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NASA SP-7037 (101)

AERONAUTICAL ENGINEERING

A Continuing Bibliography

Supplement 101

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in September 1978 in

- *Scientific and Technical Aerospace Reports (STAR)*
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INTRODUCTION

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

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 335 reports, journal articles, and other documents originally announced in September 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

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries*, in that order The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* and *STAR*, including the original accession numbers from the respective announcement journals This procedure, which saves time and money, accounts for the slight variation in citation appearances

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N78-10020*# Boeing Vertol Co Philadelphia Pa
WIND TUNNEL INVESTIGATION OF ROTOR LIFT AND PROPULSIVE FORCE AT HIGH SPEED DATA ANALYSIS
Frank McHugh Ross Clark and Mary Soloman Oct 1977 211 p 3 Vol
(Contract NAS1-14317)
(NASA-CR-145217-App-1 D210-11135-1) Avail NTIS HC A10/MF A01 CSCL 01A

The basic test data obtained during the lift-propulsive force limit wind tunnel test conducted on a scale model CH 47b rotor are analyzed Included are the rotor control positions blade loads and six components of rotor force and moment corrected for hub tares Performance and blade loads are presented as the rotor lift limit is approached at fixed levels of rotor propulsive force coefficients and rotor tip speeds Performance and blade load trends are documented for fixed levels of rotor lift coefficient as propulsive force is increased to the maximum obtainable by the model rotor Test data is also included that defines the effect of stall proximity on rotor control power The basic test data plots are presented in volumes 2 and 3 Author

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A78 13071 * # Toward a new V/STOL generation L Roberts and S B Anderson (NASA, Ames Research Center, Moffett Field, Calif) *Astronautics and Aeronautics*, vol 15, Nov 1977, p 22-27

While many V/STOL problems are now better understood and technology has progressed to the point where higher thrust/weight ratios and greater stability augmentation are achievable, a number of still existing insufficiencies provide a sobering reminder that learning in ground testing and simulation, and careful methodical planning, are a prerequisite for any research and development program The present paper is centered on the major technical problems for the Navy Type multimission V/STOL aircraft The aircraft's configurations with and without forward lift fan are discussed, along with the propulsion systems, testing techniques, controls, displays, flight dynamics, and ground/flow field interactions V P

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IAA ENTRIES

A78-40219 **The RF 15 Reconnaissance derivative of the F-15** W W Schurter (McDonnell Douglas Corp, St Louis, Mo) In Airborne reconnaissance - Tactical/real time, Proceedings of the Seminar, Reston, Va, April 18 21, 1977 Bellingham, Wash, Society of Photo-Optical Instrumentation Engineers, 1977, p 132 139

The RF 15 reconnaissance derivative of the F-15 Eagle is being studied by McDonnell Douglas for consideration by the USAF as the next generation tactical reconnaissance aircraft The design studies, based on the two-seat version of the F-15, show that state of the art technology will support the development of an RF-15 which satisfies current tactical reconnaissance requirements for timeliness, accuracy, all weather-day/night operations and survivability The basic sensor/avionics suite includes high resolution multimode radar, an EO/laser designator set, voice, digital and video communication systems, inertial/common grid navigation system and a data/sensor management set Mission flexibility and growth provisions are provided by conformal pallets which will accommodate combinations of conventional and special purpose sensors and fuel The study effort is currently entering a simulation phase to develop and evaluate data/sensor management system concepts and to provide a data base for system design and hardware specification (Author)

A78-40298 # **Pulse tubes for aerodynamic studies (Impul'snye truby v aerodinamicheskikh issledovaniiakh)** A S Korolev, B V Bosheniatov, I G Druker, and V V Zatoloka Novosibirsk, Izdatel'stvo Nauka, 1978 80 p 81 refs In Russian

The book deals with shock and hotshot tunnels and their use in aerodynamic testing Shock tunnels are wind tunnels that operate at Mach numbers of 25 or more for intervals of up to a few milliseconds by using air heated and compressed in a shock tube Hotshot tunnels are short-duration arc-heated test devices in which the high temperatures and pressures required for operation are obtained by rapidly discharging a large amount of electric energy into an enclosed small volume of air, which then expands through a nozzle and a test section The advantage of such facilities is that practically any Mach number can be achieved at pressures and temperatures considerably higher than in classical facilities The disadvantage of short run times is mitigated by the availability of modern fast-response instrumentation V P

A78-40375 # **Metals in flight /2nd enlarged and revised edition/ (Letaiushchie metally /2nd enlarged and revised edition/)** Sh Ia Korovskii Moscow, Izdatel'stvo Mashinostroenie, 1977 192 p In Russian

The book deals in elementary form with the production technology and characteristics of stainless steel and aluminum, magnesium, titanium and other alloys intended for use in aircraft and space vehicles Particular attention is given to high-strength materials and corrosion-, erosion, and heat-resistant metals and composites and to the selection of the proper production technology V P

A78-40493 **The closed spline functions** L G Napolitano and V Losito (Napoli, Universita, Naples, Italy) *Computer Methods in Applied Mechanics and Engineering,* vol 13, Mar 1978, p 335 350 Grant No AF AFOSR-74 2704

Spline problems are defined over a closed contour to solve interpolation problems related to closed curves The resulting functions, called spline functions, are defined in Hilbert space, and discussed in terms of existence, uniqueness, and numerical values A numerical analysis of planar inviscid flow fields around airfoils is presented to illustrate a specific spline function application D M W

A78-40725 # **A major refurbishing program for the NAE 5-ft x 5-ft blowdown wind tunnel** L H Ohman (National Aeronautical Establishment, Ottawa, Canada) *Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin,* no 1, 1978, p 27-33, 35-44 7 refs

Failure of the turbulence damping screens of the Canadian National Aeronautical Establishment's 5 ft by 5 ft blowdown wind tunnel has occurred on the average of once every 5000 trials In addition to improvements in the screen attachment design, modifications to the settling chamber inlet diffuser have been adopted to lessen the chance of turbulent damping screen failures In particular, a change in the porosity of perforated plates which provide a pressure drop helps to improve the settling chamber flow distribution A Mach number control device with an accuracy of + or - 0 001 for Mach numbers below 0 97 and an on-line data reduction system are among the other improvements to the wind tunnel J M B

A78-40799 # **Pressure distribution on a symmetrical butterfly wing** I Paraschivoiu and E Bilgen (Ecole Polytechnique, Montreal, Canada) *Journal of Aircraft,* vol 15, July 1978, p 444-446 8 refs Research supported by the National Research Council of Canada

When mild ogee wings are fitted with variable-geometry circular sectors on the leading edge at about the middle point of the wing, the result is a butterfly wing An experimental wing of this kind was obtained by using Bio-plastic and aluminum modified NACA 65-009 profiles with plexiglass circular sectors, and static pressure at 14 upper and 14 lower sites was measured for angles of incidence from -14 to +30 deg at a constant flow velocity of 43 m/sec The pressure distribution is seen to be more uniform on the butterfly wing than on the mild ogee wing For the same conditions, the lift increases with increasing span, which is an indication of the importance of the circular sectors in the subsonic range Calculations of total lift show that at takeoff and landing incidence angles, a nearly twofold increase in lift can be obtained with butterfly wings as compared with basic mild ogee wings P T H

A78-40800 # **Comment on 'Effect of stabilizer dihedral and static lift on T-tail flutter'** W P Rodden *Journal of Aircraft,* vol 15, July 1978, p 447, 448 27 refs

A78-40820 # **The catalytic combustor - An approach to cleaner combustion** W C Pfefferle *Journal of Energy,* vol 2, May June 1978, p 142 146 17 refs

The paper outlines the engineering basis of the catalytic combustor for gas turbine engine applications where fuels are burnt without significant formation of pollutants The basic theory underlying the operation of the catalytic combustor is described It is shown that the catalytic combustor combines the intrinsic stability advantages of mass transfer-controlled catalytic reactors with the high reaction rates characteristic of conventional thermal com bustors A quantitative model to predict combustor behavior under transient operating conditions is needed for optimization of combustor design S D

A78-40831 # **Finite-element analysis of three-dimensional potential flow in turbomachines** T E Laskaris (GE Power Systems Laboratory, Schenectady, N Y) *AIAA Journal,* vol 16, July 1978, p 717-722 7 refs

Because of the mathematical difficulties involved in the three dimensional flow in turbomachinery cascades, present practice is to divide the problem into several coupled two dimensional problems and construct from these a three-dimensional solution For such problems, a finite-element technique is presented which is capable of solving the steady-state hydrodynamic equations of the three dimensional compressible potential flow in rotating or stationary flow regions The numerical algorithm is based on Galerkin's method applied over distorted curvilinear finite elements of the flow region where the absolute velocity potential is approximated by second order Lagrange polynomials and nodal parameters The process reduces the problem to a system of nonlinear algebraic equations which is solved by the Newton-Raphson iteration scheme The method is applied to a mixed-flow type of turbine in subsonic flow of peak Mach number near unity Equipotential lines and Mach number contours of the flowfield are presented The pressure distribution on the blade surface discloses regions of steep pressure recovery where boundary layer separation could occur (Author)

A78-40836 # **Aerodynamics of slender lifting surface in accelerated flight** S Ando (Nagoya University, Nagoya, Japan) *AIAA Journal,* vol 16, July 1978, p 751-753 8 refs

The lift force of a slender wing is analytically determined for nonuniform flight speed The fluid is assumed to be inviscid, and the flight speed may be either subsonic, transonic, or supersonic It is found that the lift depends on the instantaneous acceleration and not on the history of the wing motion An acceleration (or deceleration) increases (decreases) the lift force from that of steady state This may be attributed to the component of a forward acceleration of the wing normal to the surface P T H

A78-40837 # **High-frequency subsonic flow past a pulsating thin airfoil II - Gust-type upwash** A Plotkin (Maryland, University, College Park, Md) *AIAA Journal,* vol 16, July 1978, p 753, 754 Research supported by the University of Maryland

The high-frequency subsonic flow past a thin airfoil pulsating harmonically in time is analyzed for the case where the scale of the streamwise variation of the airfoil shape is comparable to the acoustic wavelength The airfoil shape is such that the upwash is the symmetrical counterpart of that for the Sears-type compressible gust The first-order unsteady velocity potential is calculated It is valid in a region whose extent in the transverse direction is of the order of the wavelength P T H

A78-40839 # **A new method of nozzle design** R Ishii (Kyoto University, Kyoto, Japan) *AIAA Journal,* vol 16, July 1978, p 756 759 7 refs

The design of an axially symmetric supersonic nozzle is treated by an inverse method The nozzle contour is determined for prescribed flow conditions on a reference streamline, which may be the nozzle axis or another nozzle wall The analysis technique is similar to the streamline methods of Oswatitsch (1956) and Uchida and Yasuhara (1956) The main difference is that the usual stream function is abandoned as an independent or dependent variable Instead, the independent variables are chosen so that their constant values represent a family of streamlines and orthogonal trajectories to the streamlines The streamlines forming the boundaries of strips into which the flow region is divided are calculated iteratively The method was checked by starting with velocity distributions given by the second approximation of Hall's (1962) perturbation method for a known nozzle contour at the throat P T H

A78-40844 **Get acquainted with scanning-beam MLS** J R Nelson (FAA, Airborne Systems Branch, Washington, D C) *Micro-Waves,* vol 17, June 1978, p 68, 69, 72, 74 77

It is pointed out that the endorsement of a time reference, scanning-beam (TRSB) microwave landing system (MLS) by the ICAO is a major step towards the achievement of a single, standard landing system for all aircraft and airports around the world MLS operates at C-band which permits ranges of up to 30 nmi to be reliably achieved with modest transmitting powers These frequencies will also permit the use of much smaller antennas than those presently required Additional operational advantages provided by MLS are related to a use of curved approach paths for noise abatement, operation on closely spaced parallel runways, routine all-weather operations, the employment of one modular system for all aircraft and all airports, the possibility to install the system at any airport, and increased channel capacity The new TRSB MLS standard is examined, giving attention to the narrow fan-shaped beams provided by the azimuth and elevation angle transmitters, the performance and accuracy of the basic TRSB landing system, the receiver/processor aboard the aircraft, the antenna based on the cost minimized phased array circuit technique, the inexpensive alternative presented by thinned arrays, and the design of beamport antennas G R

A78-40867 # **Automation in transportation in 1990 (L'automatisation dans les transports en 1990)** M Y David (Institut de Recherche des Transports, France) *Société des Electriciens, des Electroniciens et des Radioélectriciens, Congres de Grenoble, Grenoble, France, Sept 20-24, 1977, Paper* 15 p 6 refs In French

The automation of transportation systems by 1990 is discussed with reference to the optimal use of all modes of transport, the improvement of service, and a more efficient system of task integration The areas in which automation procedures will concen trate are identified for roadway, railroad, air, and maritime transport The projected automation is considered in terms of extensions to current applications, technological capabilities (noting the use of microprocessors), and theory S C S

A78-40868 # **Evolution of aircraft design through the CCV concept (Evolution de la conception des avions grace aux commandes automatiques generalisees)** P Poisson Quinton and J C Wanner (ONERA, Châtillon sous Bagneux, Hauts de-Seine, France) *Societé des Electriciens, des Electroniciens et des Radioélectriciens, Congres de Grenoble, Grenoble, France, Sept 20-24, 1977, Paper* 30 p 35 refs In French

Benefits conferred by the control configured vehicle concept in aircraft design are discussed The use of automatic systems ensures greater aerodynamic stability Topics considered include greater leeway in aircraft design, more economical operation, the reduction of structural fatigue, greater comfort durinq turbulence, and protec tion against flutter While applications are not discussed from a technical point of view, attention is directed to the kinds of new sensing and control equipment that is being developed M L

A78-40869 # **Data transmission aboard aircraft (Transmissions de données à bord des avions)** M J Monfort *Société des Electriciens, des Electroniciens et des Radioélectriciens, Congrès de Grenoble, Grenoble, France, Sept 20-24, 1977, Paper* 14 p In French

After some information on modern avionics and the trends of its evolution, the paper describes the new solutions for onboard data transmission Most of the equipment involves new digital techniques for data transmission Called data buses and using time multiplexing, they are the main channels connecting the digital equipment Some features of two data-buses being developed in France are given The paper ends with some indications on the evolution of the onboard man machine interface (Author)

A78-40917 **A programmable display test unit** E E Forster (Harris Corp Syosset, N Y) *IEEE Transactions on Instrumentation and Measurement,* vol IM-27, June 1978, p 140-146

A display stimulus generator (DSG) has been developed for the testing and aligning of complex avionic display systems The hardware structure is based on a control microprocessor, digital video generation circuitry, sample and hold measurement assembly, switching matrix, and auxiliary display monitor The primary elements of the software are the compiler and operating system and the microprocessor-associated firmware The potential applications of the DSG include testing video signal mixers and supplying videos to multifunction displays S C S

A78-40924 **ATE and avionics display systems** J W Dickerson (General Dynamics Corp , Fort Worth, Tex) *IEEE Transactions on Instrumentation and Measurement,* vol IM-27, June 1978, p 182-188

A review of ATE and avionics display systems is presented, noting that they may be divided into three types calligraphic or stroke, raster, or stroke/raster Symbol generators contain power-supply, timing, input, data-manipulation, output, and built-in-test sections interconnected by a master frequency oscillator, a controller, and a data manipulator stage Two primary types of display unit are identified as stroke and raster, head-up displays also include an optical module assembly The main factors influencing unit under-test (UUT) testability are identified as the test point selection and circuitry partitioning Procedures are outlined for symbol-generator testing, noting the measurement of the placement of the stroke-generated symbol deflection waveform outputs, the evaluation of symbol size and shape, raster symbology testing, and verification of symbol placement accuracy S C S

A78 40995 **The airline's role in the certification of aircraft - Criteria for air transport selection** C J May (Delta Air Lines, Inc , Atlanta, Ga) *Air Law,* vol 3, no 2, 1978, p 115 122 15 refs

Federal Aviation Regulations governing the airworthiness certification of commercial aircraft are discussed Certification of several engine alternatives for one type of aircraft, and the development of Configuration Deviation Lists are among the topics considered A biennial review of airworthiness certification rules was initiated by the FAA in 1974, incorporating state-of-the-art technology into certification procedures continues to be a problem for the FAA The internationally established airworthiness requirements for the A-300 widebody aircraft are also mentioned J M B

A78-41023 # **Integration, postdevelopment, and life tests in the case of the closed-loop simulation of the MRCA flight control system (Integration, Nachentwicklung und Lebensdauertests an der Geschlossenkreissimulation des MRCA-Flugsteuersystems)** W Durr and E Thum (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper* 26 p In German

The objectives of a confidence test for the flight control system (FCS) of an aircraft are examined A confidence test (CT) conducted with the aid of the FCS test rig is a test regarding the reliability for all flight control devices and subsystems in the entire flight control system The conduction of such a CT requires the combined employment of the FCS test rig and a computer program for the simulation of a flight under real-time conditions in a closed loop test Prior to the first flight of a new aircraft, its FCS has to pass a flight qualification test under simulated flight conditions Additional flight qualification tests have to be conducted for prototype, preproduction, and production aircraft Attention is given to the confidence test carried out with the FCS of the military aircraft Tornado, tests which must be conducted prior to the confidence test, the FCS test rig for Tornado, the recording of test data, the pilot control panel, the maintenance control panel, the flap and slat built-in test equipment panel, the confidence test program, and the results obtained in the various parts of the confidence test G R

A78-41024 # **Design and optimization of the Tornado control system by means of simulation (Auslegung und Optimierung des Tornadosteuersystems mittels Simulation)** E Zehner, H Liese, and H Przibilla (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper* 30 p In German

The use of simulation in aircraft development is illustrated with the aid of an example involving the design and optimization of the primary control system in the case of the Tornado project A survey is provided regarding the role of simulation in supplementing linearization considerations in the design of the control system structure The usefuless of simulation is shown with the aid of a few selected cases An introductory description of the primary control system is presented and attention is given to the design of the control system structure with respect to the pitch axis, the optimization of control behavior in the pitch axis, the design of the structure of roll and yaw control, the design of roll control in rapid flight, and the simulation of extreme flight conditions G R

A78-41025 # **Tornado development simulation (Tornado Entwicklungssimulation)** G Feil (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) *Deutsche Gesellschaft fur Luft und Raumfahrt, Symposium uber Entwicklungssimulation, Cologne, West Germany, Dec 5, 6, 1977, Paper* 23 p In German

The main reason for a utilization of simulation approaches is related to the necessity to develop a well functioning complex weapons system which consists partly of components of proven reliability and partly of newly developed components In this connection, it is necessary to develop devices which can only be evaluated on the basis of their behavior within the entire system The Tornado project is an example for a case in which the development of an aircraft was accompanied from the beginning by simulation studies The installations used for the simulation studies are discussed A digital computer with 80 K core storage and a word length of 32 bits formed the basis of the installations The computational speed of the computer is sufficient to calculate the characteristics of the entire Tornado aircraft system within the entire altitude-Mach range with a cycle time of 45 msec A central interface is used to connect the computer to the various cockpit and rig installations The flexible design of the simulation installations makes it possible to study within a very short time another aircraft with the aid of the simulation system Attention is given to the Tornado development cockpit, the flight control rig, the avionic stage IV rig, and the simulation of the autopilot G R

A78-41029 # **An experimental study of boundary layer transition on a caret wing at hypersonic speeds** R B Deshpande (Gas Turbine Research Establishment, Bangalore, India) *Aeronautical Society of India, Journal,* vol 28 (Aug 1976), Mar 1978, p 289-296 17 refs

Heat transfer rates have been measured on the lower surface of a caret wing at Mach numbers of 8 4 and 9 7 in a gun tunnel The unit Reynolds number varied between 365,000 per inch to 730,000 per inch The heating rates at design conditions were within + or - 20% agreement of the predictions of strip theory for laminar boundary layer except in transition region and showed considerable discrepancies near the ridge line The beginning of transition of flow, as determined from heat transfer measurements, occurred at local Reynolds number down to 660,000 near the ridge line Observation of transition positions have indicated lower values of transition Reynolds number for lifting surface of the caret wing than those for unswept surface under similar conditions (Author)

A78-41146 # **Unsteady transonic thin-airfoil theory for power-law upwash** A Plotkin (Maryland, University, College Park, Md) *ASME, Transactions, Journal of Applied Mechanics,* vol 45, June 1978, p 440, 441 6 refs

The reported investigation has the objective to obtain the linearized transonic lift response for the integer power-law upwash where x is normalized by the semichord and is measured from the leading edge The relation is derived from the response to a generalized sinusoidal gust For n greater than 1, the results may be of interest for aeroelastic applications such as the flutter of a deforming airfoil The perturbation velocity potential on the upper surface of the plate for linearized unsteady transonic flow given by Landahl (1961) is considered The lift response to the power law upwash is obtained with the aid of a series expansion It is interesting to note that Amiet's (1976) solution for high-frequency subsonic flow becomes exact for values of reduced frequency of O(1) as the Mach number approaches one G R

A78-41149 # **Transition behavior of a Blasius type boundary layer subjected to uniform blowing or suction** M Sokolov and G Karpati (Tel Aviv University, Tel Aviv, Israel) *ASME, Transactions, Journal of Applied Mechanics,* vol 45, June 1978, p 450-453 9 refs

The momentum integral equation is used to study the transient behavior of a Blasius type boundary layer which is suddenly subjected to uniform blowing or suction The time required for the boundary layer to adjust itself from one steady state (Blasius) to the other (constant blowing or suction) was found to be proportional to the distance from the leading edge Boundary layer thickness of intermediate states and skin friction coefficients are also reported (Author)

A78-41157 # **The flapwing, a unique fluid machine element** R Gerharz (U S Army, Night Vision Laboratory, Fort Belvoir, Va) *ASME, Transactions, Journal of Fluids Engineering,* vol 100, June 1978, p 237, 238

A flow engine element is described which converts the oscillations of a flapwing, which is mounted on a crankshaft, into rotary energy A self starting twin model of this energy flux converter was built and tested in a moderate stream of air Driving this device with a motor reverses it into an air blower of the hydropulser class (Author)

A78-41166 **Concorde - Ride quality and passenger reactions** L G Richards and I D Jacobson (Virginia, University, Charlottesville, Va) *Aviation, Space, and Environmental Medicine,* vol 49, July 1978, p 905-913 7 refs

Passenger comfort ratings, cabin noise levels and post-flight passenger reactions were studied for four Concorde flights between Europe and North or South America A portable monitoring system furnished data on noise, vibration in six degrees of freedom, temperature and pressure in the cabin A total of 64% of the passengers responding felt that Concorde flights were better than regular flights in terms of the physical effects experienced Business advantages of the Concorde were also cited by passengers On the day following the flight, the most common mood among the Concorde passengers was active, lively and rested J M B

A78-41202 # **Study of the influence of the composition of additions on the antioxidation stability of jet fuels (Issledovanie vliianiia kompozitsii prisadok na antiokislitel'nuiu stabil'nost' reaktivnykh topliv)** O P Lykov, I A Golubeva, T P Vishniakova, N V Tumar, and G V Privezentseva (Moskovskii Institut Neftekhimicheskoi i Gazovoi Promyshlennosti, Moscow, USSR) *Khimiia i Tekhnologiia Topliv i Masel,* no 6, 1978, p 35-38 7 refs In Russian

The paper deals with the chemical stabilization of jet fuels by means of such phenol type antioxidants as ionol Specifically, the influence of the composition of ionol-base additions on the antioxidation stability of T 7 fuel was studied A sinergetic effect was observed for an ionol 4010 NA composition at a component mole ratio of 4 1 V P

A78-41280 **Airborne sampling system for plume monitoring** D L Blumenthal, J A Ogren, and J A Anderson (Meteorology Research, Inc , Altadena, Calif) *(International Symposium on Sulfur in the Atmosphere, Dubrovnik, Yugoslavia, Sept 7 14, 1977) Atmospheric Environment,* vol 12, no 1 3, 1978, p 613 620 30 refs Research supported by the U S Environmental Protection Agency

