Hertz stress of 5520 MPa (800 000 psi) a shaft speed of 10,700 rpm, and a contact angle of 30 deg Tests were run at a race temperature of 339 K (150 F) with a type 2 ester lubricant The rolling element fatigue life of AISI M-50 was not significantly different from that of EFR 18-4-1 or VAR 18-4-1 based on a statistical comparison of the test results Author

N78-21891# Committee on Public Works and Transportation (U S House)

AIRPORT AND AIRCRAFT NOISE REDUCTION

Washington GPO 1977 590 p refs Hearings on H R 4539 and related bills before Subcomm on Aviation of the Comm on Public Works and Transportation, 95th Congr 1st Sess 30-31 Mar , 5-6, 19-21, 27 Apr , 5 May 1977 (GPO-91-591) Avail Subcomm on Aviation

The establishment of a comprehensive program for the systematic reduction of noncompatible land uses in areas surrounding certain airports in the United States and the level of noise created by aircraft operating at such airports was discussed in testimony delivered and statements submitted for the record during House hearings on the resolution The text of the bill is included A R H

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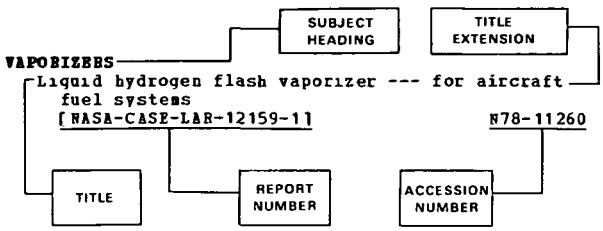

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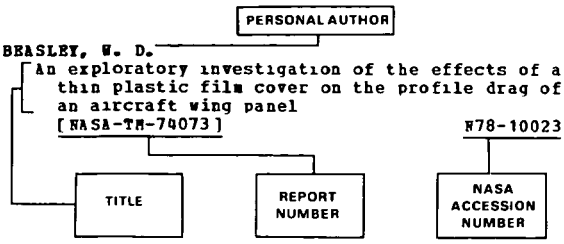

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