The instrumentation of the single engine Cessna 206 used for the airborne sampling of plumes for Project MISTT (Midwest Interstate Sulfur Transformation and Transport) is described On board aerosol instrumentation includes a condensation nuclei monitor, aerosol charge acceptance monitor, integrating nephelometer, electrical aerosol analyzer, optical particle counter, size segregated filter sampler, and a wing mounted impactor system The size distribution sample inlet system is characterized, and a list of continuously monitored chemical compounds and physical parameters is presented Advantages of the system include the ability to make a large number of simultaneous measurements and the operational procedures which allow rapid feedback of sampling results M L

A78-41393 **The employment of a dye laser with high peak power and great pulse length for the aircraft-based measurement of 'air velocity' (Verwendung eines Farbstofflasers mit hoher Spitzenleistung und langer Pulsdauer zur Messung der 'Luftgeschwindigkeit' vom Flugzeug aus)** D Mainone (Bundesamt fur Wehrtechnik und Beschaffung, Koblenz, West Germany) and X Bouis (ONERA, Grandes Souffleries de Modane Avrieux, Modane, France) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, May-June 1978, p 151-155 9 refs In German

Investigations were conducted concerning a use of the techniques of laser anemometry for measurements of flight speed to be conducted during the flight on board of the aircraft Problems regarding the selection of a suitable method were related to the limited electric power available in the aircraft On the basis of a detailed study it was decided to use a laser Doppler difference anemometry procedure employing back-scattering effects Pulse operation makes it possible to limit the electric power requirements to levels which can be provided in an aircraft The laser Doppler anemometer needed was built and tested in the laboratory in 1977 The dye laser selected employs rhodamine 6 G The laser output energy is 300 W for a pulse length of 60 microseconds The number of pulses per second can be varied from 1 to 100 The developed laser system was successfully tested on board of an aircraft during five experimental flights involving different meteorological conditions G R

A78-41394 **Experimental investigations concerning the stalling characteristics of airplanes with T-tails (Experimentelle Untersuchungen zum Uberziehverhalten von Flugzeugen mit T-Leitwerk)** W Siegler and B Wagner (Darmstadt, Technische Hochschule, Darmstadt, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, May-June 1978, p 156-165 14 refs In German Research supported by the Deutsche Forschungsgemeinschaft

Using a wing-horizontal tail model with four wings of different sweep, different taper, and aspect ratio 5, systematic wind tunnel tests (three-component measurements) have been carried out up to high angles of attack (more than 50 deg) to investigate the wing-horizontal tail interference Within the same angle of attack range two airplane models (transport aircraft, AR equals 5 6, fighter aircraft, AR equals 2 4) have been tested Tailplane incidence, height, and rear position have been varied For the airplane models also the effects of flap positions have been investigated, and downwash angle, tailplane efficiency, and dynamic pressure ratio at the horizontal tail have been estimated from the aerodynamic coefficients measured (Author)

A78-41397 **A simple propulsion system model for the simulation of nonlinear dynamic thrust response (Einfaches Triebwerksmodell zur Simulation nichtlinearer dynamischer Schubantworten)** G Schanzer and P Krauspe (Braunschweig, Technische Universitat, Braunschweig, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, May-June 1978, p 195-198 In German

A model for the performance of jet engines is introduced which allows to simulate measured thrust to-time curves in steady state operation as well as in acceleration/deceleration schedule Due to its simplicity along with its high fidelity it is very well suited for the representation of jet engines in digital simulation programs (Author)

A78-41420 **Automatic airborne spectrometer (Automatisation d'un spectromètre embarque sur avion)** J Appel, E Haziza, and J Marcault (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(Mesures, Regulation, Automatisme,* vol 42, Dec 1977, p 37 42) *ONERA, TP* no 1977-176, 1977 (p 37-42) 7 p In French

The paper describes the use of a commercial minicomputer to control an airborne infrared spectrometer associated with a heliostat The minicomputer is used for control of the operations, while data acquisition is achieved through an independent system The minicomputer has 8K 16-bit words of semiconductor memory Two interfaces take care of the spectrometer-computer dialog, one for acquisition of analog quantities, the other for exchange of logic information The operator keyboard has one key for each gas component to be analyzed and a digital keyboard The programming is in assembler and makes use of the interrupt system of the computer A sample spectrum obtained on a 11 km altitude flight is shown P T H

A78-41452 **An analysis of the leading-edge singularity in transonic small-disturbance theory** B L Keyfitz (Columbia University, New York, N Y), R E Melnik, and B Grossman (Grumman Aerospace Corp , Bethpage, N Y) *Quarterly Journal of Mechanics and Applied Mathematics,* vol 31, May 1978, p 137 155 18 refs NSF Grant No MCS-76 07654

The behavior of solutions of the transonic small-disturbance equation near the leading edge of a smooth blunt-nosed airfoil at incidence is considered The character of the leading-edge singularity is shown to depend upon the relative magnitudes of the thickness parameter, and upon the angle of attack The analysis indicates that the leading-edge behavior is dominated by thickness effects An asymptotic series is developed for this domain, with the leading term corresponding to sonic flow over a parabola at zero incidence Higher-order terms represent the effects of profile geometry, free stream speed, and incidence as regular perturbations of the leading term The boundary value problems for the first terms of the series are developed, and numerical solutions are tabulated The leading-edge solution is compared to numerical solutions of the transonic small-disturbance and full potential-flow equations It is concluded that the numerical solution and the series solution of the transonic small disturbance equation are in good agreement provided that a sufficient number of grid points is employed in the numerical computation in the leading-edge region (Author)

A78-41507 **Aircraft engine design and development through lessons learned** B L Koff (General Electric Co , Aircraft Engine Group, Cincinnati, Ohio) *(Israel Conference on Mechanical Engineering, 11th, Haifa, Israel, July 11, 12, 1977) Israel Journal of Technology,* vol 15, no 4-5, 1977, p 139-152

The article surveys the major aspects of aircraft engine design noting tradeoff studies relative to the design configuration and aircraft system requirements The details of design analysis are considered with reference to the theoretical stage (involving finite element analyses, vibration analyses, and three-dimensional finite element models), the experimental stage, and evaluations of material behavior The test and evaluation program is discussed including engine cyclic endurance, instrumentation and measurement, engine unbalance testing, and process-quality controls S C S

A78-41508 **Inlet flow distortions in axial flow compressors** J Colpin (Institut von Karman de Dynamique des Fluides, Rhode-Saint Genese, Belgium) *(Israel Conference on Mechanical Engineering, 11th, Haifa, Israel, July 11, 12, 1977) Israel Journal of Technology,* vol 15, no 4 5, 1977, p 153-163 16 refs

The present paper treats the inlet circumferential flow distortion problems following two approaches, i e , a global and a detailed analysis The first of these approaches develops the parallel compressor model by including an unsteady blade transfer function, which depends essentially on the blade reduced frequency Thus, the small distortions are well taken into account for the highly unsteady behaviour they induce at the rotor The predictions reached agree fairly well with tests done on a high speed single stage compressor distorted with various upstream grids A simple two-dimensional incompressible model is presented to simulate the rotor dynamic transfer On this basis, we extract some of the fundamental parameters involved in the unsteady transfer, i e , chord length, peripheral velocity, preswirl, stator loading Detailed measurements corroborate the conclusions we reached with the aid of the model, showing different dynamic transfers as a function of the distortion and of the peripheral velocity A unified discussion links together the two developed approaches through the common parameters (Author)

A78-41509 **Computer aided design of radial gas turbines - A method for determining the overall rotor dimensions** R S Benson (University of Manchester Institute of Science and Technology, Manchester, England) *(Israel Conference on Mechanical Engineering, 11th, Haifa, Israel, July 11, 12, 1977) Israel Journal of Technology,* vol 15, no 4-5, 1977, p 164 178 14 refs

A method is outlined for determining the overall dimensions of a radial gas turbine rotor given certain operating conditions An optimization procedure is used based on one-dimensional analysis of the turbine performance The analysis includes loss predictions due to passage losses, disk friction and clearances (Author)

A78-41510 **Optimization of the cooling system of an air-cooled internal combustion engine** A Stotter and J Katz (Technion - Israel Institute of Technology, Haifa, Israel) *(Israel Conference on Mechanical Engineering, 11th, Haifa, Israel, July 11, 12, 1977) Israel Journal of Technology,* vol 15, no 4-5, 1977, p 179 186 7 refs Research supported by the Teledyne Continental Motors Co

The air-cooled system of an internal combustion engine is presented as an air flow resistance network The various ducts, heat exchangers, cylinders, and fans are given by functions describing the change of the state of the cooling air through the element The whole system is then optimized and balanced by applying the three fundamental conditions (1) Continuity of cooling air flow, (2) total system resistance equal to pressure difference generated by the cooling fan, (3) the change of the cooling air enthalpy equal to heat rejected by the engine The calculations are programmed for a digital computer and the results provide good prediction of the performance of the system under various operating and ambient conditions, saving considerable time and money during the experimental development stage of the system (Author)

A78-41511 **The spray cooling of gas turbine exhaust gases** J Katz, D Adler, and A Stotter (Technion - Israel Institute of Technology, Haifa, Israel) *(Israel Conference on Mechanical Engineering, 11th, Haifa, Israel, July 11, 12, 1977) Israel Journal of Technology,* vol 15, no 4-5, 1977, p 187-195 12 refs

A simplified, one-dimensional calculation method has been developed for the cost-effective design of turbine exhaust-gas heat exchangers It is applicable to cases where the interacting gas-liquid is not separated and where the transferred heat is not recovered The technique is based on empirical correlations for the calculation of transfer coefficients including mass, heat, and momentum It is assumed that the flow is one-dimensional, that the droplets are continuously and uniformly distributed, that the water vapor and carrier gas are continuous and satisfy a given equation of state, and that the effect of collisions between droplets is taken into account
S C S

A78-41512 **Simulation of single and double-stage reciprocating compressor systems with allowance for frictional effects and heat transfer** A S Ucer (Middle East Technical University, Arkara, Turkey) and R S Benson (University of Manchester Institute of Science and Technology, Manchester, England) *(Israel Conference on Mechanical Engineering, 11th, Haifa, Israel, July 11, 12, 1977) Israel Journal of Technology,* vol 15, no 4-5, 1977, p 196-208 22 refs Research supported by the Scientific and Technical Research Council of Turkey

Gas flow in multiple single-stage and two-stage reciprocating compressor systems is simulated using one-dimensional gas dynamic theories Heat transfer from all parts of the system, friction loss, and longitudinal entropy gradients are considered in the pipes The effect of various heat transfer models on the predicted pressure fluctuations in the pipe between the stages of the two-stage compressor system is investigated A method for determining mesh lengths, and for obtaining an expression for pressure pulsations in all pipes, is given Receivers are simulated by neglecting lengthwise wave action and assuming that heat transfer is by natural convection Two models for predicting the rate of heat transfer from the cylinder are compared An extensive test program was applied to the simulation computer program Prediction of pressure diagrams and mass flow rate are compared with the experimental results The two stage compressor test apparatus is described The solution method offers an accurate means for predicting pressure pulsations in single and double-stage reciprocating compressor systems Deviation of predicted mass flow rates from measured values do not exceed 7% (Author)

A78-41519 **A computer-controlled system for fatigue testing under simulated service loading** H Morr and A Berkovits (Technion Israel Institute of Technology, Haifa, Israel) *(Israel Conference on Mechanical Engineering, 11th, Haifa, Israel, July 11, 12, 1977) Israel Journal of Technology,* vol 15, no 4-5, 1977, p 318-325 6 refs

Three computer programs have been designed to program simulated service loads in fatigue tests for aircraft structures Two constitute an overall load history The block program permits the determination of a block of load sequences with a variable set of maximum and minimum load pairs Each pair, or load cycle, may be applied an unlimited number of times The block is repeated until failure occurs The spectrum test program distributes loads randomly within the overall load history The conversion history, which does not depend on overall load history, duplicates an input series of consecutive load applications, having adapted the load amplitudes to the corresponding test system calibration signals S C S

A78-41536 **The effect of sheet thickness on flight simulation fatigue crack propagation in 2024 T3, 7475 T761 and mill annealed Ti-6Al-4V** R J H Wanhill (Nationaal Lucht en Ruimtevaartlaboratorium, Amsterdam, Netherlands) *Society of Environmental Engineers, Journal,* vol 17-2, June 1978, p 27 32 24 refs Research supported by the Netherlands Agency for Aerospace Programmes

A study is made of the influence of sheet thickness on fatigue crack propagation under flight simulation loading for 2024-T3 and 7475-T761 aluminum and mill annealed Ti 6Al-4V titanium alloys The sheets, having thicknesses up to 3 mm, represent lower wing skin stiffened panels of end load capacities 1 5 and 3 MN/m It is found that (1) thinner gauge materials show slower crack propagation because of an increased retardation of crack growth after severe flights, (2) monolithic sheets of 7475-T761 or 1 4-mm Ti-6Al 4V have inferior resistance to crack propagation as compared to 2024-T3, and (3) for equal panel weights 0 5-mm Ti-6Al-4V is slightly more resistant to crack propagation than 1 6-mm 2024-T3
S C S

A78-41828 # **Testing techniques and interference evaluation in the OSU transonic airfoil facility** J D Lee, G M Gregorek, and K D Korkan (Ohio State University, Columbus, Ohio) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1118* 13 p 9 refs USAF supported research

Surface pressure measurements on a series of airfoils of 7 62, 15 24, and 30 48 cm (3, 6, and 12 inch) chord lengths were made in a transonic airfoil wind-tunnel facility at Mach numbers from 0 3 to 1 06 Comparison of the airfoil pressure distributions for various chord sizes and with theory for both sub- and supercritical flow conditions indicate little interference Further, it has been shown that the degree of interference can be accounted for as an angle-of-attack correction alone Other airfoil testing techniques evaluated included pressure belt and sidewall pressure orifice measurements to compare with flush centerline airfoil pressure taps (Author)

A78-41831 * # **Acoustic evaluation of a novel swept-rotor fan** J G Lucas, R P Woodward, and M J MacKinnon (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78 1121* 13 p 12 refs

Inlet noise and aerodynamic performance are presented for a high tip speed fan designed with rotor blade leading edge sweep that gives a subsonic component of inlet Mach number normal to the edge at all radii The intent of the design was to minimize the generation of rotor leading edge shock waves thereby minimizing multiple pure tone noise Sound power level and spectral comparisons are made with several high-speed fans of conventional design Results showed multiple pure tone noise at levels below those of some of the other fans and this noise was initiated at a higher tip speed Aerodynamic performance of the fan did not meet design goals for this first build which applied conventional design procedures to the swept fan geometry (Author)

A78-41832 * # **The exact numerical calculation of propeller noise** C J Woan and G M Gregorek (Ohio State University, Columbus, Ohio) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78 1122* 12 p 12 refs Contract No NAS1-14406

This paper presents a method for computing the acoustic pressure signature of a propeller due to blade thickness and steady surface pressure loading including the effect of forward motion The tip helical speed is restricted to subsonic The formulation is based on the Ffowcs Williams Hawkings exact result concerning the sound generation by moving bodies The blade surface is described in a helical coordinate system by the blade angles, positions of the leading and trailing edges along the local pitch helix, and the camber and thickness distributions along the chord The retarded distance of the moving acoustic source on an element of surface area of the propeller blade is obtained numerically by Newton's method The surface integration over the propeller blades is carried out in the helical coordinate system using a double Gauss Legendre formula Good agreement was found between analytic and experimental results, both in the time and frequency domains Some samples showing the effects of propeller geometry and tip Mach number on the acoustic signature are included (Author)

A78-41840 # **Numerical solution of the supersonic and hypersonic viscous flow around thin delta wings** G S Bluford, Jr (USAF, Flight Dynamics Laboratory, Wright Patterson AFB, Ohio) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1136* 12 p 27 refs

Numerical solutions have been obtained for the supersonic and hypersonic, viscous flow fields around thin planar delta wings These solutions were obtained by solving the unsteady Navier-Stokes equations subject to a conical approximation The integration technique used was MacCormack's explicit finite-difference scheme Solutions were obtained for the upper, lower, and total flow fields around delta wings with supersonic leading edges These solutions span a Mach number range of 2 94 to 10 16, a local Reynolds number range of 3 345 x 10 to the 5th to 5 0 x 10 to the 6th, and various angles of attack from -15 to +15 deg The numerical results compare quite favorably with both supersonic and hypersonic experimental flow field data This investigation demonstrated the feasibility of applying a conical approximation to the Navier Stokes equations in order to calculate the flow around thin delta wings (Author)

A78-41841 * # **Calculation of supersonic viscous flow over delta wings with sharp subsonic leading edges** Y C Vigneron, J C Tannehill (NASA, Ames Research Center, Moffett Field, Calif, Iowa State University of Science and Technology, Ames, Iowa), and J V Rakich (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78 1137* 20 p 32 refs Research supported by the Iowa State University of Science and Technology, Grant No NGR-16 002-038

Two complementary procedures have been developed to calculate the viscous supersonic flow over conical shapes at large angles of attack, with application to cones and delta wings In the first approach the flow is assumed to be conical and the governing equations are solved at a given Reynolds number with a time marching explicit finite-difference algorithm In the second method the parabolized Navier Stokes equations are solved with a space-marching implicit noniterative finite difference algorithm This latter approach is not restricted to conical shapes and provides a large improvement in computational efficiency over published methods Results from the two procedures agree very well with each other and with available experimental data (Author)

A78-41842 # **Application of supercritical airfoil technology to compressor cascades - Comparison of theoretical and experimental results** H E Stephens (United Technologies Corp, Pratt and Whitney Aircraft Group, East Hartford, Conn) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1138* 11 p 15 refs

A shockless supercritical compressor blade designed with an inverse hodograph procedure has been tested in cascade Comparisons of the measured performance results with those of a conventional cascade tested at the same design conditions are presented The supercritical design is superior for this advanced application in terms of both reduced losses and increased incidence range Results of the numerical simulation of the supercritical cascade test conditions using a transonic potential flow solution show good agreement between measured and computed velocity distributions The ability to design, test, and analyze supercritical cascades is demonstrated through comparisons with detailed experimental results (Author)

A78-41843 * # **A viscous-inviscid interactive compressor calculation** W A Johnston (Case Western Reserve University, Cleveland, Ohio) and P M Sockol (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1140* 10 p 24 refs NASA-supported research

A viscous-inviscid interactive procedure for subsonic flow is developed and applied to an axial compressor stage Calculations are carried out on a two-dimensional blade to-blade region of constant radius assumed to occupy a mid-span location Hub and tip effects are neglected The Euler Equations are solved by MacCormack's method, a viscous marching procedure is used in the boundary layers and wake, and an iterative interaction scheme is constructed that matches them in a way that incorporates information related to momentum and enthalpy thicknesses as well as the displacement thickness The calculations are quasi-three dimensional in the sense that the boundary layer and wake solutions allow for the presence of spanwise (radial) velocities (Author)

A78-41844 * # **Characteristics of the near wake of a compressor or fan rotor blade** B Reynolds, B Lakshminarayana, and A Ravindranath (Pennsylvania State University, University Park, Pa) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1141* 14 p 21 refs Grant No NsG-3012

Research reported in this paper covers an experimental investigation of the rotor wake The experimental investigation included a study of the mean velocity, turbulence intensity, and Reynolds stress variations across the wake of a lightly loaded rotor blade at various axial and radial locations Only the mean velocity data and their interpretation is presented in this paper Measurements were carried out with a triaxial probe, rotating with the rotor and stationary behind the rotor Also, measurements were made with a spherical head static pressure probe rotating with the rotor Wakes were measured at various incidences to discern the effect of blade loading on the rotor wake The wake is found to be three dimensional in nature with appreciable radial velocity The measurements close to the blade trailing edge indicate that the decay of the wake is rapid in this region The wake data is correlated to derive expressions for the profile and decay of all the components (Author)

A78-41845 # **Summary of the 1977 USAF/OSR/ASEE Summer Design Study program on the integration of wind tunnels and computers** B W Marschner (Colorado State University, Fort Collins, Colo) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10 12, 1978, Paper 78-1144* 5 p Grant No AF AFOSR-77-3289

A78-41849 # **Second order accurate calculation of transonic flow over turbomachinery cascades** D C Ives and J F Liutermoza (United Technologies Corp, Pratt and Whitney Aircraft Group, East Hartford, Conn) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10 12, 1978, Paper 78 1149* 10 p 14 refs

This paper presents a number of observations made, and techniques developed, in the process of constructing an accurate finite difference method for the calculation of transonic flow through a cascade These techniques can be applied to related problems, such as flows over airfoils and inlets A simple method is given to account for wind tunnel sidewall effects in transonic flow calculations A method is then presented which can be utilized to produce more rapid convergence for coupled viscous inviscid transonic flow relaxation calculations Finally, a stable set of fully second order accurate difference equations for the full transonic potential flow equation is presented, along with some principles governing its construction and use Calculations are presented to demonstrate the importance and effectiveness of these new methods (Author)

A78-41851 # **Small perturbation theory for supersonic jets** P W Carpenter (Exeter, University, Exeter, England) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1151* 8 p 15 refs

A brief review is given of the linear theory for supersonic axisymmetric jets together with a discussion of various anomalies which arise The method of characteristics is applied to the linearised equations of motion In this way an analytical expression is found for the velocity change across the initial expansion fan A special procedure is developed for carrying out an asymptotic analysis of the full equations of motion in the expansion fan region On the basis of this analysis it is concluded that the linear theory does not in general give the correct limiting value for the velocity change across the expansion fan but, in practice, gives almost the correct shape for the jet boundary (Author)

A78-41852 * # **Calculation of far-field jet noise spectra from near-field measurements using true source location** K K Ahuja, B J Tester, and H K Tanna (Lockheed Georgia Co , Marietta, Ga) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10 12, 1978, Paper 78-1153* 8 p 10 refs Contract No NAS3 20050

Jet mixing noise data at different measurement distances are compared with values calculated from the Lockheed prediction method Although the method does not include any acoustic near-field effects, the measured and predicted results agree well where the measured data deviates from the inverse square law It is therefore suggested that departures from the inverse square law are primarily the result of (1) the non-negligible distance between the nozzle exit plane and the true axial source location and (2) the jet mixing noise directionality, as modeled in the prediction method Allowing for these effects, jet noise data at 8 and 96 diameters over a wide range of frequencies, angles and jet conditions are shown to collapse with reasonable accuracy (Author)

A78-41876 # **Viscous drag computation for axisymmetric bodies at high Reynolds numbers** M F Zedan and C Dalton (Houston, University, Houston, Tex) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1183* 12 p 41 refs

A critical comparison has been made between the drag characteristics of a number of the best available axisymmetric body shapes The comparison was carried out in the Reynolds number range of high speed submarine shapes and airships (of the order of 10 to the 8th) where experimental data and theoretical investigations are lacking Assuming turbulent boundary layer behavior over most of the body surface, the study showed that all profiles have almost equal drag coefficients, when referenced to the two-thirds power of the body volume However, based on the frontal area, several laminar bodies were found to have substantially lower drag coefficients If the laminar boundary layer could survive for some distance at such high Reynolds number, the laminar profiles will have substantially less drag Therefore, this study suggests that unconventional laminar body shapes are best candidates from the drag point of view for airship and submarine profile design at high Reynolds numbers (Author)

A78-41877 # **Aircraft operating environments around high speed ships** J F Marchman, III (Virginia Polytechnic Institute and State University, Blacksburg, Va) *American Institute of Aeronautics and Astronautics Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78 1184* 12 p

A wind tunnel study was conducted to determine the flowfield around a hydrofoil ship in order to determine the operating environment for a remotely piloted vehicle in the vicinity of the ship Flow visualization tests were conducted using smoke and wool tufts Tests were run using an RPV model mounted on a traverse such that it could simulate aircraft reactions to the flow Velocity profiles were examined in detail at two stations along the ship fantail All tests were run over a range of ship yaw angles between plus or minus 15 deg Tests were run with and without ship stack exhaust simulation The dominant feature was shown to be two vortices along the ship's deck edge which may make aircraft operation from high speed ships difficult, if not impossible (Author)

A78-41882 * # **Prediction of nearfield jet entrainment by an interactive mixing/afterburning model** S M Dash, H S Pergament (Aeronautical Research Associates of Princeton, Inc , Princeton, N J), and R G Wilmoth (NASA, Langley Research Center, Hampton, Va) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1189* 16 p 28 refs Contract No NAS1-14794

The development of a computational model (BOAT) for calculating nearfield jet entrainment, and its application to the prediction of nozzle boattail pressures, is discussed BOAT accounts for the detailed turbulence and thermochemical processes occurring in the nearfield shear layers of jet engine (and rocket) exhaust plumes while interfacing with the inviscid exhaust and external flowfield regions in an overlaid, interactive manner The ability of the model to analyze simple free shear flows is assessed by detailed comparisons with fundamental laboratory data The overlaid methodology and the entrainment correction employed to yield the effective plume boundary conditions are assessed via application of BOAT in conjunction with the codes comprising the NASA/LRC patched viscous/inviscid model for determining nozzle boattail drag for subsonic/transonic external flows Comparisons between the predictions and data on underexpanded laboratory cold air jets are presented (Author)

A78-41885 * # **Hot-wire, laser anemometer and force balance measurements of cross-sectional planes of single and interacting trailing vortices** J D Iversen, S Park, D R Backhus, R A Brickman (Iowa State University of Science and Technology, Ames, Iowa), and V R Corsiglia (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1194* 14 p 19 refs Research supported by the Iowa State University of Science and Technology and NASA

Single and multiple trailing vortices shed from semi span wings and a transport model in a wind tunnel were studied by means of a laser-velocimeter, hot-wire anemometer, and a trailing model incorporating a 6 component force balance Velocity profile and turbulence data from the laser velocimeter and hot-wire anemometer are presented and shown to compare well with the Betz inviscid circulation model Lift and rolling moment measurements on the following model are compared with those predicted from the flow field measurements (Author)

A78-41886 * # **The spanwise lift distribution on a wing from flow-field velocity surveys** K L Orloff (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1195* 12 p 8 refs

The application of the incompressible three-dimensional momentum integral equation to a finite wing is reviewed The objective is to interpret the resulting equations in a way that suggests an alternate experimental method for determining the span-wise distribution of lift Consideration is given to constraints that must be placed on the character of the vortex wake of the wing to provide the familiar relationship between lift and bound vorticity A novel technique is then presented for obtaining, from behind the wing, the spanwise lift distribution from velocity surveys that are made over only a short distance above and below the wing trailing edge The necessary formalism is developed to use these measured values to obtain the actual span loading by using an equivalent single horseshoe vortex model to account for the unmeasured portion of the downward (or upward) momentum The results of a numerical simulation are presented for a typical loading distribution The technique is then verified experimentally using laser velocimeter data for the flow field around a model wing (Author)

A78-41887 * # **Flying-hot-wire study of two-dimensional mean flow past an NACA 4412 airfoil at maximum lift** D Coles and A J Wadcock (California Institute of Technology, Pasadena, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78 1196* 12 p 10 refs Grants No NGL 05 002-229, No NsG-2319

Hot-wire measurements have been made in the boundary layer, the separated region, and the near wake for flow past an NACA 4412 airfoil at maximum lift The Reynolds number based on chord was about 1,500,000 The main instrumentation was a hot-wire probe mounted on the end of a rotating arm A digital computer was used to control synchronized sampling of hot wire data at closely spaced points along the probe arc Ensembles of data were obtained at several thousand locations in the flow field The data include intermittency, two components of mean velocity, and twelve mean values for double, triple, and quadruple products of two velocity fluctuations The data are available on punched cards in raw form and also after use of smoothing and interpolation routines to obtain values on a fine rectangular grid aligned with the airfoil chord The data are displayed in the paper as contour plots (Author)

A78-41888 # **Techniques for the experimental investigation of the near wake of a circular cylinder** R W Wlezien and J L Way (Illinois Institute of Technology, Chicago, Ill) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10 12, 1978, Paper 78-1197* 10 p 21 refs Contract No F44620 76-C 0062

The near wake of a circular cylinder in crossflow is experimentally investigated in a wind tunnel for Reynolds numbers from 5,800 to 10,400 A thermal tag is applied to one of the cylinder boundary layers prior to separation, and the instantaneous strength of the contaminant is detected downstream by an array of high resolution differential resistance thermometers A generalized form of phase conditioning is used to determine average properties of the amplitude and frequency modulated wake, and the phase mean wake temperature profiles are constructed The present method of phase conditioning is compared with other schemes (Author)

A78-41890 # **An experimental and computational investigation of a swept-wing flow at subsonic speeds** A Bertelrud *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78 1200* 16 p 19 refs Research sponsored by the Defence Materiel Administration of Sweden

The paper reports on an experimental and computational investigation of the flow on a portion of an aircraft swept wing in a wind tunnel at low speeds The range of angle of attack covered the domain encountered by the aircraft, and the actual outer part of a wing was used for the tests The experiments included static pressure distributions in the leading-edge region, as well as the rest of the chord, shear-stress measurements in the leading edge region, obtained with heated film gages, and skin friction measurements on the main part of the wing, obtained with modified Preston tubes Velocity profile data across the boundary layer were taken in a smaller region, and some measurements of the turbulence characteristics at a few locations on the main wing were also taken The pressure distribution was shown to be satisfactorily represented by patching a two dimensional inviscid method in the leading edge region and a three-dimensional panel method on the main wing Starting from this, boundary-layer calculations were performed with Bradshaw's finite-difference program for straight tapered swept wings, where different spanwise stations were calculated separately The results are encouraging, as the estimated skin-friction magnitude and trends with Reynolds numbers were predicted reasonably well (Author)

A78 41891 * # **Strake-wing analysis and design** J E Lamar (NASA, Langley Research Center, Hampton, Va) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1201* 12 p 14 refs

The technology is still evolving for improving the transonic maneuver capability of strake-wing configurations Much of the work to date has been of an experimental nature, whereas, the theories that are available to handle vortex-flow aerodynamics have mostly treated wings of constant sweep Hence, two efforts were undertaken They are (1) to extend the suction analogy to more general configurations and evaluate the method by using selected critical planforms, and (2) to develop a procedure for strake planform shaping and test the resulting shape in conjunction with a wing-body The conclusions from this study are that (1) some improvement has been made in estimating high-angle-of-attack longitudinal aerodynamics, and (2) the gothic strake designed with the developed procedure does produce a stable vortex system in the presence of a wing body and flat post-maximum-lift characteristics (Author)

A78-41892 * # **Theoretical and experimental aerodynamics of strake-wing interactions up to high angles-of attack** J M Luckring (NASA, Langley Research Center, Hampton, Va) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1202* 13 p 17 refs

This paper reports on an experimental investigation where the longitudinal aerodynamic characteristics were determined up to high angles-of-attack for configurations employing parametric variations in strake span and wing sweep and includes correlations with theory The investigation included both component and complete configuration studies to provide information for the analysis of interaction effects Comparisons between strake-wing and high canard-wing configurations demonstrate the strake-wing to develop higher lift coefficients than did the canard wing due to enhanced interference effects Correlations with theory demonstrate the suction analogy to be a useful method for estimating the effects of vortex flow aerodynamics on both component and total forces and moments (Author)

A78-41893 # **Application of the viscous-inviscid iteration technique using surface transpiration to calculate subsonic flow over wing-body configurations** V R Sonnad and L A Lemmerman (Lockheed-Georgia Co , Marietta, Ga) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1203* 10 p 10 refs Research supported by the Lockheed-Georgia Independent Research and Development Program

This paper describes the development of a method to obtain the subsonic flow field about complex, three-dimensional geometries, using the viscous-inviscid iteration technique to correct the potential flow for viscous effects A panel method for the calculation of three-dimensional inviscid flow is used iteratively with a two-dimensional, integral boundary layer method The important feature is the use of surface transpiration to simulate boundary layer effects The cross flow is neglected in the boundary layer calculations, which are carried out along chordwise strips on the wing A doubly under-relaxed iteration scheme has resulted in an extremely stable method, which usually gives satisfactory results after 4-5 iterations The method has been tested on a wide variety of configurations and the results have been uniformly satisfactory It has been demonstrated that the method of surface transpiration is completely equivalent to the displacement thickness approach as a means of representing the boundary layer (Author)

A78-41894 * # **Time-domain Green's Function Method for three-dimensional nonlinear subsonic flows** K Tseng and L Morino (Boston University, Boston, Mass) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1204* 9 p 20 refs Grant No NGR 22 004-030

The Green's Function Method for linearized 3D unsteady potential flow (embedded in the computer code SOUSSA P) is extended to include the time-domain analysis as well as the nonlinear term retained in the transonic small disturbance equation The differential-delay equations in time, as obtained by applying the Green's Function Method (in a generalized sense) and the finite-element technique to the transonic equation, are solved directly in the time domain Comparisons are made with both linearized frequency-domain calculations and existing nonlinear results (Author)

A78-41897 # **Three-dimensional supersonic interacting turbulent flow along a corner** J S Shang, W L Hankey (USAF, Flight Dynamics Laboratory, Wright Patterson AFB, Ohio), and J S Petty (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1210* 11 p 29 refs

The numerical solution of a three-dimensional laminar-transitional-turbulent flow along a symmetric corner was obtained for the Navier-Stokes equations using a modified Gessner's turbulence model The specific case examined was the symmetric corner formed by the intersection of two wedges with identical wedge angles of 9 48 degrees at a Mach number of three, with the Reynolds number spanning a range from 0 4 x 10 to the 6th to 1 1 x 10 to the 6th for which experimental data existed The numerical results duplicated all the essential experimental observations The present investigation seems to indicate that careful application of a turbulent eddy-viscosity concept is not limited to mere two-dimensional thin shear-layer flows Finally, the present procedure appears to offer promise for practical engineering applications (Author)

A78-41902 # **Design and test of transonic airfoils under consideration of drag divergence Mach number** N Kamiya, T Nishi, and T Itoh (National Aerospace Laboratory, Tokyo, Japan) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78 1221* 11 p 6 refs

This paper describes the recent development of a series of airfoils intended to delay the drag divergence Mach number in transonic flow Several airfoils having good transonic performance were designed optimizing the value of parameter F introduced in this paper F, therefore, can be employed, as a figure, to represent the merit of transonic airfoils Improvements in drag divergence Mach number over roof top airfoils amount to 0 1 and can be compared favorably with other published examples of new technology airfoils Drag and low speed characteristics are also discussed (Author)

A78-41903 # **Laminar leading edge stall prediction for thin airfoils** W L Ely and R N Herring (McDonnell Aircraft Co , St Louis, Mo) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10 12, 1978, Paper 78-1222* 13 p 14 refs

The objective of this research was to provide a criterion for the prediction of bubble burst on airfoils typical of those used for fighter wings The approach taken is that of correlating existing airfoil data using Reynolds number and velocity gradient parameters at laminar separation The separation point and associated velocity gradient is determined by a modified Stratford method using pressure distributions derived from Weber but modified to provide universal accurate, smooth distributions near the airfoil nose Results of a wind tunnel test to substantiate the correlation and to extend its use to swept sections are shown The method is demonstrated by applications to the prediction of the maximum lift for a class of airfoils An explanation of the distinction between thin airfoil stall and leading edge stall is advanced (Author)

A78 41904 # **Viscous flow around an oscillating airfoil A numerical study** N L Sankar and J C Wu (Georgia Institute of Technology, Atlanta, Ga) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10 12, 1978, Paper 78-1225* 11 p 12 refs Contract No N00014 75 C-0249

The unsteady, two dimensional Navier Stokes equations in terms of velocity and vorticity are solved for incompressible laminar flow around an oscillating Joukowski 12 percent airfoil The computations are confined to a small region of significant vorticity through the use of an integral relationship for the kinematics aspect of the problem The vorticity transport equation is solved using a hybrid scheme that employs finite difference and finite element techniques in different regions of the flow field An accurate, efficient numerical scheme is presented for the surface vorticity determination Numerical results are presented for three different combinations of frequency, mean angle of attack and amplitude These results are interpreted in the light of thin airfoil theory (Author)

A78-41924 * # **Durability of foam insulation for LH2 fuel tanks of future subsonic transports** E L Sharpe (NASA, Langley Research Center, Hampton, Va) and R G Helenbrook (Bell Aerospace Textron, Buffalo, N Y) *International Cryogenic Materials Conference Board, International Cryogenic Materials Conference on Nonmetallic Materials and Composites at Low Temperatures, Munich, West Germany, July 10, 11, 1978, Paper* 20 p 6 refs

In connection with the potential short supply of petroleum based fuels, NASA has initiated investigations concerning the feasibility of aircraft using as fuel hydrogen which is to be stored in liquid form One of the problems to be solved for an operation of such aircraft is related to the possibility of a suitable storage of the liquid hydrogen A description is presented of an experimental study regarding the suitability of commercially available organic foams as cryogenic insulation for liquid hydrogen tanks under extensive thermal cycling typical of subsonic airline type operation Fourteen commercially available organic foam insulations were tested The thermal performance of all insulations was found to deteriorate with increased simulated flight cycles Two unreinforced polyurethane foams survived over 4200 thermal cycles (representative of approximately 15 years of airline service) without evidence of structural deterioration The polyurethane foam insulations also exhibited excellent thermal performance G R

A78-42100 **Dynamic coefficient of an elastically supported, pre-stressed beam** S Chonan (Tohoku University, Sendai, Japan) *Ingenieur-Archiv,* vol 47, no 3, 1978, p 187 196 11 refs

An analysis is made of the problem of vibrations of a beam with an axial force resting on elastic foundation, when the beam is uniform and of finite length and is subjected to an impulsive load The solution is presented within the framework of a beam theory which includes the effects of shear deformation and rotary inertia An example is provided where the dynamic coefficient for the bending moment is calculated From the results of theoretical analysis, it becomes evident that the axial force in the beam and the stiffness of the foundation have considerable effect upon the dynamical behaviour of the system (Author)

A78-42198 # **Second order transonic small perturbation flow** K Fujii and K Karashima (Tokyo, University, Tokyo, Japan) *(Japan Society for Aeronautical and Space Sciences, General Meeting, 8th, Tokyo, Japan, Apr 5, 1977) Japan Society for Aeronautical and Space Sciences, Transactions,* vol 21, May 1978, p 24 34 12 refs

In this paper is presented a numerical approach to a second-order transonic small perturbation flow past conventional airfoils, where the boundary value problem is formulated by use of a method of thickness perturbation Numerical computation is carried out using the type dependent method based on the successive line overrelaxation algorithm It is shown that the second order effect provides a favorable modification of the surface pressure near the point of suction peak and becomes considerable for either thick airfoils or low free stream Mach numbers, while it does not affect the location of the surface shock wave substantially It is concluded that the present approach is capable of predicting the full potential solution with satisfactory accuracy over the entire surface of the airfoil and a wide range of free stream Mach numbers including the subcritical to supercritical transition (Author)

A78-42200 # **Flow of highly rarefied gas past a circular cylinder at low Mach numbers** K Yamamoto (Okayama University, Okayama, Japan) and K Tamada (Kyoto University, Kyoto, Japan) *Japan Society for Aeronautical and Space Sciences, Transactions,* vol 21, May 1978, p 46-53 7 refs

The two dimensional steady flow of a highly rarefied gas past a circular cylinder at low Mach numbers is studied on the basis of the linearized B G K equation in kinetic theory The case of free molecular flow is first considered and analytical expressions for fluid-dynamic quantities are obtained Numerical discussions are made on the fields of these quantities as well as on the flow pattern Starting from the result of free molecular flow, integral iteration method is applied to take into account the effect of intermolecular collision Correction terms to the fluid-dynamic quantities on the surface of the cylinder are obtained to the first order Corresponding formula for the drag coefficient of the cylinder is also derived, which matches well with a previous result for slightly rarefied gas The agreement between the theory and an existing experiment is also good (Author)

A78-42449 **Aircraft motions in moving air** G A J van de Moesdijk and J C van der Vaart (Delft Technische Hogeschool, Delft, Netherlands) *Delft Progress Report,* vol 3, Mar 1978, p 111 126 16 refs

The dynamics of clear air turbulence (CAT) are described with reference to its effect on aircraft motion A mathematical model is presented, which relies chiefly on a numerical analysis of the power spectral density (PSD) In the medium frequency range of the PSD, it is shown that power is transferred from lower to higher frequencies at a slope of 5/3 on a log scale Calculations of deviations from a specific trajectory are modeled by the Monte Carlo method Applica tions of a better understanding of CAT include improvements in ride comfort, as well as gust and load alleviation It is noted that non gaussian turbulence can also be modelled by applying a nonlinear operation using non gaussian white noise sources D M W

A78 42511 # **Calibration of the West Canadian Loran-C chain** A R Mortimer, R M Eaton, and D H Gray (Canadian Hydrographic Service, Ottawa, Canada) *(Canadian Aeronautics and Space Institute, Canadian Symposium on Navigation, 3rd, Ottawa, Canada, Nov 16, 17, 1977) Canadian Aeronautics and Space Journal,* vol 24, May-June 1978, p 129 136 10 refs

For most applications, Loran C Time Difference (TDs) must be converted to geographic position to be useful To do this requires accurate knowledge of the propagation velocity, which for ground-wave is a complex function of ground impedance and other variables In calibrating the West Canadian chain, the travel time of the Loran C wave from the transmitter to points on land and at sea was measured, in order to ensure that the TD lattice printed on marine charts was correctly located, to verify the mathematical model used in lattice prediction, and to measure effective ground impedance The lattice was located to 150m accuracy using satellite navigation at sea, and verified the propagation anomaly predicted at the coastline (Author)

A78-42512 # **Current trends in the aerial application of fire retardants** C W George (Northern Forest Fire Research Laboratory, Missoula, Mont) *(Canadian Aeronautics and Space Institute, Annual General Meeting, Quebec, Canada, May 17, 18, 1977) Canadian Aeronautics and Space Journal,* vol 24, May June 1978, p 150-158 8 refs

The use of aerially delivered fire retardants has been increasing in forest areas of the U S and Canada at the same time that the cost of aircraft fuel and petroleum-based fire retarding chemicals has been going up To cope with the higher costs, forest services have been using larger aircraft, e g , the 2400 gal C-119 and the 3000 gal DC-6/7, and more efficient methods of delivery, taking into account meteorological parameters Attention is given to a pattern of optimized flow rate, based on ambient and ground wind speed, temperature, and topography, as well as the physical chemical properties of the retardant itself D M W

A78-42513 # **The Air Combat Maneuvering Range/ Instrumentation system** S P Altman (Department of Communications, Communications Research Centre, Ottawa, Canada) *Canadian Aeronautics and Space Journal,* vol 24, May June 1978, p 159-167

The Air Combat Maneuvering Range/Instrumentation (ACMR/I) system monitors, controls and directs combat training and weapon system evaluation of simulated combat dogfights between several fighter aircraft The ACMR/I system in operation at the Nellis Air Force Base, Nevada, is the test system for carrying out the extensive fighter evaluations of the Air Intercept Missile Evaluation/Air Combat Evaluation (AIMVAL/ACEVAL) exercises being conducted jointly by the USN and USAF The ACMR/I concept of comprehensive real time monitor and control of all air combat participants is described in terms of the dynamics of combat exercises in ground and aircraft instrumentation subsystems The use of system error analysis and error budgets is presented as an example of cost effective tools for the controlled design of a large scale developmental program Future growth applications include the potential use of the ACMR/I concept for Air Traffic Control in high-density, high-dynamics air traffic problems (Author)

A78-42514 # **General aviation flight instrument displays** R L Newman (Crew Systems Consultants, Yellow Springs, Ohio) and G M Palmer (Purdue University, West Lafayette, Ind) *(American Institute of Aeronautics and Astronautics, Symposium on Affordable Systems, Wright Patterson AFB, Ohio, Mar 1977) Canadian Aeronautics and Space Journal,* vol 24, May June 1978, p 168 175 15 refs

The basic criteria of ease of use and rapid failure detection have been applied to general aviation instrument designs Several suggestions can be made to improve the existing instrument standards by relocating the primary navigation and vertical speed indicators and by including the clock and magnetic compass in the standards Power supplies for instruments must not be designed to allow a single failure to jeopardize the airplane The general aviation airplane should have the same degree of care given to instrument and systems design as is given to the transport In fact, since these airplanes are typically flown by inexperienced pilots and since the systems often do not have redundant components, human factors and systems engineering should play even greater roles (Author)

A78-42555 **Applications of the continuum theory of subcritical flaw growth under uniaxial tensile fatigue stresses to service life cycle analysis** H C Hagendorf (Lehigh Associates, Hawthorne, Calif) In International Conference on Fracture Mechanics and Technology, Hong Kong, March 21-25, 1977, Proceedings Volume 1 Alphen aan den Rijn, Netherlands, Sijthoff and Noordhoff International Publishers, 1977, p 99-110 12 refs

The fatigue crack propagation considered in the investigation is related to the subcritical growth of a dominant macrocrack in a homogeneous and isotropic structural material caused by cyclically varying external tensile stresses The investigation has the objective to develop a rational methodology for predicting service life of tension critical structural elements subjected to constant amplitude fatigue stresses which can be likened to uniaxial cyclically stressed central flawed specimens The scope of the continuum theory of fatigue crack growth outlined is limited to propagating fatigue cracks for which the orientation of the plane of the crack is perpendicular to the maximum principal tensile cyclic stresses and the subsequent flaw growth remains in the original plane of the crack The rational material-environment characterization of fatigue crack growth is discussed G R

A78-42569 **The effect of strain rate on mechanical properties of adhesives and adhesive bonded joints** S Amijima and T Fujii (Doshisha University, Kyoto, Japan) In International Conference on Fracture Mechanics and Technology, Hong Kong, March 21-25, 1977, Proceedings Volume 1 Alphen aan den Rijn, Netherlands, Sijthoff and Noordhoff International Publishers, 1977, p 363-372

A method for the compression-load testing in shear of adhesives and adhesively bonded joints using double-cylinder specimens has been developed and applied to the determination of the mechanical properties of two adhesives (Araldite Standard 400B and AW106) under static, quasi-static, and impact loading Results show that the mechanical properties of the adhesives tested are strain-rate dependent In some cases adhesion strength under impact loading was found to be more than three times that under static loading The strain-rate sensitivities of the adhesive were dependent not only on test temperature, but also on hardener content B J

A78-42630 # **Possibilities of phase separation in supersonic two-phase flows (O vozmozhnostiakh razdeleniia faz v sverkhzvukovykh dvukhfaznykh techeniiakh)** A A Stoliarov (Vsesoiuznyi Nauchno Issledovatel'skii Institut Prirodnogo Gaza, Moscow, USSR) *Akademiia Nauk SSSR, Doklady,* vol 239, Apr 11, 1978, p 1071 1073 In Russian

The paper considers a technique for the separation of the gas phase from the solid particle phase in a compressible two phase flow in an underexpanded supersonic nozzle To achieve the separation, the nozzle is equipped with an oblique component, inclined to the axis of the outlet section Trajectories of the gas continuum and of solid particles in the oblique component do not coincide, this leads to a redistribution of their densities along the cross section of the supersonic jet and to phase separation with moderate energy dissipation Experimental results on the use of the Coanda effect to separate phases in supersonic flow in a Laval nozzle with oblique component are reported B J

A78-42721 * **Interior noise studies for general aviation types of aircraft I - Field studies II - Laboratory studies** S K Jha (Cranfield Institute of Technology, Cranfield, Beds , England) and J J Catherines (NASA, Langley Research Center, Acoustic and Noise Reduction Div , Hampton, Va) *Journal of Sound and Vibration,* vol 58, June 8, 1978, p 375-406 11 refs

Sources of the interior noise level of typical light aircraft are identified for stationary conditions on the ground and in flight In addition, the relationship between the exterior near and far field noise around an aircraft and the interior noise field is examined The sound transmission paths of a light aircraft fuselage are investigated, and the relative effectiveness of several components of the fuselage for sound attenuation is assessed The fuselage furnishes an acoustic attenuation of about 20 dB, windows and metallic areas appear to transmit approximately equal amounts of sound energy J M B

A78 42740 - **Formation of residual stresses in the thermal strengthening of gas-turbine engine components (Formirovanie ostatochnykh napriazhenii pri termouprochnenii detalei GTD)** B A Kravchenko, G N Gutman, and G N Kostina *Problemy Prochnosti,* May 1978, p 12 15 In Russian

Thermal strengthening (i e heating followed by intensive cooling) is an effective technique for components designed for high temperature operation In the present paper, the residual stresses generated by this treatment in gas turbine engine components are calculated for various types of cooling with allowance for the real strain curve of the material The influence of the scale factor is examined V P

A78-42742 # **Operational experience with long-safe life gas-turbine engines having shrouded turbine rotor blades (Opyt ekspluatatsii GTD bol'shogo resursa s bandazhirovannymi rabochimi lopatkami turbin)** A A Mukhin, A A Kovalev, A N Vedin, and A A Simakov *Problemy Prochnosti,* May 1978, p 18-21 In Russian

The technical state of the contact surfaces of shrouded turbine blades was studied to determine the appropriate overhaul period Graphs showing the arrangement of the blades and shrouds are given, along with plots of the shroud tightness vs the mode of engine operation, plots of the stress vs the shroud clearance, plots of the maximal clearance in test stand and in flight conditions, and plots of the shroud clearance vs the blade pitch The vibration frequencies are analyzed as a function of the clearance The influence on wear of various coatings and of the working temperature of the blade material is studied V P

A78-42763 # **Laminar hypersonic wake of a lifting body (Laminarnyi giperzvukovoi sled za nesushchim telom)** O S Ryzhov and E D Terent'ev *Prikladnaia Matematika i Mekhanika,* vol 42, Mar Apr 1978, p 277 288 15 refs In Russian

The paper considers an asymptotic method for solving the Navier Stokes equations describing the steady hypersonic far wake of a lifting body The velocity field is divided into two parts (1) a outer region where the gas flow is governed by Euler equations, and (2) an inner region with a laminar wake which is formed by longitudinal heat flux and viscous shear stresses The solution is obtained by joining the asymptotic expansions for the two regions This joining procedure is complicated for three dimensional flow by the fact that perturbations induced by lift force on the outer boundary of the wake have an oscillatory nature B J

A78-42764 # **Construction of higher approximations in the problem of special flows in plane Laval nozzles (Postroenie vysshikh priblizhenii v zadache o spetsial'nykh techeniiakh v ploskikh soplakh Lavalia)** A L Brezhnev and I A Chernov *Prikladnaia Matematika i Mekhanika,* vol 42, Mar Apr 1978, p 289-295 10 refs In Russian

A method involving a series expansion with respect to self similar components is used to obtain a solution to the equations of gas dynamics that describe certain modes of the two-dimensional potential flow of an ideal gas in a Laval nozzle In particular, the case of limiting Taylor flow, where local supersonic zones form on the axis of the nozzle, is considered The self-similar expansion is carried out in parallel on the flow plane and on the hodograph plane, the first three terms of the expansion are calculated for the case of limiting Taylor flow The correction terms for this flow retain the property of double symmetry with respect to the horizontal and vertical axes that pass through the center of the nozzle B J

A78-42774 # **Display of radar information by the strata method** J Matyas (TESLA, Radio Engineering Research Institute, Pardubice, Czechoslovakia) *TESLA Electronics,* vol 11, Mar 1978, p 3 10

Increased air traffic density has necessitated elevated requirements in radar information display, including the display of cartographic data and coarse lines given by automatic radio direction finders, and increased resolution, accuracy, and brightness Three types of information display are described (1) video signal compression, (2) a composite video map displayed in real time, and (3) synthetic information display The information supplied by these techniques may be processed by the strata method which minimizes the time (or beam path) required for displaying the coordinates of the points given The time required for display is proportional to the total number of steps required to pass over all points in the region defined by the radar range This region is divided into strata by either the method of concentric annuli or the television method of display S C S

A78-42856 # **Analysis of pavements designed by CBR equation** Y T Chou (U S Army, Soils and Pavements Laboratory, Vicksburg, Miss) *ASCE, Transportation Engineering Journal,* vol 104, July 1978, p 457-474 9 refs

A description is presented of a study which was conducted to analyze various pavements designed by the California Bearing Ratio (CBR) equation for known performance using the layered elastic theory The results of the analysis should be valuable to the understanding of pavement response to wheel loads and to the design of flexible pavements A pavement designed by the CBR equation has a thickness sufficient to prevent shear failure in the subgrade soil Burmister's linear elastic layered theory was used to compute the stresses and strains in the pavement Attention is also given to the plastic deformations of subgrade soils, the presentations of computed results, the elastic response of pavements, permanent deformations, and the significance of failure criteria on computed results and current design It is found that the elastic displacements and accumulated permanent deformations at both pavement and sub grade surfaces are not necessarily the same for each pavement but vary with the subgrade modulus and the wheel load, except the elastic vertical strain at the subgrade surface that is nearly inde pendent of these factors G R

A78-42860 * Air terminals and liquid hydrogen commercial air transports P F Korycinski (NASA, Langley Research Center, Hampton, Va) *International Journal of Hydrogen Energy,* vol 3, June 30, 1978, p 231 250 9 refs

An initial appraisal is made of results of two studies of the ground requirements of liquid hydrogen (LH2) air transports Each hypothesized the use of a 400-passenger 5500 nautical mile range subsonic commercial LH2 transport Two of the world's busiest commercial airports, Chicago O'Hare International and San Francisco International, were selected for study The current and predicted wide body traffic at these airports was assumed to simulate the LH2 transport traffic at these airports in the 1990-1995 time period Both studies produced conceptual designs for facilities to generate the required quantities of fuel from pipeline gaseous hydrogen and to deliver liquid hydrogen to the airplanes Although the LH2 and jet fuel facilities were kept apart, both study teams found it practical to converge the fuel supply lines so that with proper safety and operational procedures and specialized LH2 equipment both LH2 and jet fuel transports can use common ramp and gate facilities (Author)

A78-42872 Dynamics of gas turbine engine blades under unsteady flow (Dinamika lopatok gazoturbinnykh dvigatelei pri nestatsionarnom obtekanii) A S Vol'mir, V V Guliaev, V F Mikhnev, and A T Ponomarev *Mekhanika Polimerov,* Mar Apr 1978, p 257-264 12 refs In Russian

Aeroelastic characteristics of composite compressor array blades under unsteady flow conditions are studied The governing system of linear integrodifferential equations of unsteady aeroelasticity is formulated using the method of integral representations The aerodynamic load is determined through a generalized unit-step response as a function of pressure by solving basic gasdynamic problems using the method of discrete vortices An illustrative example is provided for a transonic flow past a GFRP blade array S D

A78-42918 # Unsteady incompressible flow past thin porous airfoils (Nestatsionarnoe obtekanie neszhimaemoi zhidkost'iu ton kikh pronitsaemykh profilei) I I Efremov (Akademiia Nauk Ukrainskoi SSR, Institut Gidromekhaniki, Kiev, Ukrainian SSR) *Prikladnaia Mekhanika,* vol 14, June 1978, p 103 109 In Russian

Rakhmatulin's hypothesis concerning flow past porous bodies (1950) in combination with a scheme of vortex wake generation is used to derive an integrodifferential equation describing the unsteady aerodynamic (e g gust) loading of a deformable infinitely thin airfoil The vortex wake in the case of aperiodic motions is considered finite Attention is given to the development of the lift force, and it is shown that the irrotational part of the lift force depends on the higher derivatives of velocity with respect to time B J

A78-42983 # Weight testing of heavy models in a pulsed wind tunnel (Vesovye ispytaniia tiazhelykh modelei v impul'snoi aerodinamicheskoi trube) V A Dmitriev, V V Zatoloka, and V I Zvegintsev (Akademiia Nauk SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk,* Feb 1978, p 32-38 12 refs In Russian

The method of the freely moving model for measuring aero dynamic forces acting on a model during short period (tens of milliseconds) wind tunnel tests is analyzed In particular, the case is studied where, at a constant Mach number, the pressure, velocity head, and aerodynamic forces decrease smoothly by a factor of 2-4 during the test time This method makes it possible to use a model having about 1 kg of mass, thereby practically eliminating the mass constraint on well-known tensometric methods used in short period tests Tests in this regime were conducted on a sphere and cones with mass 0 7-4 3 kg in a pulsed wind tunnel at Mach number of approximately 11, and the results were in good agreement with known experimental and computed data P T H

A78-42984 # Experimental study of overexpansion flows in a flat nozzle (Eksperimental'noe issledovanie techenii na rezhimakh pererasshireniia v ploskom sople) V V Zatoloka, V N Zudov, V I Shevchenko, and V I Lushanov (Akademiia Nauk SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk,* Feb 1978, p 39 48 13 refs In Russian

Numerical and experimental studies of flow in overexpansion regime in a flat nozzle of inner outer expansion with lateral cheeks were carried out A strong three dimensional effect was revealed, consisting of the convergence of shock waves caused by oblique separation of the boundary layer from the nozzle lateral edges into the flow These shock waves cause considerable increase in the pressure on the traction wall of the nozzle P T H

A78 42997 # A finite element solution of cascade flow in a large-distorted periodic flow H Daiguji and H Shirahata (Tohoku University, Sendai, Japan) *JSME, Bulletin,* vol 21, May 1978, p 824 831 14 refs

A finite element method is developed for calculating the characteristics of the unsteady inviscid rotational flow through a cascade in the case of a distorted periodic inlet flow with a large disturbance whose wavelength is equal to the blade pitch A convective-difference scheme for calculating the vorticity is proposed along with an iterative procedure in which the outlet flow angle is modified so that the Kutta condition holds, and the trailing vortex wake being shed by the blade is taken into account so that the one valued pressure condition holds As an example, the unsteady flows past a compressor cascade composed of segmented circles under specified inlet flow conditions are calculated The flow patterns and the time variations of lift and drag forces are obtained S D

A78-43015 Modern materials, selection, testing, application II - Surveys about special areas of materials technology for study and practice - Titanium and titanium alloys (Moderne Werkstoffe - Auswahl - Prufung - Anwendung II - Ubersichten Uber Sondergebiete der Werkstofftechnik fur Studium und Praxis Titan und Titanlegierungen) K Rudinger (Thyssen Edelstahlwerke AG, Krefeld, West Germany) *Zeitschrift fur Werkstofftechnik,* vol 9, June 1978, p 214-218 49 refs In German

Titanium and titanium alloys react readily with hydrogen and show an increased tendency for the formation of layers of scale at temperatures above 700 C This phenomenon is in particular related to the diffusion of oxygen into the uppermost layers of the material The allotropic transformation of the hexagonal alpha phase into the bcc phase of the pure metal at 882 C occurs in the case of technical titanium and titanium alloys during a temperature interval The transition temperature, which changes as a function of alloy composition, has a fundamental effect on the structural characteristics and the strength properties depending on them The utilization of the transition temperature conditions in hot forming operations is considered along with aspects of heat treatment and welding techniques under exclusion of air or in a noble gas atmosphere It is pointed out that the aerospace industry is the greatest consumer of titanium Subsonic engines, for which an employment of titanium offers special advantages in connection with an achievement of lower temperature stresses, can contain as much as 30 wt % of titanium materials G R

A78-43039 User delay cost model for a terminal control area L B Greene and M Sternberg-Powidzki (ARINC Research Corp , Annapolis, Md) In Modeling and simulation Volume 8 -

Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa , April 21, 22, 1977 Part 1 Pittsburgh, Pa , Instrument Society of America, 1977, p 249 261 10 refs

This paper is a description of a Monte Carlo simulation of delays to the aircraft using community caused by facility outage, weather, and schedule intensity The Boston Terminal Control Area (TCA) was used as a guide in the model's development, but the input parameter set can be changed to model any TCA The model was developed as an analytic tool for the assessment of the effect of facilities availability on user delays, it permits imputation of user delay to variations of any of the following input parameter sets facility outage, weather, schedule intensity, airport layout and facility configuration, and air control standards A unique weather-generation module operates on a four-year record of weather at Boston, Logan Airport, and produces stochastic changes in the weather that capture the statistical correlation among wind direction and speed, ceiling, visibility, and time of day (Author)

A78-43041 **General aviation dynamics** M A Duffy, G L Eiden, and C W Hamilton (Battelle Columbus Laboratories, Columbus, Ohio) In Modeling and simulation Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa , April 21, 22, 1977 Part 1 Pittsburgh, Pa , Instrument Society of America, 1977, p 267-274 U S Department of Transportation Contract No FA74WA 3485

A system dynamics model of the general aviation system has been developed The model can be used to forecast general aviation activity, evaluate alternative policy actions, and perform sensitivity analyses It has three major sectors, depicting the most important state variables in the model pilot supply, aircraft utilization, and aircraft demand The system dynamics methodology was chosen because of its applicability in explaining the causal interactions between each of these sectors Implemented in NUCLEUS, a computer software system, an interactive dialogue feature is used to guide the unfamiliar analyst through a series of procedures and options (Author)

A78-43042 **Simulation of the uncontrolled terminal area air traffic to evaluate the 'see and avoid' concept** E G Baxa, Jr and L J Morrissey (Research Triangle Institute, Research Triangle Park, N C) In Modeling and simulation Volume 8 Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa , April 21, 22, 1977 Part 1 Pittsburgh, Pa , Instrument Society of America, 1977, p 275-279 14 refs

This paper describes a Monte-Carlo simulation procedure which has been developed to measure the pilot's ability to detect other aircraft in potential mid-air collision situations in the uncontrolled terminal area Actual radar tracking data obtained at several uncontrolled airports were used to determine statistical descriptions of typical three-dimensional aircraft paths within the constraints of the particular local procedure in effect Results of these analyses are incorporated into a traffic generation model designed to produce statistically valid pairs of aircraft tracks in collision situations The generation model provides the flexibility of creating situations typical of various procedures suitably defined in terms of input parameter specifications A method of analyzing a statistically significant set of these pairs in collision from the standpoint of detectability is described The results are limited to a description of the Monte Carlo analysis procedure and the associated uncontrolled airport environment aircraft path simulation model (Author)

A78-43043 **FAA facilities maintenance cost reduction model** J H Witt (ARINC Research Corp , Annapolis, Md) and F Frankel (U S Department of Transportation, Transportation Systems Center, Cambridge, Mass) In Modeling and simulation Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa , April 21, 22, 1977 Part 1 Pittsburgh, Pa , Instrument Society of America, 1977, p 281 285 U S Department of Transportation Contract No TSC-1173

This paper describes the development of a model to determine the expected personnel requirements and costs within an FAA Airway Facilities Maintenance Sector as a function of the support scenario and facility characteristics The model will be used to investigate alternative approaches to reducing the cost of facilities maintenance within the FAA, which currently is in excess of $350 million annually, with more than 80 percent due to labor costs These alternatives include changing the preventive-maintenance schedules, the equipment reliability and maintainability characteristics, and the facility-restoration-level requirements Initial exercise results are presented for the Logan (Boston) Sector to demonstrate the model's capabilities and utility (Author)

A78-43053 **Use of simulation in evaluating an early warning system for avoidance of jumbo jet trailing vortex turbulence in airports** R S Rudland In Modeling and simulation Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa , April 21, 22, 1977 Part 1 Pittsburgh, Pa , Instrument Society of America, 1977, p 393 396

Wake turbulence from large aircraft has created a safety hazard for smaller aircraft that land soon after a Jumbo-Jet A laser detection system was developed to monitor wake turbulence in the airport and to provide early warning to the air traffic controller Since each part of the system has been developed separately, proper integration of this system depends on simulation of realistic landing patterns with wake turbulence to see if the detection system and the warning system can provide the controller with the right information at the right time A description of the simulation model is developed to be able to provide random landing patterns to create realistic aircraft sequencing With this simulation model controller performance can be evaluated (Author)

A78-43055 * **Hierarchy of simulation models for a turbofan gas engine** W E Longenbaker and R J Leake (Notre Dame, University, Notre Dame, Ind) In Modeling and simulation Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa , April 21, 22, 1977 Part 1 Pittsburgh, Pa , Instrument Society of America, 1977, p 449 453 8 refs Grant No NsG 3048

Steady-state and transient performance of an F-100 like turbo fan gas engine are modeled by a computer program, DYNGEN, developed by NASA The model employs block data maps and includes about 25 states Low-order nonlinear analytical and linear techniques are described in terms of their application to the model Experimental comparisons illustrating the accuracy of each model are presented D M W

A78-43057 **Simulation testing via mini computer** J N Frisina (Singer Co , Kearfott Div , Wayne, N J) In Modeling and simulation Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa , April 21, 22, 1977 Part 1 Pittsburgh, Pa , Instrument Society of America, 1977, p 477 481

A description is presented of the Digital Inertial navigation HUD Radar weapon Delivery Simulator (DIHURDS) This simulator offers a low-cost, repeatable, accurate, reliable method of exercising the inertial navigation computer software, the computer processor, and associated input/output modules, over a wide range of dynamic test conditions Historically, simulators have utilized either a large computation facility or a minicomputer Each approach has advan tages and drawbacks A large computation center provides many support features, the possibility to use a high order language, and a great computational accuracy However, it is expensive to use Minicomputers are inexpensive, but they lack the computational power to perform the complex trajectory processing that is desired The unique solution selected for DIHURDS is related to a division of the problem into two parts The computational functions are performed on a large computation center offline, which facilitates trajectory generation The data from this part is passed to a minicomputer which maintains the real-time interface with the

Airborne Digital Computer Thus, the minicomputer must only solve the closed-loop portion of the problem G R

A78-43085 # **Two-channel method of processing interval codes (Dvukhkanal'nyi sposob obrabotki interval'nykh kodov)** L P Kuklev *Radioelektronika,* vol 21, Apr 1978, p 37 41 In Russian

The paper examines the noise immunity of processing pulsed signals in a two channel decoder which consists of a discrete coincidence circuit and an analog circuit of pulse accumulation, there is subsequent limitation of the accumulated sum in a threshold device, whose output pulses are used to scan the signals of the coincidence decoder False processing of side peaks is practically eliminated, with an insignificant increase in the probability of main peak suppression It is shown that, in weak noise, this decoding procedure is more noise immune than the usual coincidence decoding procedure B J

A78-43103 # **Calculation of the two-dimensional flow of a viscous incompressible fluid through a cascade with separation at the leading edge (Raschet dvumernogo obtekaniia reshetki viazkoi neszhimaemoi zhidkost'iu s otryvom na vkhodnoi kromke)** G L Podvidz and G Iu Stepanov *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May-June 1978, p 34-44 7 refs In Russian

The analysis deals with the two dimensional steady turbulent flow of constant density through a turbine cascade without and with separation from the blade leading edge and with subsequent attachment of the flow In the model proposed, a distinction is made between a viscous layer and the external inviscid flow The flow is assumed to reattach at the convex surface of a large-curvature blade The viscous layer at the blade is broken down into four regions V P

A78-43107 # **Influence of the transverse curvature of the lower surface in the conical supersonic flow field of a delta configuration (Vliianie poperechnoi krivizny nizhnei poverkhnosti na pole konicheskogo sverkhzvukovogo techeniia u del'tovidnogo apparata)** A P Kosykh and A N Minailos *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May-June 1978, p 103-110 13 refs In Russian

In the present paper, the inviscid flow past a delta wing, whose lower surface is formed as a circular cone and is an elliptical segment in cross section, is calculated in a nonlinear formulation The analysis reveals a flow regime characterized by two separation lines and three spreading lines at the lower surface The conditions for laminar turbulent transitions are determined for the surface under consideration V P

A78-43114 # **Numerical study of flow in axisymmetric Laval nozzles, taking account of overexpansion with flow separation (Chislennoe issledovanie techeniia v osesimmetrichnykh soplakh Lavalia, vkliuchaia rezhimy pererasshireniia s otryvom potoka)** R K Tagirov *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May June 1978, p 161-165 11 refs In Russian

A numerical approach developed by Tagirov (1978) for calculating ideal gas flow in a convergent nozzle is applied to the problem of flow in an axisymmetric convergent-divergent nozzle with large wall curvature at the critical point Gas overexpansion in the nozzle is calculated using a simple separation model based on the empirical dependence on local Mach number of the intensity of the shock which induces boundary layer separation from the nozzle wall B J

A78-43116 # **The effect of two-dimensionality of the flow of a gas with stepwise distribution of total parameters on the integral characteristics of a Laval nozzle (O vliianii dvumernosti techeniia gaza so stupenchatym raspredeleniem polnykh parametrov na integral'nye kharakteristiki sopla Lavalia)** A N Laniuk *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* May-June 1978, p 170 173 5 refs In Russian

The paper presents a theoretical investigation of the effect of two-dimensionality of the flow of a gas with stepwise distribution of total enthalpy and entropy at the inlet of a Laval nozzle on the integral characteristics - discharge and specific impulse The results obtained are compared with those obtained employing the stratified-hydraulics approximation as well as with results obtained by the finite-difference numerical integration of the two-dimensional equations of gas dynamics Consideration is given to the stationary untwisted flow of an ideal gas with stepwise distribution of total parameters in a Laval nozzle, when the nozzle flow does not depend on ambient pressure B J

A78-43225 **A compass for the crystal ball** J Rhea (Washington Communications Service, Vienna, Va) *Hovering Craft and Hydrofoil,* vol 17, May-June 1978, p 44 51

A recent survey of future technologies for naval ships and aircraft is reviewed Point design requirements are discussed, the generic vehicle concepts considered are noted, and the personnel involved in the survey are identified Nine vehicle concepts are described (1) a catamaran design known as the small waterplane area twin hull or SWATH, (2) the planing hull, (3) hydrofoils, (4) surface-effect ships, including an aircraft carrier, (5) air cushion vehicles, (6) vessels based on the wing in-ground (WIG) effect, (7) lighter-than-air (LTA) craft, (8) air loiter aircraft, and (9) sea loiter aircraft F G M

A78-43298 **Mitsubishi Passenger Transfer Vehicle Model 150** *Mitsubishi Heavy Industries Technical Review,* vol 15, Feb 1978, p 72, 73

The paper describes the Mitsubishi Passenger Transfer Vehicle which may be operated between terminal buildings and aircraft The vehicle, which runs at a maximum speed of 31 km/h and maximum acceleration of 2 5 km/h/s, carries up to 150 passengers The cabin of the vehicle may be raised or lowered by a scissors lifting mechanism Extension floors provide easy connections between aircraft and terminal entrances S C S

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STAR ENTRIES

N78-26048*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
SUMMARY OF NASA LANDING-GEAR RESEARCH
B D Fisher R K Sleeper and S M Stubbs Mar 1978 34 p refs
(NASA-TM-78679) Avail NTIS HC A03/MF A01 CSCL 01C
This paper presents a brief summary of the airplane landing gear research underway at NASA The technology areas include ground handling simulator antiskid braking systems space shuttle nose-gear shimmy active control landing gear wire brush skid landing gear air cushion landing systems tire/surface friction characteristics tire mechanical properties tire-tread materials powered wheels for taxiing and crosswind landing gear This paper deals mainly with the programs on tire-tread materials powered wheel taxiing air cushion landing systems and crosswind landing gear research with particular emphasis on previously unreported results of recently completed flight tests Work in the remaining areas is only mentioned Author

N78-26049# Advisory Group for Aerospace Research and Development Paris (France)
GUIDANCE AND CONTROL DESIGN CONSIDERATIONS FOR LOW-ALTITUDE AND TERMINAL-AREA FLIGHT
Apr 1978 316 p refs Papers presented at Guidance and Control Panel Symp Dayton Ohio 17-20 Oct 1977
(AGARD-CP-240 ISBN-92-835-1278-2) Avail NTIS HC A14/MF A01
Navigational problems and collision avoidance are considered for low altitude and terminal area flights Operational problems terrain following terminal area landing weapon delivery and system integration are included

N78-26050# Ministry of Defence London (England)
GUIDANCE AND CONTROL FOR LOW LEVEL OFFENSIVE AIRCRAFT A ROYAL AIR FORCE VIEW
G A Barnes *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 5 p
Avail NTIS HC A14/MF A01
The operational requirements for guidance and control systems for offensive aircraft in the central region of Europe depend both on the weapon delivery accuracy and on the penetration tactics and weapon delivery profiles The profiles are affected by the enemy s anti-aircraft defense system and by weather conditions Possible parameters are suggested for aircraft use in counter air interdiction and close air support roles J A M

N78-26051# National Aerospace Lab Amsterdam (Netherlands)
THE GROUND-ATTACK/PENETRATION MODEL A MONTE CARLO SIMULATION MODEL TO ASSESS THE SURVIVABILITY AND TO EVALUATE TACTICS FOR LOW-ALTITUDE MILITARY MISSIONS IN AN ENVIRONMENT OF GROUND-BASED AIR DEFENCE SYSTEMS
M H W Bovy *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 5 p refs
Avail NTIS HC A14/MF A01
In the ground attack/penetration model the following sets of parameters, each describing an essential component of the aircraft defense system interaction were established (1) defense system data (such as detection performance data, fire control computer performance data missile data) (2) environmental factors (such as terrain features meteorological conditions), and (3) aircraft characteristics (aircraft trajectory, radar cross section ECM capabilities etc) This model was used for assessing aircraft vulnerability to air defense systems J A M

N78-26052# Technische Universitaet Brunswick (West Germany)
OPEN-LOOP COMPENSATION OF WIND-SHEAR EFFECTS IN LOW LEVEL FLIGHT
Rudolf Brockhaus and Peter Wuest *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 19 p refs
Avail NTIS HC A14/MF A01
Since efficient closed loop control of wind shear produces high throttle activity an open loop control law was developed that proved to be very efficient without the shortcomings of closed loop control An open loop activation of throttle and spoilers was adequate to minimize the wind shear effects and thereby to discharge the closed loop system A very simple Kalman filter with nonlinear limitation of the second derivative of wind velocity was found adequate to solve the separation problem J A M

N78-26053# Royal Aircraft Establishment Farnborough (England) Flight Systems Dept
AIRCRAFT RIDE-BUMPINESS AND THE DESIGN OF RIDE-SMOOTHING SYSTEMS
J C Jones and D E Fry *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 12 p refs
Avail NTIS HC A14/MF A01
Aircraft longitudinal ride-bumpiness due primarily to aircraft rigid-body response is discussed Results for flight at high speeds and low altitude are described and the implications for aircraft design deduced both in terms of basic airframe considerations and the use of active controls Bumpiness is distinguished from vibration the former being characterized by a sequence of separately identifiable g fluctuations referred to as bumps the latter being associated with quasi-sinusoidal oscillations Using statistical discrete gust theory, bumpiness is described in terms of g counts per unit time In addition to providing a quantitative measure of exceedance counts of arbitrary g levels, this theory allows the straightforward computation of the sharpness of a bump in the sense of the rise-time of a typical discrete fluctuation in normal acceleration J A M

N78-26054# Northrop Corp Hawthorne Calif Aircraft Group
FLIGHT CONTROL SYSTEM DESIGN FOR RIDE QUALITIES OF HIGHLY MANEUVERABLE FIGHTER AIRCRAFT
J F Moynes and J T Gallagher *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 21 p refs
Avail NTIS HC A14/MF A01
A flight control system design is presented that utilizes a ride improvement mode system (RIMS) in conjunction with a control augmentation system to achieve desired ride smoothing for low altitude high speed flight conditions The large amplitude flight simulator and the continuous system modeling program were used as the tools to analyze and evaluate ride qualities of a highly maneuverable fighter aircraft in low altitude high speed flight conditions Analysis included the effect of the first body bending mode on ride quality and pilot evaluations of the RIMS as flown on the large amplitude flight simulator It is demonstrated that significant improvement in ride quality on a low wing loaded multipurpose combat airplane could be achieved without adverse impact on the handling qualities J A M

N78-26057# Stuttgart Univ (West Germany) Inst Fuer Flugnavigation
PROPOSAL FOR A COST EFFECTIVE RADAR NAVIGATION SYSTEM FOR LOW ALTITUDE AND TERMINAL AREA FLIGHT
E Wildermuth *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 13 p refs
Avail NTIS HC A14/MF A01
The combination of already existent, well proved, and reliable navigational components or systems may be integrated to an effective navigation system The usefulness of this concept was

demonstrated on a practical example, where a dead reckoning navigation system and a radar set belonging to the navigation equipment of a close support aircraft were integrated to a cost effective radar navigation system The utility and advantage of this system were proved in navigation test flights Results showed that the system could be a valuable navigational aid for low altitude and terminal area flight J A M

N78-26058# British Aircraft Corp Preston (England) Military Aircraft Div
DESIGN CONSIDERATIONS FOR A GROUND AVOIDANCE MONITOR FOR FIGHTER AIRCRAFT
D A Whittle *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 13 p refs
Avail NTIS HC A14/MF A01

The problem of ground avoidance as a consequence of maneuvers executed by fighter aircraft is considered and a relatively simple form of monitor is proposed to provide a pilot warning in the event of the aircraft being subjected to a hazardous trajectory The parametric requirements of the ground avoidance monitor are discussed along with difficulties associated with selection of suitable and available sensors J A M

N78-26059# Marconi-Elliott Avionic Systems Ltd Rochester (England) Flight Control Div
SYSTEM INTEGRATION AND SAFETY MONITORING TO ACHIEVE INTEGRITY IN LOW ALTITUDE FLIGHT CONTROL SYSTEMS
D Sweeting *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 16 p refs
Avail NTIS HC A14/MF A01

Problems of monitoring the key flight control system elements were examined in particular the primary terrain following (TF) sensor The TF sensors are proposed that take advantage of the digital computing system capability (which was not available on first generation TF sensors) Improvements in navigation systems such as strapdown IN and NAVStar when combined with stored map information can be employed during low altitude operation to warn of hazardous situations relative to terrain J A M

N78-26060# Air Force Flight Dynamics Lab Wright-Patterson AFB Ohio
TERRAIN FOLLOWING CRITERIA THE NEED FOR A CANNON MEASURE
A F Barfield *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 13 p
Avail NTIS HC A14/MF A01

A research program was undertaken to organize meaningful terrain following criteria The standards were required to be independent of system mechanization Initially a literature search was conducted to obtain data on various terrain following systems and previously used criteria Terrain following concepts were categorized and used to define common system elements that would be considered in the study Criteria were then established based on this previous work and a current simulation effort Performance measures were quantified and a performance index established The performance index in conjunction with a checklist provided a means of comparing terrain following techniques A handbook was then formulated but remains to be validated before incorporation into applicable Air Force Specifications The proposed criteria are intended for use not only in writing terrain following system specifications but also in determining terrain following equipment design equating and ranking alternate terrain following methods and allowing the merits of modifications to be assessed J A M

N78-26061# Air Force Flight Test Center Edwards AFB Calif
B-1 TERRAIN-FOLLOWING DEVELOPMENT
Charles W Brinkley Patrick S Sharp and Richard Abrams (Rockwell International, Edwards Calif) *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 13 p
Avail NTIS HC A14/MF A01

The B-1 terrain following (TF) system and low altitude penetration capabilities were evaluated The B-1 mission, flight test program goals, and test philosophy are discussed The operating theory of the TF system is outlined including the forward looking radar, TF computer radar altimeter TF/flight control system adapter automatic throttle system and autopilot Ground tracking requirements and types of maneuvers flown are also considered J A M

N78-26062# Royal Aircraft Establishment Bedford (England) Operational Systems Div
STEEP GRADIENT APPROACH SYSTEMS RESEARCH FOR ALL-WEATHER OPERATIONS
A D Brown *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 15 p refs
Avail NTIS HC A14/MF A01

Some aspects are described of steep gradient approach research carried out at RAE Redford using flight trials, piloted simulation and theoretical studies Because only conventional aircraft were available the flight program was oriented towards establishing the limitation of such types and their associated avionics equipment when used for R/STOL operations Only performance data for the twin turbojet BAC 1-11 and the twin turboprop HS 748 are presented Aspects considered include the determination of the maximum useable glideslope angle and the optimum bandwidths for azimuth and elevation ratio guidance to permit R/STOL operations using a standard autopilot It is suggested the MLS with DME range information will overcome some of the limitations identified Manual approach performance results are also presented which indicate the need for 150-200 ft decision heights Piloted simulation research has shown a requirement for approach lighting comparable to existing Category 2 patterns for poor visibility operations Even then, it is unlikely that acceptable missed approach rates can be achieved unless RVRs are in excess of 1000 metres L S

N78-26063*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va Flight Research Div
RECENT FLIGHT TEST RESULTS USING AN ELECTRONIC DISPLAY FORMAT ON THE NASA B-737
Samuel A Morello *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 10 p refs
Avail NTIS HC A14/MF A01 CSCL 01D

The results of a flight evaluation of two electronic display formats for the approach to landing under instrument conditions The evaluation was conducted for a baseline electronic display format and for the same format with runway symbology and track information added The evaluation was conducted during 3 deg manual, straight in approaches with and without initial localizer offsets Flight-path tracking performance data and pilot subjective comments were examined with regard to pilot's ability to capture and maintain localizer and glideslope using both display formats The results of the flight tests agree with earlier simulation results and show that the addition of a perspective runway symbol with an extended centerline and relative track information to a baseline electronic display format improved both lateral and vertical flight-path tracking Pilot comments indicated that the rental workload required to assess the approach situation was reduced as a result of integrating perspective runway with extended centerline along with relative track information into the vertical situation display L S

N78-26064*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
AIRLINE PILOT SCANNING BEHAVIOR DURING APPROACHES AND LANDING IN A BOEING 737 SIMULATOR
Amos A Spady Jr *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 5 p refs
Avail NTIS HC A14/MF A01 CSCL 05J

A series of approaches using airline-rated Boeing 737 pilots in an FAA qualified simulator was conducted The test matrices include both manual and coupled approaches for VFR Category 1 and Category 2 conditions A nonintrusive oculometer system was used to track the pilot s eye-point-of-regard throughout the approach The results indicate that in general the pilots use a different scan technique for the manual and coupled (auto-pilot with manual throttle) conditions For the manual approach 73 percent of the time was spent on the Flight Director and 13 percent on airspeed as opposed to 50 percent on Flight Director and 23 percent on airspeed for the coupled approaches For the visual portion of approach from less than 100m to touchdown or when the touchdown point came into view, the pilots tend to fixate on their aim or touchdown area until the flare initiation at which time they let their eye-point-of-regard move up the runway to use the centerline lights for rollout guidance L S

N78-26065# Analytic Sciences Corp Reading, Mass
EVALUATION OF DIGITAL FLIGHT CONTROL DESIGN FOR VTOL APPROACH AND LANDING
Paul W Berry John R Broussard and Robert F Stengel (Princeton Univ N J) *In* AGARD *Guidance and Control Design* Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 21 p refs
Avail NTIS HC A14/MF A01

Methods and results in the design and evaluation of a digital flight control system (DFCS) for a CH-47B helicopter are presented The DFCS employs proportional-integral control logic to provide rapid, precise response to automatic or manual guidance commands while following conventional or spiral-descent approach paths It contains attitude- and velocity-command modes, and it adapts to varying flight conditions through gain scheduling Extensive use is made of linear systems analysis techniques -- the DFCS is designed using linear-optimal estimation and control theory and the effects of gain scheduling are assessed by examination of closed-loop eigenvalues and time responses The pre-flight-test evaluation described provides a direct comparison of alternate navigation guidance, and control philosophies, confirms the practical merits of the DFCS design approach, and demonstrates techniques which will aid the development of future guidance and control systems L S

N78-26066*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
AUTOMATIC FLIGHT PERFORMANCE OF A TRANSPORT AIRPLANE ON COMPLEX MICROWAVE LANDING SYSTEM PATHS
Thomas M Walsh and Earl F Weener (Boeing Co, Seattle) *In* AGARD *Guidance and Control Design Considerations for* Low-Altitude and Terminal-Area Flight Apr 1978 12 p refs

Avail NTIS HC A14/MF A01

During this demonstration the microwave landing system was utilized to provide the terminal configured vehicle B-737 airplane with guidance for automatic control on complex, curved descending paths with precision turns into short final approaches terminating in landing and roll-out, even when subjected to strong and gusty tail- and cross-wind components and severe wind shear The data collected from more than fifty approach flights during the demonstration provided an opportunity to analyze airplane flight performance on a statistical basis rather than on a single flight record basis as is customarily done with limited data replication Mean and standard deviation data are presented for approach flight path tracking parameters In addition, the adverse wind conditions encountered during these flights are described using three-dimensional wind vector characteristics computed from the extensive on-board sensor data L S

N78-26067# Centre d Etudes et de Recherches, Toulouse (France)
ACCURATE TIMING IN LANDINGS THROUGH AIR TRAFFIC CONTROL
Marc Pelegrin and Nicole Imbert *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 14 p refs

Avail NTIS HC A14/MF A01

In order to increase the accuracy of the landing time corrections of speed and heading to be made during the approach of the aircraft are proposed Numerical simulations including instrumentation localization, navigation errors and wind were performed for four different aircraft on four approach trajectories The comparison of the results of 200 simulations in each case with and without the corrections, point out the improvement of the accuracy of the landing time due to these corrections Flight tests also were made on commercial flights and the results of these tests are included L S

N78-26069# Standard Elektrik Lorenz A G Stuttgart (West Germany)
DME-BASED SYSTEM FOR ENROUTE/TERMINAL NAVIGATION, ALL-WEATHER LANDING AND AIR TRAFFIC CONTROL
K D Eckert *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 13 p
Avail NTIS HC A14/MF A01

An analysis is given of the various subsystems of the DME system detailing its advantages over other installations The areas of operational performance and economic efficiency are studied L S

N78-26070# National Aerospace Lab Amsterdam (Netherlands)
THE ANALYSIS OF OPERATIONAL MISSION EXECUTION AN ASSESSMENT OF LOW-ALTITUDE PERFORMANCE, NAVIGATION ACCURACY AND WEAPON DELIVERY PERFORMANCE
T J Stahlie *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 10 p
Avail NTIS HC A14/MF A01

A description is given of characteristics of the mission analysis programs as carried out for the Royal Netherlands Air Force by the National Aerospace Laboratory Although the program objectives can differ from trial to trial they have a number of common properties the use of onboard instrumentation/recording equipment, no need for ground equipment specific high accuracy techniques for the determination of aircraft position with the aid of aerial photographs etc All the programs are aimed at the analysis of relevant mission parameters e g low-altitude performance navigation accuracy execution of attack maneuver score of the (simulated) attack Apart from this primary objective the additional intentions are a realistic training opportunity for fighter pilots the evaluation of new tactics and the acquisition of realistic input data for simulation studies The main point in the description is the technical set-up including instrumentation and data reduction techniques calculation techniques applied *and typical results obtained* L S

N78-26071*# *National Aeronautics and Space Administration* Langley Research Center Langley Station Va
EXPERIMENTAL DETERMINATION OF THE NAVIGATION ERROR OF THE 4-D NAVIGATION, GUIDANCE, AND CONTROL SYSTEMS ON THE NASA B-737 AIRPLANE
Charles E Knox *In* AGARD Guidance and Control Design *Considerations for Low-Altitude and Terminal-Area Flight* Apr 1978 14 p
Avail NTIS HC A14/MF A01 CSCL 17G

Navigation error data from these flights are presented in a format utilizing three independent axes - horizontal vertical and time The navigation position estimate error term and the autopilot flight technical error term are combined to form the total navigation error in each axis This method of error presentation allows comparisons to be made between other 2- 3-, or 4-D navigation systems and allows experimental or theoretical determination of the navigation error terms Position estimate error data are presented with the navigation system position estimate based on dual DME radio updates that are smoothed with inertial velocities dual DME radio updates that are smoothed with true

airspeed and magnetic heading, and inertial velocity updates only The normal mode of navigation with dual DME updates that are smoothed with inertial velocities resulted in a mean error of 390 m with a standard deviation of 150 m in the horizontal axis a mean error of 1 5 m low with a standard deviation of less than 11 m in the vertical axis, and a mean error as low as 252 m with a standard deviation of 123 m in the time axis
L S

N78-26072# Technische Universitaet, Brunswick (West Germany)
DIRECT LIFT CONTROL FOR FLIGHT PATH CONTROL AND GUST ALLEVIATION
Gunther Shaenzer *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 14 p refs
Avail NTIS HC A14/MF A01

Most of the results from the use of direct lift controls have not been very encouraging The main reason for this is the coupling of desirable lift change with undesirable change of drag and pitch moment This leads to unfavorable cross couplings with respect to handling qualities Another reason is a design problem that can occur due to the high actuator rate, required for the DLC device High actuator rate leads to high costs of the control actuator and actuator power supply as well as to drawbacks in the reliability of the system An analysis is given to illustrate some of the problems to point out the main cause of these problems and to indicate when DLC can be used successfully
L S

N78-26073# Elektronik-System G m b H , Munich (West Germany)
NAVIGATION SYSTEM ASPECTS OF LOW ALTITUDE FLIGHT
Paul A Bross *In* AGARD Guidance and Control Design Considerations for Low-Altitude and Terminal-Area Flight Apr 1978 13 p
Avail NTIS HC A14/MF A01

The requirements deriving from accurate weapon delivery in enemy controlled areas are examined Specifically, the requirements imposed on precision and integrity and safety are investigated The need for an integration navigation system is stressed Principal design criteria for low altitude flight are suggested
L S

N78-26074# Advisory Group for Aerospace Research and Development, Paris (France)
PERFORMANCE PREDICTION METHODS
May 1978 355 p refs Partly in ENGLISH and FRENCH Presented at Flight Mech Panel Specialists Meeting on Performance Prediction Methods Paris 11-13 Oct 1977
(AGARD-CP-242 ISBN-92-835-1282-0) Avail NTIS HC A16/MF A01

Most of the analyses involve extrapolation of wind tunnel data to full scale flight conditions In addition to performance prediction the fields of flight mechanics flight path optimization and engine performance prediction are discussed Pilot input and the question of performance method standardization are also discussed
26094

N78-26075# Air Force Flight Dynamics Lab Wright-Patterson AFB Ohio
PERFORMANCE METHODS FOR AIRCRAFT AND MISSILES
L Earl Miller and Burtis R Benson *In* AGARD Performance Prediction Methods May 1978 16 p refs

Avail NTIS HC A16/MF A01

Approximate closed form solutions are derived for a typical fighter mission Also flyout range and maneuvering requirements are derived for missiles These solutions are suitable for the initial stages of preliminary design analysis The state of the art of trajectory optimization and air to air analysis are reviewed The development of singular perturbation theory has eliminated some of the numerical difficulties associated with two point boundary value problems
P R A

N78-26076# Technische Hochschule, Darmstadt (West Germany) Fachgebiet Flugtechnik
A SIMPLE CRITERION TO DISTINGUISH BETWEEN POINT AND INTEGRAL PERFORMANCE PROBLEMS AND ITS USE TO SIMPLIFY FLIGHT PROFILE OPTIMIZATIONS
Bernd Faber *In* AGARD Performance Prediction Methods May 1978 15 p refs
Avail NTIS HC A16/MF A01

Cookbook rules to simplify the mathematical model to a point performance problem and a procedure to its solution are given Many flight-path optimization problems can be described adequately by such a point performance model This will be demonstrated by two examples the minimum time-to-climb path and the minimum-distance takeoff
P R A

N78-26077# Technische Hogeschool Delft (Netherlands)
PREDICTION OF OFF-DESIGN PERFORMANCE OF TURBOJET AND TURBOFAN ENGINES
H Wittenberg *In* AGARD Performance Prediction Methods May 1978 31 p refs
Avail NTIS HC A16/MF A01

A simple method is developed to estimate the off-design performance of engines fixed by the design point conditions This method is based on gasdynamics relationships only and does not require a priori information from detailed fan compressor or turbine performance maps The method is based on the assumption of a choked exhaust nozzle or a choked turbine through which the working points of the engine components upstream of these aerodynamic throats are developed Single and two spool turbojet engines and two and three spool turbofan engines are considered The calculation method is illustrated by some examples for existing engine types the predicted off-design performance shows at least fair agreement with experimental and engine manufacturers data
P R A

N78-26078# Technische Universitaet Munich (West Germany) Lehrstuhl fuer Flugmechanik und Flugregelung
THE ON-BOARD CALCULATION OF OPTIMAL CLIMBING PATHS
Gerhard Bruening and Peter Hahn (Messerschmitt-Boelkow-Blohm G m b H Ottobrunn West Ger) *In* AGARD Performance Prediction Methods May 1978 15 p refs

Avail NTIS HC A16/MF A01

Whereas subsonic aircraft perform their climbing flight phases according to optimal strategies in regular service the corresponding strategies for supersonic aircraft are most difficult and time consuming to compute and tough to follow by the pilot because complicated relations between altitude and Mach number must be observed The methods developed so far are, therefore not suitable for an application on-board the aircraft Optimal climbing flight schedules computed by strong mathematical methods can be replaced to a high degree of accuracy by a series of arcs flown with constant load factor The pertinent computer programs are simple and can be implemented with on-board computers
P R A

N78-26079*# National Aeronautics and Space Administration Washington D C
PROPULSION-AIRFRAME INTERACTIONS PREDICTABILITY
Ronald H Smith *In* AGARD Performance Prediction Methods May 1978 20 p refs
Avail NTIS HC A16/MF A01

An illustration of the possible magnitude of the transonic performance prediction problem is shown These results derived from a careful and systematic set of tests run on a jet effects model an aerodynamic and force model and a pressure model evaluated test techniques and wind tunnel effects The results were then carefully compared with flight test data where significant discrepancies in zero-lift drag were observed A vigorous review of the test techniques identified a number of potential error sources Some of these were thought to be aircraft roughness and protuberances tunnel anomalies sting/model support corrections and hot gas effects In addition there were questions on model metric splitline location and magnitude of corrections for scale and Reynolds number Flight test inlet/engine characteristics were thought to differ also from those of the calibration settings in the ground facilities PRA

N78-26080# Messerschmidt-Boelkow G m b H Munich (West Germany) Unternehmensbereich Flugzeuge

DRAG MEASUREMENT IN TRANSONIC WIND TUNNELS

Felix Awehla *In* AGARD Performance Prediction Methods May 1978 18 p refs

Avail NTIS HC A16/MF A01

In order to increase the accuracy it is recommended to take into account the simultaneously measured wall pressure By linking these wall pressures with theoretical wall interference computations it seems possible to approach the absolute limit of accuracy This requires, however consideration of axial pressure gradients produced by the tunnel wall or by inappropriate model suspensions An example shows that these pressure gradients can cause errors in the absolute pressure drag of more than 100% and even in the drag differences of about 20% respectively The influence of Reynolds number on afterbody drag and on wing shock locations is critically reviewed and the variation of wind tunnel boundary layer is suggested as prime cause for these affects Lastly, unsteady flow separation problems are briefly touched and general recommendations for improved drag assessment are made PRA

N78-26081# Royal Aircraft Establishment Farnborough (England)

PERFORMANCE IMPLICATIONS OF SOME RECENT ADVANCES IN WEAPON CARRIAGE RESEARCH

L Davies *In* AGARD Performance Prediction Methods May 1978 18 p refs

Avail NTIS HC A16/MF A01

The possibilities that exist, and are being developed for reducing the drag penalties associated with the carriage of weapons on combat aircraft are discussed Performance implications of drag reduction for large weapon loads are discussed not only in terms of speed and radius of action for existing aircraft but also in terms of sizing a new aircraft to attain a specified performance PRA

N78-26082# Hawker Siddeley Aviation Ltd, Kingston upon Thames (England)

VTOL PERFORMANCE ESTIMATION FOR JET LIFT AIRCRAFT

C M Milford *In* AGARD Performance Prediction Methods May 1978 10 p refs

Avail NTIS HC A16/MF A01

The development of a semi-analytical model for VTOL performance estimation is described Only vertical motion is considered the calculation takes account of engine acceleration time, changes in vehicle mass due to fuel flow and the vertical drags due to aircraft motion Hot gas recirculation and ground effects are obtained from temperature and force measurements on model test rigs The calculated height-time histories show good agreement with measurements of actual aircraft VTOs the available full scale VL data is more limited but also shows satisfactory agreement with prediction PRA

N78-26083# Vereinigte Flugtechnische Werke-Fokker G m b H, Bremen (West Germany)

COMPARISON OF ESTIMATED AND FLIGHT DATA FOR ROLLING TAKE-OFF AND TRANSITION OF A VTOL AIRCRAFT

Guenter Kollokowsk and Richard Smyth *In* AGARD Performance Prediction Methods May 1978 19 p refs

Avail NTIS HC A16/MF A01

The accurate prediction of multi-engine VTOL-aircraft performance during rolling take-off and transition must take a larger number of parameters into consideration than conventional aircraft These additional parameters are strongly interconnected and have a large influence of overall aircraft performance A suitable performance prediction model will be defined for a lift plus lift cruised aircraft with two lift engine performance into account The predicted results will be compared with data from flight test for typical railing take-off and transition operations Author

N78-26084# British Aerospace Aircraft Group Woodford (England) Manchester Div

A COMPUTERIZED AIRCRAFT PERFORMANCE SYSTEM

John Richardson *In* AGARD Performance Prediction Methods May 1978 16 p

Avail NTIS HC A16/MF A01

The system referred to as CAPS, is a group of computer programs or modules covering the essential elements of performance evaluation and prediction and also the subsequent processing of results The relationship and interfaces of CAPS with other technical disciplines, for example, aircraft systems power plant, flight test, and technical publications is discussed and the need to integrate CAPS into the overall design process is emphasized The use of the system in conjunction with on-line terminals and interactive graphical visual display units is also discussed PRA

N78-26085# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France) Div des Etudes Avancees

PERFORMANCE PREDICTIONS OF MARCELL DASSAULT-BREGUET AVIATION AIRCRAFT [PREVISIONS DES PERFORMANCES AUX AVIONS MARCEL DASSAULT-BREGUET AVIATION]

Pierre Bohn *In* AGARD Performance Prediction Methods May 1978 12 p In FRENCH

Avail NTIS HC A16/MF A01

Results of performance predictions for numerous Marcel Dassault-Breguet aircraft were examined, and reference was given to nominal and safety performances Most of the performances measured were closely related to predictions, however, it was suggested that an improvement in methods of aerodynamic theory would reduce the present diversity in results Transl by B B

N78-26086# National Aerospace Lab, Amsterdam (Netherlands) Performance and Evaluation Dept

PREDICTION OF OPERATIONAL COMBAT PERFORMANCE

H Tellegen *In* AGARD Performance Prediction Methods May 1978 7 p

Avail NTIS HC A16/MF A01

There are indications that further improved performance of future fighter aircraft will no longer result into a proportional improvement in combat capability and that therefore, in order to obtain superior combat capability other means must be found One of these is to improve tactics and, in particular, assisting pilots in the execution of complex tactical-maneuvers This includes the design of maneuvers which are sound from a flight mechanics point of view and the identification of key points in the maneuver which can be handled by the pilot as reference, provided that he has available, in a suitable form the required information with respect to the flight conditions As an example of maneuver design a pitch-up type ground attack maneuver is considered G Y

N78-26087# Dornier-Werke G m b H Friedrichshafen (West Germany)

ANALYSIS OF ERROR SOURCES IN PREDICTED FLIGHT PERFORMANCE

Michael Lotz and Heribert Friedel *In* AGARD Performance Prediction Methods May 1978 11 p

Avail NTIS HC A16/MF A01

The errors involved in the flight performance prediction before the first flight stem in the case of point performances (SEP, load factor etc) from uncertainties in the prediction of aerodynamic and engine data and in the case of integral performances (take off, landing climb etc) also from improper assumptions in the procedures for their calculation The results of an analysis of these errors are shown for a typical CAS aircraft G Y

N78-26088# Office National d'Etudes et de Recherches Aerospatiales, Leclerc (France)

PREDICTION OF AERODYNAMIC CHARACTERISTICS OF AN AIRCRAFT FROM A CORRELATION OF RESULTS ON A CALIBRATION MODEL TESTED IN VARIOUS LARGE TRANSONIC TUNNELS

Ph Poisson-Quinton and X Vaucheret *In* AGARD Performance Prediction Methods May 1978 17 p refs In FRENCH, ENGLISH summary

Avail NTIS HC A16/MF A01

A program was initiated in 1969 to test a series of similar calibration models, representative of a transport aircraft, in various transonic tunnels of seven countries The configuration was chosen to have a typical design Mach number (M approximately 0 84) for a transport aircraft with very specific aerodynamic troubles at given Mach numbers and angles of attack, for the purpose of a precise comparison between various wind tunnel results on flight envelop prediction This paper is restricted to the results obtained with the largest model, tested in the U S A, Canada, England, Holland, and France The aerodynamic characteristics obtained are recalled to show that, in general, the results obtained are more and more misleading when the Reynolds number decreases below two (2) million From this experiment, it is still impossible to define a magic Reynolds number above which there is no more effect on the aerodynamic characteristics G Y

N78-26089# Naval Air Systems Command Washington, D C

DEVELOPMENT OF TECHNIQUES AND CORRELATION OF RESULTS TO ACCURATELY ESTABLISH THE LIFT/DRAG CHARACTERISTICS OF AN AIR BREATHING MISSILE FROM ANALYTICAL PREDICTIONS, SUB-SCALE AND FULL SCALE WIND TUNNEL TESTS AND FLIGHT TESTS

E C Rooney and R E Craig (General Dyn /Convair, San Diego, Calif) *In* AGARD Performance Prediction Methods May 1978 18 p refs

Avail NTIS HC A16/MF A01

The aerodynamic correlations provide information for validating or improving current lift/drag prediction techniques Correlations for the various prediction/documentation procedures are presented for linear range lift variations with angle of attack, maximum drag, induced drag and skin friction drag over the subsonic and low transonic mach regimes The correlations for lift and induced drag characteristics show generally good to excellent agreement The minimum drag prediction procedures for transonic drag rise is poor for all prediction precedures compared to flight test Analytical prediction methods and subscale model test results for subsonic minimum drag (which do not totally account for the effects of manufacturing tolerances, protuberances and excrescences) require an increase of approximately 8% to produce agreement with the minimum drag level obtained from powered full scale wind tunnel and flight tests G Y

N78-26090# McDonnell Aircraft Co St Louis Mo Aerodynamics Dept

FLIGHT TEST VERIFICATION OF F-15 PERFORMANCE PREDICTIONS

J M Abercrombie *In* AGARD Performance Prediction Methods May 1978 13 p refs

Avail NTIS HC A16/MF A01

The prediction of the performance characteristics of the F-15 Eagle was based primarily on data obtained in an extensive wind tunnel test program This test program was designed to determine the basic lift and drag characteristics for all flight conditions In addition, the effects of engine operating conditions as reflected in inlet mass flow and engine nozzle geometry and jet plume characteristics were carefully measured Inlet performance model tests served to provide accurate definition of recovery characteristics for calculation of net propulsive forces The test techniques and the methods used to adjust the wind tunnel results to predicted flight performance are discussed A description of the flight test program for performance with flight qualification is also included Selected comparison of predicted performance with flight test results are presented Assessment of the performance prediction methods used based on the degree of verification available from flight test data is also included The results prove that with sufficiently sophisticated wind tunnel models and through test techniques, satisfactory performance predictions can be made G Y

N78-26091# Northrop Corp Hawthorne Calif Aircraft Group

YF-17 FULL SCALE MINIMUM DRAG PREDICTION

H W Grellmann *In* AGARD Performance Prediction Methods May 1978 12 p

Avail NTIS HC A16/MF A01

The problem of predicting the full scale minimum drag of supersonic fighter aircraft is addressed The YF-17 aircraft is used to illustrate the various factors which must be taken into account Two comparisons of YF-17 minimum drag are presented The first comparison is between analytical estimates and wind tunnel results The second comparison is between the full scale predicted minimum drag based on wind tunnel data and the flight test drag level based on in-flight measured thrust The data presented show in detail how the YF-17 full scale minimum drag was predicted Areas of uncertainty are discussed which may contribute to the differences between the predicted and measured flight test minimum drag G Y

N78-26092# General Dynamics/Fort Worth Tex

CORRELATION OF F-16 AERODYNAMICS AND PERFORMANCE PREDICTIONS WITH EARLY FLIGHT TEST RESULTS

T S Webb D R Kent and J B Webb *In* AGARD Performance Prediction Methods May 1978 17 p refs

Avail NTIS HC A16/MF A01

F-16 design objectives and pertinent configuration features are reviewed and the major external configuration differences between the YF-16 prototype and the F-16 full-scale development airplanes are discussed The approach to predicting F-16 aerodynamics was to use YF-16 flight-test-derived data corrected for YF-16-to-F-16 configuration differences as determined from wind tunnel tests A comparison of YF-16 and F-16 wind tunnel lift, drag, and pitching-moment data reflects the close similarity between the F-16 and YF-16 configurations Early F16 flight test results show similar differences between wind tunnel and flight test lift and drag as experienced on the YF-16 and, therefore, validate this empirical approach The untrimmed drag due to lift generally appears lower in flight than in the wind tunnel and the subsonic lift in the intermediate angle-of-attack range is higher inflight than in the wind tunnel The trim horizontal-tail deflections, however, are larger than indicated by the wind tunnel which was not the case for the YF-16 and therefore was not predicted This results in a small increase in trim drag G Y

N78-26093# Societe Nationale Industrielle Aerospatiale, Paris (France)

A COMPARISON OF PREDICTIONS OBTAINED FROM WIND TUNNEL TESTS AND THE RESULTS FROM CRUISING FLIGHT (AIRBUS AND CONCORDE) [COMPARISON ENTRE LES PREVISIONS DEDUITES DES ESSAIS EN SOUFLLERIE ET LES RESULTATS DE VOL EN CROISIERE (AIRBUS ET CONCORDE)]

J Berger *In* AGARD Performance Prediction Methods May 1978 50 p refs In FRENCH

Avail NTIS HC A16/MF A01

A review of methods to establish aerodynamic and propulsion data is presented Comparison was made between flight tests results and predictions made from the data Various theories and improvements in the aerodynamic data are used to explain the slight deficiency found on the Airbus and Concord Thrust characteristics, air flow and consumption in the gas generator assembly must be established Transl by B B

N78-26094# Lockheed-California Co Burbank

CORRELATION OF WIND-TUNNEL AND FLIGHT-TEST DATA FOR THE LOCKHEED L-1011 TRISTAR AIRPLANE

R H Hopps and E C B Danforth *In* AGARD Performance Prediction Methods May 1978 12 p

Avail NTIS HC A16/MF A01

The methodology of prediction and the degree of correlation between wind tunnel test and flight test results are presented Included in the presentation are the general lift and drag characteristics minimum airspeed, buffet characteristics and static and dynamic longitudinal and lateral/directional stability characteristics G Y

N78-26095 Aeronautical Research Labs, Melbourne (Australia)
TRANSONIC WIND TUNNEL TESTS ON A NACA 0012 AEROFOIL
N Pollock Apr 1977 45 p refs
(ARL/Aero-Rept-148 AR-000-244) Copyright *Avail Issuing* Activity

Transonic wind tunnel tests on three geometrically similar NACA 0012 airfoil models are reported The test which comprised surface pressure distribution and wake traverse measurements covered a Mach number range of 0 5 to 0 82 and an incident range of 0 to 8 degrees The test Reynolds number for the three models were 1 680 000, 840 000 and 420,000 for the large intermediate and small models respectively Brief tests on the two larger models at reduced Reynolds number were also included All tests were conducted with artificial boundary layer transition fixing on both surfaces The investigation was proposed to provide data to evaluate wall interference effects in the transonic wind tunnel The data should also be helpful for checking the accuracy of interference theories at high subsonic speed G Y

N78-26096*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
EFFECT OF TWIST AND CAMBER ON THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A POWERED CLOSE-COUPLED WING-CANARD CONFIGURATION
John W Paulson Jr and James L Thomas May 1978 159 p refs
(NASA-TM-78722) Avail NTIS HC A08/MF A01 CSCL 01A

A series of wind-tunnel tests were conducted in a V/STOL tunnel to determine the low-speed longitudinal aerodynamic characteristics of a powered close-coupled wing/canard fighter configuration The data was obtained for a high angle-of-attack maneuvering configuration and a takeoff and landing configuration The data presented in tabulated form are intended for reference purposes Author

N78-26099*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
VSTOL TILT NACELLE AERODYNAMICS AND ITS RELATION TO FAN BLADE STRESSES
Robert J Shaw, Robert C Williams and Joseph L Koncsek (Boeing Mil Airplane Develop) Jul 1978 15 p refs Proposed for presentation at the 14th Joint Propulsion Conf Las Vegas Nev 25-27 Jul 1978 sponsored by the AIAA and the Soc of Automotive Engr
(NASA-TM-78899 E-9635) Avail NTIS HC A02/MF A01 CSCL 10A

A scale model of a VSTOL tilt nacelle with a 0 508 m single stage fan was tested in a low speed wind tunnel to ascertain inlet aerodynamic and fan aeromechanical performance over the low speed flight envelope Fan blade stress maxima occurred at discrete rotational speeds corresponding to integral engine order vibrations of the first flatwise bending mode Increased fan blade stress levels coincided with internal boundary layer separation but became severe only when the separation location had progressed to the entry lip region of the inlet G G

N78-26100*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
A VISCOUS-INVISCID INTERACTIVE COMPRESSOR CALCULATIONS
William Johnston (Case Western Reserve Univ) and Peter M Sockol Jul 1978 14 p refs Presented at 11th Fluid and Plasma Dynamics Conf Seattle Washington 10-12 Jul 1978 sponsored by AIAA
(NASA-TM-78920 E-9658) Avail NTIS HC A02/MF A01 CSCL 01A

A viscous-inviscid interactive procedure for subsonic flow is developed and applied to an axial compressor stage Calculations are carried out on a two-dimensional blade-to-blade region of constant radius assumed to occupy a mid-span location Hub and tip effects are neglected The Euler equations are solved by MacCormack s method a viscous marching procedure is used in the boundary layers and wake, and an iterative interaction scheme is constructed that matches them in a way that incorporates information related to momentum and enthalpy thicknesses as well as the displacement thickness The calculations are quasi-three-dimensional in the sense that the boundary layer and wake solutions allow for the presence of spanwise (radial) velocities Author

N78-26101*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
CALCULATION OF SUPERSONIC VISCOUS FLOW OVER DELTA WINGS WITH SHARP SUBSONIC LEADING EDGES
Yvon C Vigneron (Iowa State Univ Ames) John V Rakich and John C Tannehill (Iowa State Univ Ames) Jun 1978 81 p refs Presented at the AIAA 11th Fluid and Plasma Dynamics Conf Seattle 10-12 Jul 1978
(NASA-TM-78500) Avail NTIS HC A05/MF A01 CSCL 01A

Two complementary procedures were developed to calculate the viscous supersonic flow over conical shapes at large angles of attack with application to cones and delta wings In the first approach the flow is assumed to be conical and the governing equations are solved at a given Reynolds number with a time-marching explicit finite-difference algorithm In the second method the parabolized Navier-Stokes equations are solved with a space-marching implicit noniterative finite-difference algorithm This latter approach is not restricted to conical shapes and provides a large improvement in computational efficiency over published methods Results from the two procedures agree very well with each other and with available experimental data Author

N78-26102*# Polytechnic Inst of New York Dept of Mechanical and Aerospace Engineering
SLENDER BODY THEORY PROGRAMMED FOR BODIES WITH ARBITRARY CROSS SECTION
J Werner and A R Krenkel Feb 1978 77 p refs
(Grant NsG-1300)
(NASA-CR-145383 POLY-M/AE-77-17) Avail NTIS HC A05/MF A01 CSCL 01A

A computer program developed for determining the subsonic pressure, force and moment coefficients for a fuselage-type body using slender body theory is described The program is suitable for determining the angle of attack and sideslipping characteristics of such bodies in the linear range where viscous effects are not predominant Procedures developed which are capable of treating cross sections with corners or regions of large curvature are outlined J M S

N78-26103*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
SUBSONIC LONGITUDINAL AND LATERAL-DIRECTIONAL STATIC AERODYNAMIC CHARACTERISTICS OF A GENERAL RESEARCH FIGHTER MODEL EMPLOYING A STRAKE-WING CONCEPT
Charles H Fox Jr 1978 142 p refs
(NASA-TM-74071) Avail NTIS HC A07/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 Strakes with exposed semi-spans of 10 percent 20 percent, and 30 percent of the wing reference semi-span were tested in combination with wings having leading edge sweep angles of 30 44 and 60 degrees The angle of attack range was from -4 degrees to approximately 48 degrees at sideslip angles of 0, -5, and 5 degrees The data are presented without analysis in order to expedite publication Author

N78-26105*# National Aeronautics and Space Administration Washington D C

MEASUREMENT OF LOW TURBULENCE LEVELS WITH A THERMOANEMOMETER

V S Demin O V Morin N F Polyakov and V A Shcherbakov Jun 1978 11 p refs Transl into ENGLISH from Izv Sib Otd Akad Nauk SSSR Tekh Nauk (USSR) vol 8 no 2 Jun 1972 p 21-24 Original language document was announced as A73-13666 Transl by Kanner (Leo) Associates Redwood City Calif
(Contract NASw-2790)
(NASA-TM-75282) Avail NTIS HC A02/MF A01 CSCL 01A

The trend for decreasing the drag of aircraft is retention of laminar flow in the boundary layer over a large portion of the surface The laminar boundary layer was studied in a low turbulence wind tunnel for low subsonic velocities The method used and results of measurements of very low levels of turbulence are presented Measurements were performed by a constant-resistance thermoanemometer M V

N78-26106*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

COMPUTATIONAL WING OPTIMIZATION AND COMPARISONS WITH EXPERIMENT FOR A SEMI-SPAN WING MODEL

E G Waggoner (Vought Corp Dallas Tex) H P Haney (Vought Corp Dallas Tex) and W F Ballhaus Jun 1978 90 p refs
(NASA-TM-78480 A-7395 AVRADCOM-TR-78-33(AM)) Avail NTIS HC A05/MF A01 CSCL 01A

A computational wing optimization procedure was developed and verified by an experimental investigation of a semi-span variable camber wing model in the NASA Ames Research Center 14 foot transonic wind tunnel The Bailey-Ballhaus transonic potential flow analysis and Woodward-Carmichael linear theory codes were linked to Vanderplaats constrained minimization routine to optimize model configurations at several subsonic and transonic design points The 35 deg swept wing is characterized by multi-segmented leading and trailing edge flaps whose hinge lines are swept relative to the leading and trailing edges of the wing By varying deflection angles of the flap segments camber and twist distribution can be optimized for different design conditions Results indicate that numerical optimization can be both an effective and efficient design tool The optimized configurations had as good or better lift to drag ratios at the design points as the best designs previously tested during an extensive parametric study J M S

N78-26111# National Aerospace Lab Amsterdam (Netherlands) Fluid Dynamics Div

EVALUATION OF A METHOD FOR THE PREDICTON OF JET-AIRFRAME INTERFERENCE

H Snel 22 Nov 1976 64 p refs
(Contract NIVR-1761)
(NLR-TR-76132-U) Avail NTIS HC A04/MF A01

A method developed at NLR for the prediction of interference between (propulsion) jets and parts of airframes is presented The jet flow region is described by a model for a jet in a non-uniform mainflow accounting for the presence of the airframe The potential flow field around the airframe-jet combination is calculated with a panel method The location of the jet boundary and the inflow conditions on this surface follow from the jet model The method is applied to a number of wing-nacelle-jet combinations which were also studied experimentally Calculated and measured pressure distribution on the wing were compared in detail and agreement was found to be good for all configurations Author (ESA)

N78-26112# Aeronautical Research Inst of Sweden, Stockholm Aerodynamics Dept

MEASUREMENT OF THE PITCH DAMPING ON TWO AGARD B MODELS IN THE FFA S4 AND S5 WIND TUNNELS Final Report

Stig Lundgren 1977 29 p refs
(Contract F-INK-11-12-73208)
(FFA-AU-556) Avail NTIS HC A03/MF A01

Transonic/supersonic wind tunnel measurements of the pitch damping of two AGARD B models of wing spans 120 mm and 240 mm respectively were made using free oscillation techniques The purpose of the investigation was to measure stability derivatives in pitch of the models and to study interference effects on the pitch damping in the two tunnels The results of the investigation show a large difference in the pitch damping with and without boundary layer trips on the models For the larger model the pitch damping in the two tunnels agreed rather well up to M = 0 95 but between M = 0 95 to 1 0 the damping was smaller in the larger tunnel For the smaller model the agreement in the results from the two tunnels was somewhat less Comparison of results for models of different sizes in the same tunnel showed discrepancies at near sonic speeds Rolling angles of 90 deg had no effect on the pitch damping in the larger tunnel but for the larger model in the smaller tunnel the effect was considerable Various vertical positions of the models in the tunnels had little effect on the pitch damping Author (ESA)

N78-26113# National Aerospace Lab , Amsterdam (Netherlands) Fluid Dynamics Div

UNSTEADY AIRLOADS ON AN OSCILLATING SUPERCRITICAL AIRFOIL

H Tijdeman P Schippers and A J Persoon 7 Mar 1977 18 p refs Presented at the AGARD Specialists Meeting on Unsteady Airloads in Separated and Transonic Flow Lisbon 17-22 Apr 1977 Sponsored by Neth Agency for Aerospace Programs (NIVR)
(NLR-MP-77008-U) Avail NTIS HC A02/MF A01

Results are presented of unsteady pressure measurements on a two-dimensional model of the supercritical NLR 7301 airfoil performing pitching oscillations about an axis at 40 per cent of the chord Author (ESA)

N78-26115# Advisory Group for Aerospace Research and Development Paris (France)

TECHNICAL EVALUATION REPORT OF THE SPECIALISTS' MEETING ON UNSTEADY AIRLOADS IN SEPARATED AND TRANSONIC FLOW

W J Mykytow (AFFDL Wright-Patterson AFB Ohio), B Laschka (Messerschmitt-Boelkow-Blohm GmbH Munich) and J J Olsen (AFFDL Wright-Patterson AFB Ohio) Apr 1978 80 p refs Meeting held in Lisbon 19-20 Apr 1977
(AGARD-AR-108 ISBN-92-835-1279-0) Avail NTIS HC A05/MF A01

The prediction and description of the separated flow environment and the essential effects of airframe response on individual aircraft components are discussed Flutter, aeroelastic instabilities involving coupling with active control systems and other static and dynamic aeroelastic problems, with specific reference to the transonic speed range, are also presented

N78-26116# Messerschmitt-Boelkow-Blohm G m b H Munich (West Germany)

AIRFRAME RESPONSE TO SEPARATED FLOW

B Laschka and W J Mykytow (AFFDL, Wright-Patterson AFB Ohio) *In* AGARD Tech Evaluation Rept of the Specialist Meeting on the Unsteady Airloads in Separated and Transonic Flow Apr 1978 p 3-40 refs
Avail NTIS HC A05/MF A01

The effects of separated or unsteady flow on military aircraft may lead to failures of primary or secondary structures when exceeding design stress limits or design fatigue loads The separated and unsteady flow environment is described, and its unsteady pressures and forces were determined by wind tunnel and flight test techniques A description and discussion of the analytical approaches used for the prediction of the essential airframe response effects are given M V

N78-26117# Air Force Flight Dynamics Lab , Wright-Patterson AFB Ohio

TRANSONIC UNSTEADY AEROELASTIC PHENOMENA

W J Mykytow and J J Olsen *In* AGARD Tech Evaluation Rept of the Specialist Meeting on the Unsteady Airloads in

Separated and Transonic Flow Apr 1978 p 42-76 refs

Avail NTIS HC A05/MF A01

The development of two dimensional non-viscous methods for predicting unsteady airloads up to M = 0 9 are discussed Methods and measurements of airloads on an oscillating thick supercritical airfoil were evaluated These papers and their references set the state-of-the-art and provide a groundwork for some judgments concerning the development of three dimensional engineering methods and will help to define standard configurations and parameters to be used in formal and informal joint experimental and analytical programs M V

N78-26118# Advisory Group for Aerospace Research and Development, Paris (France)

COMMENTS ON THE STATE OF THE ART OF TRANSONIC UNSTEADY AERODYNAMICS

H C Garner *In its* Tech Evaluation Rept of the Specialist Meeting on the Unsteady Airloads in Separated and Transonic Flow Apr 1978 p 77-78

Avail NTIS HC A05/MF A01

A Venn diagram concerning the state-of-the-art with respect to aerodynamic loading on wings in supercritical flow is presented It was suggested that military applications demand attention to realistic methods for low-supersonic flutter aerodynamics M V

N78-26123# Federal Aviation Administration Washington D C Systems Research and Development Service

DISCRETE ADDRESS BEACON SYSTEM (DABS) DEVELOPMENT TEST AND EVALUATION (DT AND E) PROGRAM Final Report

John J Wojciech Dec 1977 28 p refs

(FAA Proj 034-241)

(AD-A052363 FAA-RD-77-185) Avail NTIS HC A03/MF A01 CSCL 17/2

The program to accomplish the Development Test and Evaluation (DT&E) of the Discrete Address Beacon System (DABS) is defined The goals of the DABS DT&E Program are to establish the DABS performance characteristics determine the compatibility of DABS with the Air Traffic Control (ATC) system and demonstrate the ATC performance improvements made possible by DABS The DABS DT&E Program consists of four phases factory acceptance tests field acceptance tests performance tests and DABS/ATC systems tests General information is provided on the test requirements associated with each program phase documentation requirements organizational responsibilities and schedules L S

N78-26130# Sperry Rand Corp, Great Neck, N Y Gyroscope Div

LASER-GYRO STRAPDOWN INERTIAL SYSTEM APPLICATIONS

Emanuel Levinson *In* AGARD Strap-Down Inertial Systems May 1978 48 p refs

Avail NTIS HC A13/MF A01

The following laser gyro strapdown inertial systems are described (1) tactical air to surface missile midcourse guidance (2) shipboard fire control, attitude reference, and (3) aircraft inertial navigation Mission requirements system configuration, alignment techniques, and existing hardware and software are delineated for each application Error analysis simulation and test data are presented which demonstrate the capacity of the laser gyro system to meet the specific application requirements B B

N78-26131# Messerschmitt-Boelkow-Blohm G m b H, Munich (West Germany) Aircraft Div

APPLICATION OF STRAPDOWN INERTIAL NAVIGATION TO HIGH PERFORMANCE FIGHTER AIRCRAFT

Wolfgang J Kubbat *In* AGARD Strap-Down Inertial Systems May 1978 16 p refs

Avail NTIS HC A13/MF A01

A experimental strapdown inertial navigation system which is part of an integrated guidance and control system was examined Based upon technical requirements and a general comparison between a gimballed solution vs a strapdown solution, a description of the major elements of the redundant inertial information and computation system was given The redundant inertial information and computation system was given The redundancy management problem was addressed as well as software timing and memory occupation Various aspects of advanced configurations such as sensor skewing and data bus application were also included B B

N78-26133*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

TRAJECTORY MODULE OF THE NASA AMES RESEARCH CENTER AIRCRAFT SYNTHESIS PROGRAM ACSYNT

Michael E Tauber and John A Paterson Jul 1978 73 p refs

(NASA-TM-78497 A-7480) Avail NTIS HC A04/MF A01 CSCL 01C

A program was developed to calculate trajectories for both military and commercial aircraft for use in the aircraft synthesis program ACSYNT The function of the trajectory module was to calculate the changes in the vehicle s flight conditions and weight as fuel is consumed, during the flying of one or more missions The trajectory calculations started with a takeoff followed by up to 12 phases chosen from among the following climb cruise acceleration combat loiter, descent and paths In addition, a balanced field length was computed The emphasis was on relatively simple formulations and analytic expressions suitable for rapid computation since a prescribed trajectory had to be calculated many times in the process of converging an aircraft design or finding an optimum configuration The trajectory module consists of about 2500 cards and operational on a CDC 7600 computer G G

N78-26134# Royal Aircraft Establishment Farnborough (England)

COMPILATION OF MEASURES TO INCREASE THE FATIGUE STRENGTH OF AIRCRAFT STRUCTURES

D Schuetz J J Gerharz and J E Moon ed Nov 1977 81 p refs Transl into ENGLISH of Rept TB-126 Lab fuer Betriebsfestigkeit Darmstadt, 1975 80 p

(RAE-Lib-Trans-1942 BR62769) Avail NTIS HC A05/MF A01

This literature survey is orientated to comprehensively inform the designer and to ease the selection of suitable measures for a fatigue critical structural detail Improvement factors presented should only be used as lead-values G G

N78-26135# Air Force Inst of Tech Wright-Patterson AFB Ohio School of Engineering

OPTIMAL MISSILE EVASION M S Thesis

Robert L Smith Dec 1977 76 p refs

(AD-A053267 AFIT/GA/EE/77-5) Avail NTIS HC A05/MF A01 CSCL 15/7

The purpose of the study is to formulate a method to determine the control strategies that maximize the probability of survival for an evading aircraft against an air-to-air missile The missile model developed is a typical infrared missile using proportional navigation steering The P(k) is modeled as ellipsoidal iso-cost surfaces with a cost value that decays exponentially The problem terminates when the line-of-sight from the missile to the target aligns on the edge of the missile s fusing cone angle The algorithm developed employs a second order differential dynamic programming model which optimizes the controls of the evading aircraft Author (GRA)

N78-26136# AiResearch Mfg Co Torrance Calif

DESIGN CRITERIA FOR APPLICATION OF MEMBRANE NITROGEN INERTING SYSTEMS TO ARMY AIRCRAFT FUEL TANKS Final Technical Report, Oct 1976 - Sep 1977

Scott A Manatt Linus B Buss and Alfred F Funk Dec 1977 76 p

(Contract DAAJ02-76-C-0073 DA Proj 1F2-62209-AH-76)

(AD-A052869 AIRESEARCH-77-14332 USARTL-TR-77-50) Avail NTIS HC A04/MF A01 CSCL 01/3

This report describes a study and development program to evaluate the application of a hollow fiber permeable-membrane-based inert gas generation fuel tank inerting system to U S Army aircraft The purpose of the system is to reduce the oxygen concentration in aircraft fuel tank ullage to an inert condition to eliminate the vulnerability of this volume to explosion and fire hazards associated with the presence of ignition source from hostile gunfire Unlike some other fuel tank inerting systems the inert gas generating system requires no regular resupply of expendables and does not add to the fuel tanks any materials that displace or retain fuel Feasibility studies of system designs and aircraft penalties were evaluated for U S Army AH-1G AAH, UH-1H UTTAS CH-47C and OV-1D aircraft Preliminary designs were prepared for systems for the following aircraft AH-1G CH-47C, and OV-1D (drop tanks only) The design of a flightworthy system was completed for the AH-1G Cobra helicopter GRA

N78-26137# Air Force Inst of Tech Wright-Patterson AFB Ohio School of Engineering

THE DESIGN AND SIMULATION OF A TAKEOFF STABILIZATION SYSTEM FOR AN AIRCRAFT WITH AN AIR CUSHION LANDING SYSTEM M S Thesis

Edward A Kenney Dec 1977 119 p refs

(AD-A053220 AFIT/GE/EE/77D-43) Avail NTIS HC A06/MF A01 CSCL 01/3

The inherent instability in pitch and roll associated with an Air Cushion Landing System (ACLS) aircraft at low airspeeds was investigated, and a means to aid control in pitch and roll was developed The control system required the use of vertical wing tip thrusters which provided thrust up or down depending on the control signal (similar to space vehicle thrusters) These thrusters could be activated alternately to control roll angle and roll rate with the use of a bang-bang optimal controller As well, the thrusters would be set forward of the aircraft center of gravity and could be activated in tandem to aid in pitch control The Jindivik Remotely Piloted Vehicle an Australian target drone, was fitted with an ACLS and taxi tests showed the instability and need for a stabilization system Subsequent use of Jindivik wind tunnel and taxi test data served as the basis for the development of the roll/pitch control system presented in this paper Due to computational problems with the air cushion model of the computer program the controller designs could not be completely verified but expected trends in pitch roll and yaw control were shown Author (GRA)

N78-26138# Royal Netherlands Aircraft Factories Fokker Schiphol-Oost Dept CB-SC/SO

A STATISTICAL TEST OF THE CALCULATED MEAN FATIGUE LIFE USING SERVICE EXPERIENCE

C A Hermens Aug 1977 17 p refs

(FOK-S-144) Avail NTIS HC A02/MF A01

The calculated mean fatigue life of aircraft structures is discussed A computer program developed to carry out the test was applied to the service experience of the F-27 drag stay bracket It was shown that the method of Larsson for calculation of the mean life of a lug is reliable The difference between calculated mean life and mean life derived from service experience is probably due to the fact that the average actual load spectrum in service is less severe than the assumed load spectrum in calculation ESA

N78-26139# General Accounting Office Washington, D C Procurement and Systems Acquisition Div

CAN THE ARMY'S $2 8 BILLION PROGRAM MODERNIZE THE CH-47 HELICOPTER BE IMPROVED Report to Congress

24 Feb 1978 28 p

(PB-277397/6, PSAD-78-18) Avail NTIS HC A05/MF A01 CSCL 01C

The Army plans to modernize most of its CH-47 helicopter fleet and purchase new modernized CH-47s to provide medium helicopter capability through the 1990s If current plans are carried out, awards totaling $2 8 billion will be made without the benefit of prime contractor competition The Secretary of Defense should determine whether or not competition at the prime contractor level may be carried out for this multibillion dollar program GRA

N78-26140# General Accounting Office Washington D C Procurement and Systems Acquisition Div

STATUS OF THE NAVY'S VERTICAL SHORT TAKEOFF AND LANDING AIRCRAFT Report to Congress

23 Feb 1978 48 p

(PB-277401/6 PSAD-78-61) Avail NTIS HC A03/MF A01 CSCL 01C

A vertical short takeoff and landing (VSTOL) aircraft program is reported that could change the complexion of Naval aviation at sea The program will begin replacing conventional takeoff and landing aircraft with VSTOL aircraft during the 1991 to 2000 time frame VSTOL decisions affect the Navy s entire sea-based aircraft program New operational concepts are being explored and technology needs are being assessed for VSTOL Development costs alone are estimated in the billions GRA

N78-26141# Human Engineering Labs Aberdeen Proving Ground Md

A REVIEW OF THE LITERATURE ON ELECTRO-OPTICAL FLIGHT DISPLAYS Final Report

Andrew T Buckler Feb 1978 14 p refs

(AD-A053310 HEL-TM-3-78) Avail NTIS HC A02/MF A01 CSCL 05/8

This report contains a review of the literature on electro-optical flight displays with special emphasis on rotary-wing aircraft The primary focus of this review was to find research studies in which different symbology formats were compared experimentally Research of this type was found to be for the most part sorely lacking in literature However some valuable work has been done in effort to demonstrate the feasibility of certain specific systems This work should be taken as a baseline in developing candidate symbology formats to be tested empirically to arrive at an optimal standard for rotary-wing E/O displays Author (GRA)

N78-26142 Stanford Univ, Calif

MINIMUM TIME ACCELERATION OF AIRCRAFT TURBOFAN ENGINES BY USING AN ALGORITHM BASED ON NONLINEAR PROGRAMMING Ph D Thesis

Fred Teren 1978 179 p

Avail Univ Microfilms Order No 78-08855

Minimum time accelerations of aircraft turbofan engines are presented The calculation of these accelerations is made by using a piecewise-linear engine model and a new algorithm based on nonlinear programming Use of this model and algorithm allows such trajectories to be readily calculated on a digital computer with a minimal expenditure of computer time The new algorithm may be used for solution of optimal control problems which are nonlinear in the state variables and linear in the control variables Specifically the most general problem considered is to minimize a performance index subject to satisfaction of the system dynamic equations a set of terminal constraints and path inequality constraints The performance index system equations and path constraints are all linear in the control variables Dissert Abstr

N78-26143*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

COMBUSTOR CONCEPTS FOR AIRCRAFT GAS TURBINE LOW-POWER EMISSIONS REDUCTION

E J Mularz, C C Gleason (G E Co Evandale, Ohio) and W J Dodds (G E Co Evandale Ohio) Jul 1978 20 p refs Presented at the 14th Propulsion Conf Las Vegas Nev 25-27 Jul 1978 co-sponsored by the AIAA and the Soc of Automotive Engr

(NASA-TM-78875 AVRADCOM-TR-78-23(PL) AIAA-Paper-78-999) Avail NTIS HC A02/MF A01 CSCL 20E

Several combustor concepts were designed and tested to demonstrate significant reductions in aircraft engine idle pollutant emissions Each concept used a different approach for pollutant reductions the hot wall combustor employs a thermal barrier coating and impingement cooled liners, the recuperative cooling combustor preheats the air before entering the combustion chamber and the catalytic converter combustor is composed of a conventional primary zone followed by a catalytic bed for pollutant cleanup The designs are discussed in detail and test results are presented for a range of aircraft engine idle conditions The results indicate that ultralow levels of unburned hydrocarbons and carbon monoxide emissions can be achieved B B

N78-26144*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
END-WALL BOUNDARY LAYER PREDICTION FOR AXIAL COMPRESSORS
Peter M Sockol 1978 19 p refs Presented at the 11th Fluid and Plasma Dynamics Conf Seattle 10-12 Jul 1978 sponsored by AIAA
(NASA-TM-78928 E-9668) Avail NTIS HC A02/MF A01 CSCL 21E

An integral boundary layer procedure was developed for the computation of viscous and secondary flows along the annulus walls of an axial compressor The procedure is an outgrowth and extension of the pitch-averaged methods of Mellor and Horlock In the present work secondary flow theory is used to develop approximations for the velocity profiles inside a rotating blade row and for the blade force deficit terms in the momentum integral equations The computer code based on this procedure was iteratively coupled to a quasi-one-dimensional model for the external inviscid flow Computed results are compared with measurements in a compressor cascade Author

N78-26145*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
LIQUID-COOLING TECHNOLOGY FOR GAS TURBINES REVIEW AND STATUS
G James VanFossen, Jr (Army Res and Technol Labs) and Francis S Stepka Aug 1978 14 p refs Proposed for presentation at the 13th Intersoc Energy Conversion Eng Conf San Diego Calif 20-25 Aug 1978 sponsored by the SAE ACS, AIAA ASME IEEE AICHE and ANS
(NASA-TM-78906 AVRADCOM-TR-78-26(PL) E-9517-1) Avail NTIS HC A02/MF A01 CSCL 21E

A review of research related to liquid cooling of gas turbines was conducted and an assessment of the state of the art was made Various methods of liquid cooling turbines were reviewed Examples and results with test and demonstrator turbines utilizing these methods along with the advantages and disadvantages of the various methods are discussed B B

N78-26149*# Boeing Commercial Airplane Co Seattle Wash
FLIGHT EFFECTS ON NOISE BY THE JT8D ENGINE WITH INVERTED PRIMARY/FAN FLOW AS MEASURED IN THE NASA-AMES 40 BY 80 FOOT WIND TUNNEL
Frank G Strout Jun 1978 246 p refs
(Contract NAS2-9302)
(NASA-CR-2996) Avail NTIS HC A11/MF A01 CSCL 21E

A JT8D-17R engine with inverted primary and fan flows was tested under static conditions as well as in the NASA Ames 40 by 80 Foot Wind Tunnel to determine static and flight noise characteristics and flow profile of a large scale engine Test and analysis techniques developed by a previous model and JT8D engine test program were used to determine the in-flight noise The engine with inverted flow was tested with a conical nozzle and with a plug nozzle, 20 lobe nozzle and an acoustic shield Wind tunnel results show that forward velocity causes significant reduction in peak PNL suppression relative to uninverted flow The loss of EPNL suppression is relatively modest The in-flight peak PNL suppression of the inverter with conical nozzle was 2 5 PNdb relative to a static value of 5 5 PNdb The corresponding EPNL suppression was 4 0 EPNdb for flight and 5 0 EPNdb for static operation The highest in-flight EPNL suppression was 7 5 EPNdb obtained by the inverter with 20 lobe nozzle and acoustic shield When compared with the JT8D engine with internal mixer, the inverted flow configuration provides more EPNL suppression under both static and flight conditions A R H

N78-26150# Indian Inst of Tech , Bombay Dept of Electrical Engineering
OPTIMAL AUTOSTABILIZER FOR A SUPERSONIC FIGHTER AIRCRAFT
V V Athani and Y S Apte 19 Sep 1977 20 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Guidance and Control in Jan -Feb 1979
Avail NTIS HC A02/MF A01

A fourth order model that includes elevator system dynamics was used The performance index selected contains quadratic terms in state variables but not in the control variable Consequently the optimal control law is of bang-bang type Since initial conditions in the system keep on changing from time to time the optimal control law ought to be of feedback type This makes it incumbent to use dynamic programming to derive the optimal control law A novel method, involving extension of Krotov's numerical technique was used for solving the resulting Bellman s equation of dynamic programming The control law obtained contains only a linear combination of the state variables and is thus very simple to implement Analog computer results show a dramatic reduction in response time from 3 secs for the aircraft without control to 0 5 sec with control L S

N78-26151*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
A FLIGHT INVESTIGATION OF THE STABILITY, CONTROL, AND HANDLING QUALITIES OF AN AUGMENTED JET FLAP STOL AIRPLANE
Richard F Vomaske, Robert C Innis Brian E Swan (Canadian Armed Forces Ottawa) and Seth W Grossmith (Canadian Dept of Transport, Ottawa) Jun 1978 147 p refs
(NASA-TP-1254 A-7246) Avail NTIS HC A07/MF A01 CSCL 01C

The stability control and handling qualities of an augmented jet flap STOL airplane are presented The airplane is an extensively modified de Havilland Buffalo military transport The modified airplane has two fan-jet engines which provide vectorable thrust and compressed air for the augmentor jet flap and Boundary-Layer Control (BLC) The augmentor and BLC air is cross ducted to minimize asymmetric moments produced when one engine is inoperative The modifications incorporated in the airplane include a Stability Augmentation System (SAS) a powered elevator and a powered lateral control system The test gross weight of the airplane was between 165,000 and 209,000 N (37 000 and 47,000 lb) Stability, control, and handling qualities are presented for the airspeed range of 40 to 180 knots The lateral-directional handling qualities are considered satisfactory for the normal operating range of 65 to 160 knots airspeed when the SAS is functioning With the SAS inoperative poor turn coordination and spiral instability are primary deficiencies contributing to marginal handling qualities in the landing approach The powered elevator control system enhanced the controllability in pitch particularly in the landing flare and stall recovery Author

N78-26152*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
PLANNING FOR AIRPORT ACCESS AN ANALYSIS OF THE SAN FRANCISCO BAY AREA
Jarir S Dajani ed (Stanford Univ Calif) James V Jucker, ed (Stanford Univ , Calif), and J Lloyd Jones May 1978 300 p refs Stanford-NASA-ASEE Summer Faculty Fellowship Program on Engineering System Design held at Moffett Field Calif 1977
(NASA-CP-2044 A-7347) Avail NTIS HC A13/MF A01 CSCL 09E

A multidisciplinary systems analysis of airport access to the major airports of the San Francisco Bay Area was made Basically it was found that there is no major airport access problem The argument of the report is that commonly perceived airport access problems are either minor inconvenience magnified out of proportion by a combination of the traveler's unreasonable expectations anxiety over flight departure and lack of information or not subject to solutions which do not consider the entire urban transit system Nine specific conclusions and recommendations for improvement are presented and discussed Author

N78-26153*# Iowa State Univ of Science and Technology, Ames Dept of Mechanical Engineering
A STUDY OF TEST SECTION CONFIGURATION FOR SHOCK TUBE TESTING OF TRANSONIC AIRFOILS Final Report
William J Cook Jun 1978 70 p refs
(Grant NsG-2152, ISU Proj 1233)
(NASA-CR-157237 ISU-ERI-Ames-78336) Avail NTIS HC A04/MF A01 CSCL 14B

Two methods are investigated for alleviating wall interference effects in a shock tube test section intended for testing two-dimensional transonic airfoils The first method involves contouring the test section walls to match approximate streamlines in the flow Contours are matched to each airfoil tested to produce results close to those obtained in a conventional wind tunnel Data from a previous study and the present study for two different airfoils demonstrate that useful results are obtained in a shock tube using a test section with contoured walls The second method involves use of a fixed-geometry slotted-wall test section to provide automatic flow compensation for various airfoils The slotted-wall test section developed exhibited the desired performance characteristics in the approximate Mach number range 0 82 to 0 89, as evidenced by good agreement obtained between shock tube and wind tunnel results for several airfoil flows G G

N78-26202# Pratt and Whitney Aircraft Group, West Palm Beach Fla Government Products Div
TITANIUM DAMAGE TOLERANT DESIGN DATA FOR PROPULSION SYSTEMS Final Report, 1 Jun 1975 - 30 Apr 1977
James R Beyer David L Sims and Raymond M Wallace Aug 1977 93 p refs
(Contract F33615-75-C-5130)
(AD-A053252 FR-8480, AFML-TR-77-101) Avail NTIS HC A05/MF A01 CSCL 11/6

The program consisted of crack growth threshold crack growth rate and fracture toughness testing for each alloy plus strain controlled low cycle fatigue crack initiation testing on Ti 8-1-1 The effects of stress ratio cyclic frequency and temperature were determined providing a broad data base for damage tolerant design of titanium gas turbine engine components GRA

N78-26220# Royal Netherlands Aircraft Factories Fokker Schiphol-Oost Manufacturing Research and Product Development Dept
ADHESION OF EROSION RESISTANT TAPES ON SEVERAL SURFACE CONFIGURATIONS
J A Cromwijk Apr 1977 6 p
(FOK-R-2132) Avail NTIS HC A02/MF A01

The leading edges of the F-28 aircraft suffer from severe erosion especially in tropic environments To get an impression of the adhesion of the tapes to the several surface configurations an investigation was carried out using tape Y-8562 for application to leading edges with a thermal de-icing system and limited film thickness Tape type U-8598 was tested for application to leading edges with no limitation in film thickness Author (ESA)

N78-26221# Royal Netherlands Aircraft Factories Fokker Schiphol-Oost Manufacturing Research and Product Development Dept
SPACELAB TESTING OF METALBOND 328 WC AND FOAM ADHESIVE BSL 208/5
W Cleven 13 Sep 1977 30 p refs
(FOK-R-2162) Avail NTIS HC A03/MF A01

Tests were carried out on metal-to-metal metal-to-honeycomb and honeycomb-core splice joints in order to obtain information for design allowables for METALBOND 328 WC adhesive film and core splice adhesive BSL 208/5 Adhesive M 328 WC is the same adhesive as M328 type I used for the F-28 structure however the M 328 WC is unsupported According to material specification TH 37 0103 the specific weight of the film is 2 25 + or - N/sq m and the nominal film thickness is 0 16 mm It was found that 328 WC adhesive is temperature stable up to at least 110 C strength retention of all the 110 C tests is above 70% as compared to room temperature tests all but one flexural shear test Specimen failed by shear in the honeycomb core and core splice adhesive BSL 208/5 is functional in the tested configuration at a temperature of at least 110 C ESA

N78-26223* National Aeronautics and Space Administration Washington D C
AVIATION FUELS BEYOND THE 1980'S
Willson H Hunter (NASA Senior Sci Representative Canberra Australia) 1978 17 p refs Presented at the Symp on Aviation Fuel in the 1980 s Melbourne 26-27 Jun 1978 sponsored by the Inst of Engr Australia and the Australian Inst of Petrol
(NASA-TM-79510) Avail Issuing Activity CSCL 21D

The competitive use and effect of coal-derived synthetic JET-A and cryogenic liquid methane (LCH4) and liquid hydrogen (LH2) fuels on the design mass and operation of large subsonic supersonic and hypersonic transport aircraft are analyzed Overall energy and cost efficiency comparisons are presented from studies of JET-A and LH2 fuels usage in subsonic and supersonic transports The probable concerns of the public and the aviation industry over the use of the coal-derived fuels are discussed The possibility that space-flight-vehicle-derived technology may be applied to special purpose passenger transports is considered The likelihood that petroleum-derived fuels similar to JET-A will continue in major use in aviation for the foreseeable future is predicted Author

N78-26392*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
INDUCED VELOCITY FIELD OF A JET IN A CROSSFLOW
Richard L Fearn (Florida Univ Gainesville) and Robert P Weston May 1978 148 p refs
(NASA-TP-1087 L-11624) Avail NTIS HC A07/MF A01 CSCL 20D

An experimental investigation of a subsonic round jet exhausting perpendicularly from a flat plate into a subsonic crosswind of the same temperature was conducted Velocity and pressure measurements were made in planes perpendicular to the path of the jet for ratios of jet velocity to crossflow velocity ranging from 3 to 10 The results of these measurements are presented in tabular and graphical forms A pair of diffuse contrarotating vortices is identified as a significant feature of the flow and the characteristics of the vortices are discussed Author

N78-26446*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
FILTRATION EFFECTS ON BALL BEARING LIFE AND CONDITION IN A CONTAMINATED LUBRICANT
Stuart H Loewenthal and Donald W Moyer (Tribon Mfg Co, Cleveland) Oct 1978 26 p refs Proposed for presentation at the Joint Lubrication Conf Minneapolis 24-26 Oct 1978 sponsored by the Am Soc of Mech Engr and the Am Soc of Lubrication Engr
(NASA-TM-78907 E-9418) Avail NTIS HC A03/MF A01 CSCL 13I

Ball bearings were fatigue tested with a noncontaminated lubricant and with a contaminated lubricant under four levels of filtration The test filters had absolute particle removal ratings of 3 30 49 and 105 microns Aircraft turbine engine contaminants were injected into the filter s supply line at a constant rate of 125 milligrams per bearing hour Bearing life and running track condition generally improved with finer filtration The experimental lives of 3 and 30 micron filter bearings were statistically equivalent approaching those obtained with the noncontaminated lubricant bearings Compared to these bearings the lives of the 49 micron bearings were statistically lower The 105 micron bearings experienced gross wear The degree of surface distress, weight loss and probable failure mode were dependent on filtration level with finer filtration being clearly beneficial Author

N78-26449# Aeronautical Systems Div Wright-Patterson AFB Ohio

RECESS FASTENERS Final Report, 1 Sep - 1 Dec 1977

E J Raimondi Feb 1978 183 p refs

(AD-A053221 ASD-TR-78-5) Avail NTIS HC A09/MF A01 CSCL 13/5

This report covers four tasks A recess fastener test method is developed and the results of tests showing the affect of parameters and comparative recess performance are reported The results of an investigation into the factors affecting removal torque are reported An analytical method for determining fastener tensile strength as a function of recess depth is described Finally the results of a field data gathering effort to measure torque end load, and tool angle during installation and removal of fasteners are detailed Author (GRA)

N78-26460# Advisory Group for Aerospace Research and Development Paris (France)

NON-DESTRUCTIVE INSPECTION RELATIONSHIPS TO AIRCRAFT DESIGN AND MATERIALS

Mar 1978 336 p refs In ENGLISH and FRENCH Presented at the 45th Meeting of the AGARD Struct and Mater Panel Voss Norway, 27-28 Sep 1977

(AGARD-CP-234, ISBN-92-835-0213-2) Avail NTIS HC A15/MF A01

The state of the art of nondestructive inspection methods for materials of interest to the aerospace industry is considered along with the weak points of some methods and the trends of application Composite ceramic and metallic materials are included Low angle neutron scattering digitalized infrared thermography tomography and very high frequency ultrasonic beam scattering are among the methods discussed

N78-26461# Aeritalia S p A Torino (Italy)

NDI TECHNIQUES IN AEROSPACE

Enrico Bolis *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 3 p

Avail NTIS HC A15/MF A01

The application of nondestructive inspection techniques to assure the safety and reliability of aerospace structures and components is discussed The importance of quality assurance techniques and standards at all levels of development (materials procurement engineering specifications structures manufacturing) and in monitoring structures during service life is emphasized J M S

N78-26462# Politecnico di Torino (Italy) Inst Progetto di Aeromobili

CRITICAL REVIEW OF VARIOUS STRUCTURAL SAFETY CONCEPTS TAKING INTO ACCOUNT NDI METHODS

E Antona *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 22 p refs

(Contract CNR-SAS-76-0031)

Avail NTIS HC A15/MF A01

A critical review is given of the various structural safety concepts adopted during the aeronautical and space technology development with particular emphasis on fatigue and fracture mechanics A comparison is made between the deterministic and the probabilistic point of view in the analysis of the loading condition and the structural behavior and consequently between the deterministic and the probabilistic formulation of the structural safety concepts As a conclusion to these considerations an analysis is performed relative to the present and the expected impact of fracture mechanics in aerospace structural design philosophy and to the impact of nondestructive inspection methods on fracture mechanics analysis J M S

N78-26463# Air Force Materials Lab Wright-Patterson AFB Ohio

THE ECONOMIC IMPLICATIONS OF NDE OPPORTUNITIES AND PAYOFF

D M Forney and T D Cooper *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 15 p refs

Avail NTIS HC A15/MF A01

Progress in the development of nondestructive evaluation procedures which may have significant economic benefits is reviewed Nondestructive evaluation requirements in both initial manufacturing and in-service functions are discussed to exemplify cost effective approaches Other possible future opportunities are also considered J M S

N78-26464# Royal Air Force London (England)

UNFULFILLED NEEDS OF NON-DESTRUCTIVE INSPECTION OF MILITARY AIRCRAFT

H M Kent *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 10 p refs

Avail NTIS HC A15/MF A01

The research and development needs of nondestructive inspection technology are discussed in terms of maintaining the airworthiness of military aircraft Techniques for in-flight monitoring and detection of defects due to corrosion residual and thermal stress and adhesive bond deterioration are included J M S

N78-26465# Fiat Research Center Orbassano (Italy)

APPLICATION OF SMALL-ANGLE NEUTRON SCATTERING TO NDI OF MATERIALS AND MANUFACTURED COMPONENTS

P Pizzi *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 17 p refs

Avail NTIS HC A15/MF A01

Examples of heat treatment effects cold work effects and creep effects measured by small angle neutron scattering are presented Application of the small angle neutron scattering technique to the study of microstructural degradation phenomena in nickel superalloys and in particular in turbine blades during service is discussed An example of anisotropic scattering measured in carbon-carbon fiber composites is included J M S

N78-26466# Fiat Research Center Orbassano (Italy)

SURFACE CORROSION EVALUATION BY RELATIVE MAGNETIC SUSCEPTIBILITY MEASUREMENTS

H Walther *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 11 p ref

Avail NTIS HC A15/MF A01

A method based on the principles of a magnetic balance is proposed for detecting the corrosion effects in the very early stage of the degeneration process The method is based on the fact that superalloys and stainless steels change their magnetic susceptibility during oxidation and carburization in their subsurface layer Results of measurements performed on IN-100 aircraft turbine blades and INCONEL X-750 power plant gas turbine blades are reported J M S

N78-26467# Lanchester Polytechnic Coventry (England)

APPLICATION OF X-RAY DIFFRACTION STRESS MEASURING TECHNIQUES

D Kirk *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 13 p refs

Avail NTIS HC A15/MF A01

Examples of residual stress analysis are given to illustrate the wide range of useful applications that are possible for the X-ray stress measuring techniques The variation of residual stress at the surface for a machined aluminum alloy extrusion and for the region adjacent to a butt-welded steel plate is discussed along with the variation of residual stress below the original surface for shot-peened components and for a flow-formed maraging steel tube The advantages of chemical polishing for layer removal are considered The practical problems associated with unusual geometry and physical size of components are described J M S

N78-26468# Direzione Laboratori Aeronautica Militaire Rome (Italy)

X-RAY DIFFRACTION FROM STRUCTURAL X-RAY DIFFRACTOGRAPHY TO X-RAY OSCILLOGRAPHIC DIFFRACTOSCOPY

Angelo Tronca *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 12 p refs

Avail NTIS HC A15/MF A01

Fast inspection of jet engine compressor blades is considered Classical X-ray diffractography which utilizes filtered radiation and plane X-ray films and oscillographic fast inspection are described Results obtained by each method are presented and correlated Oscillographic observations of rotating compressor steel blades are reported J M S

N78-26469# Saab-Scania Linkoping (Sweden) Aerospace Div

ON THE DETECTION AND MEASUREMENT OF CRACKS IN CRITICALLY LOADED HOLES

Sven Malmquist *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 3 p

Avail NTIS HC A15/MF A01

A method developed for the inspection of the surface of a hole with the bolt removed is described A stereomicroscope and a mirror in the hole a surface roughness meter, and an eddy current instrument are used in the inspection Scratches, cracks corrosion and fretting corrosion damages are observed with the stereomicroscope and mirror The depth of scratches is measured with a surface roughness meter Surtonic 3 which was modified for this purpose Scratches that have grown into cracks are indicated and measured with an eddy current technique J M S

N78-26470# Middle East Technical Univ Ankara (Turkey) Dept of Metallurgical Engineering

DYNAMIC NONDESTRUCTIVE TESTING OF MATERIALS

E M Uygur *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 43 p refs

Avail NTIS HC A15/MF A01

It is shown that damping or internal friction and frequency measurements can be used for flaw detection and quality control as well as measurements of physical properties Application areas and instrumentation used are discussed J M S

N78-26471# Industrieanlagen-Betriebsgesellschaft m b H, Ottobrunn (West Germany)

NDI METHODS ON FULL-SCALE FATIGUE TESTS AND THEIR SERVICE USAGE

Richard Schuetz *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 22 p refs

Avail NTIS HC A15/MF A01

Procedures used to select the most effective nondestructive inspection methods and intervals are outlined The problem of fatigue damages undetected by nondestructive inspection during full scale fatigue testing are discussed J M S

N78-26472# Southwest Research Inst, San Antonio, Tex

CRITICAL INSPECTION OF BEARINGS FOR LIFE EXTENSION

John R Barton, Felix N Kusenberger, and Richard T Smith *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 29 p refs

Avail NTIS HC A15/MF A01

Research with the object of developing more definite nondestructive inspection methods for improved reliability and quality of rolling element bearings is reviewed Inspection of precision mainshaft and transmission bearing assemblies in which the individual components -- outer race, rolling elements, (balls or rollers) and inner race -- can be separated is emphasized Results obtained with magnetic perturbation for flaw detection Barkhausen Noise Analysis for residual stress assessment, and laser scattered radiation for surface finish and surface anomaly detection are presented The critical inspection of bearings for life extension program concept is described, a cardinal element of this program is the examination of new and used bearings installation of the bearings in gas turbine engines, re-examination of bearings at engine overhaul, and the development of serviceability criteria based on actual service performance of the bearings in engines J M S

N78-26474# Royal Aircraft Establishment, Farnborough (England) Structures Dept

NON-DESTRUCTIVE INSPECTION OF COMPOSITE MATERIALS FOR AIRCRAFT STRUCTURAL APPLICATIONS

D E W Stone *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 18 p refs

Avail NTIS HC A15/MF A01

The capabilities and limitations of various nondestructive inspection techniques to detect defects in fiber reinforced plastics are reviewed Emphasis is placed on carbon fiber reinforced plastics Difficulties in transferring laboratory techniques to prototype and production structural components are discussed along with problem areas The role of acoustic emission in nondestructive inspection is considered J M S

N78-26475# Royal Netherlands Aircraft Factories Fokker Schiphol-Oost Technological Centre

THE RESONANCE-IMPEDANCE METHOD AS A MEANS FOR QUALITY CONTROL OF ADVANCED FIBRE REINFORCED PLASTIC STRUCTURES

R J Schliekelmann *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 16 p refs

Avail NTIS HC A15/MF A01

The principles of the resonance frequency/impedance method are discussed Detection of laminate thickness variations matrix density variations and delaminations is considered along with application of the method to inspection of advanced composite structures J M S

N78-26476# Dornier-Werke G m b H Friedrichshafen (West Germany)

INSPECTION OF CARBON FIBRE PARTS AFTER FABRICATION AND DURING SERVICE

Michael Kaitatzidis *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 16 p

Avail NTIS HC A15/MF A01

The individual parts of the Alpha Jet carbon fiber plastic airbrake were subjected to nondestructive testing by means of ultrasonics and X-rays Quantity and size of the laminate flaws detected are reported along with adhesive defects in advanced composite structures The experience gained during the inspection of the prototype airbrakes is described and prospects for proceeding in this field are considered J M S

N78-26477# Vereinigte Flugtechnische Werke-Fokker G m b H, Lemwerder (West Germany) Materials and Processes Development Dept

DETECTABILITY OF FLAWS IN BORON AND CARBON COMPOSITE PARTS

Gustav Tober and Hilmar Schnell *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 14 p

Avail NTIS HC A15/MF A01

The experience gained in nondestructive testing in the development of boron fiber reinforced plastics and carbon fiber reinforced plastics is discussed The soft X-ray technique, ultrasonic, acoustic flaw detector, sonic resonator, holography and tapping test are among the methods described Types of faults detected by each method are reported along with the capacity of each method for practical use J M S

N78-26478# Laboratoire Central Aerospatiale, Suresnes Cedex (France)

THE PRESENT STATUS AND EVOLUTION OF THE INSPECTION OF CARBON COMPOSITE AIRCRAFT STRUCTURES

IN FRANCE [ETAT ACTUEL ET EVOLUTION EN FRANCE DU CONTROLE DE STRUCTURES D'AVION EN COMPOSITES CARBONE]
M Treca *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 7 p refs In FRENCH

Avail NTIS HC A15/MF A01
A number of nondestructive test methods utilized for the inspection of composite aircraft structures were studied These methods are now being evaluated and are utilized in industry The best method suitable for the inspection of monolithic structures is testing by ultrasonic transmission Holographic interferometry appears to be a global method for the inspection of sandwich structures which can be applied to industrial use Transl by B B

N78-26480# Army Missile Research and Development Command, Redstone Arsenal Ala Advanced Systems Development and Manufacturing Technology Directorate
DETECTION OF FLAWS IN METALLIC AND NON-METALLIC COMPOSITE STRUCTURES USING LIQUID CRYSTAL TECHNOLOGY
Shelba Profitt Brown *In* AGARD Non-destructive Inspection Relationships to Aircraft Design and Mater Mar 1978 14 p

Avail NTIS HC A15/MF A01
An experimental nondestructive test technique using brush-on liquid crystals and custom liquid crystal films is described Application of the technique to metallic and nonmetallic composites is discussed along with demonstration of the technique on missile wings and elevons aircraft and helicopter blades composite body structures, and numerous types of electronic equipment J M S

N78-26493*# National Aeronautics and Space Administration, Washington, D C
CAN ACOUSTIC EMISSION DETECT THE INITIATION OF FATIGUE CRACKS APPLICATION TO HIGH-STRENGTH LIGHT ALLOYS USED IN AERONAUTICS
C Bathias, B Brinet, and G Sertour Jun 1978 10 p refs Transl into ENGLISH from Aeronaut Astronaut (Paris), no 66, 1977 p 41-45 Original language document was announced as A78-15023 Transl by Kanner (Leo) Associates, Redwood City, Calif Original doc prep by Societe National Industriel Aerospatiale, Central Laboratory (Suresnes, France)
(Contract NASw-2790)
(NASA-TM-75306) Avail NTIS HC A02/MF A01 CSCL 20K
Acoustic emission was used for the detection of fatigue cracking in a number of high-strength light alloys used in aeronautical structures Among the features studied were the influence of emission frequency, the effect of surface oxidation and the influence of grains It was concluded that acoustic emission is an effective nondestructive technique for evaluating the initiation of fatigue cracking in such materials Author

N78-26494*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
LIGHT AIRPLANE CRASH TESTS AT THREE FLIGHT-PATH ANGLES
Claude B Castle and Emilio Alfaro-Bou Jun 1978 69 p refs Films supplement number L-1247 to this report is available on request
(NASA-TP-1210, L-12060) Avail NTIS HC A04/MF A01 CSCL 01C
Three similar twin engine general aviation airplane specimens were crash tested at Langley impact dynamics research facility at 27 m/sec and at flight-path angles of -15 deg -30 deg and -45 deg Other flight parameters were held constant The test facility, instrumentation, test specimens, and test method are briefly described Structural damage and accelerometer data for each of the three impact conditions are presented and discussed Author

N78-26507# National Aerospace Lab, Amsterdam (Netherlands) Structures and Materials Div
PRELIMINARY INVESTIGATION INTO THE APPLICATION OF MAGNETIC RUBBER INSPECTION (M R I)
E A B DeGraaf 12 Jan 1978 15 p refs
(Contract RNLAF-RB-KLu-1976 C12)
(NLR-TR-76083-U) Avail NTIS HC A02/MF A01
A brief description of the principles and probable advantages of the magnetic rubber inspection technique is given The results of demonstration of the method are discussed and it is concluded that the method needs further evaluation
Author (ESA)

N78-26552*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
DESIGN AND OPERATING EXPERIENCE ON THE US DEPARTMENT OF ENERGY EXPERIMENTAL MOD-0 100-kW WIND TURBINE
John C Glasgow and Arthur G Birchenough 1978 17 p refs Proposed for presentation at the 13th Intersoc Energy Conversion Eng Conf San Diego, Calif, 20-25 Aug 1978
(Contract E(49-26)-1028)
(NASA-TM-78915, E-9652, DOE/NASA/1028-78/18) Avail NTIS HC A02/MF A01 CSCL 10A
The experimental wind turbine was designed and fabricated to assess technology requirements and engineering problems of large wind turbines The machine has demonstrated successful operation in all of its design modes and served as a prototype developmental test bed for the Mod-0A operational wind turbines which are currently used on utility networks The mechanical and control system are described as they evolved in operational tests and some of the experience with various systems in the downwind rotor configurations are elaborated G G

N78-26561# Sydney Univ (Australia) Dept of Aeronautical Engineering
THE THEORETICAL PERFORMANCE OF A STRAIGHT-BLADED, VERTICAL AXIS WIND TURBINE
T A Thomson Jan 1978 42 p refs
(ATN-7802) Avail NTIS HC A03/MF A01
Equations predicting the performance, under unstalled operating conditions of the blading, of straight-bladed, vertical axis wind turbine rotors are derived analytically Performance characteristics of rotors of this type are evaluated and discussed Author

N78-26877*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
A RING-SOURCE MODEL FOR JET NOISE
Lucio Maestrello Apr 1978 41 p refs Presented at the 95th Meeting of the Acoust Soc of Am, Providence, 14-19 May 1978
(NASA-TM-73959) Avail NTIS HC A03/MF A01 CSCL 20A
A model consisting of two ring sources was developed to study the direct radiation of jet noise in terms of correlation, coherence, and phase and also to aid in solving the inverse radiation problem of determining the noise source in terms of far-field measurements The rings consist of discrete sources which are either monopoles or quadrupoles with Gaussian profiles Only adjacent sources, both within the rings and between rings, are correlated Results show that from the far-field information can be used to determine when the sources are compact or noncompact with respect to the acoustic wavelength and to distinguish between the types of sources In addition, from the inverse radiation approach, the center of mass, the location and separation distance of the ring, and the diameters can be recovered A R H

N78-26879*# Georgia Inst of Tech, Atlanta School of Mechanical Engineering
AIRCRAFT NOISE PROPAGATION Final Technical Report
W James Hadden and Allan D Pierce Jun 1978 128 p refs
(Grant NsG-1307)
Avail NTIS HC A07/MF A01 CSCL 20A

Sound diffraction experiments conducted at NASA Langley Research Center to study the acoustical implications of the engine over wing configuration (noise-shielding by wing) and to provide a data base for assessing various theoretical approaches to the problem of aircraft noise reduction are described Topics explored include the theory of sound diffraction around screens and wedges, the scattering of spherical waves by rectangular patches, plane wave diffraction by a wedge with finite impedence and the effects of ambient flow and distribution sources A R H

N78-26880*# Lockheed-Georgia Co Marietta
NOISE CHARACTERISTICS OF UPPER SURFACE BLOWN CONFIGURATIONS SUMMARY Final Report, May 1975 - Nov 1976
N N Reddy and J S Gibson Jun 1978 60 p refs
(Contract NAS1-13870)
(NASA-CR-2918, LG77ER0103) Avail NTIS HC A04/MF A01 CSCL 20A

A systematic experimental program was conducted to develop a data base for the noise and related flow characteristics of upper surface blown configurations The effect of various geometric and flow parameters was investigated experimentally The dominant noise was identified from the measured flow and noise characteristics to be generated downstream of the trailing edge The possibilities of noise reduction techniques were explored An upper surface blown (USB) noise prediction program was developed to calculate noise levels at any point and noise contours (footprints) Using this noise prediction program and a cruise performance data base, aircraft design studies were conducted to integrate low noise and good performance characteristics A theory was developed for the noise from the highly sheared layer of a trailing edge wake Theoretical results compare favorably with the measured noise of the USB model Author

N78-26881*# Bolt, Beranek, and Newman, Inc, Cambridge, Mass
A REVIEW OF THE THEORY OF TRAILING EDGE NOISE Contractor Report, Jul - Dec 1977
M S Howe Jun 1978 67 p refs
(Contract NAS1-14611)
(NASA-CR-3021 BBN-3679) Avail NTIS HC A04/MF A01 CSCL 20A

Literature on the theory of the generation of sound by the interaction of low Mach number turbulent flow with the edge of a semi-infinite rigid plate is critically reviewed Three different approaches to the subject are identified, consisting of theories based on (1) Lighthill s acoustic analogy (2) the solution of special, linearized hydroacoustic problems and (3) ad hoc aerodynamic source models When appropriately interpreted all relevant theories produce essentially identical predictions in the limit of very small Mach numbers None of the theories discusses the implications of the Kutta condition, however, nor of the effect of forward flight and source motion relative to the trailing edge An outline of a redevelopment of the theory is included to give a unified view of the problem, exhibit the significance of the various approximations, and incorporate the effect of mean motion and of the Kutta condition A R H

N78-27043*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
APPLICATION OF A COST/PERFORMANCE MEASUREMENT SYSTEM ON A RESEARCH AIRCRAFT PROJECT
James J Diehl Jun 1978 24 p refs
(NASA-TM-78498 A-7488) Avail NTIS HC A02/MF A01 CSCL 05A

The fundamentals of the cost/performance management system used in the procurement of two tilt rotor aircraft for a joint NASA/Army research project are discussed The contractor s reporting system and the GPO s analyses are examined The use of this type of reporting system is assessed Recommendations concerning the use of like systems on future projects are included A R H

N78-27046*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
CTOL TRANSPORT TECHNOLOGY, 1978
Jun 1978 516 p refs Conf held at Hampton, Va, 28 Feb - 3 Mar 1978
(NASA-CP-2036-Pt-1 L-12178) Avail NTIS HC A22/MF A01 CSCL 02A

Technology generated by NASA and specifically associated with advanced conventional takeoff and landing transport aircraft is reported Topics covered include aircraft propulsion structures and materials and laminar flow control

N78-27047*# National Aeronautics and Space Administration, Washington, D C
OVERVIEW OF NASA CTOL PROGRAM
James J Kramer *In* NASA Langley Res Center CTOL Transport Technol, 1978 Jun 1978 p 1-7

Avail NTIS HC A22/MF A01 CSCL 02A

Technology generated by NASA and specifically oriented toward advanced commercial air transport is reviewed Results of the Aircraft Energy Efficiency program and of related disciplinary areas are reported The CTOL research efforts are put into perspective relative to the total NASA aeronautics program J M S

N78-27048*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
ACEE PROPULSION OVERVIEW
Donald L Nored *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 9-23 refs

Avail NTIS HC A22/MF A01 CSCL 21E

Technology for fuel-efficient subsonic CTOL transport aircraft is discussed The engine component improvement project, the energy efficient engine project, and the advanced turboprop project are included The overall goals and objectives of each project are reviewed and the approach and schedule for accomplishing these project goals and objectives are given J M S

N78-27049*# General Electric Co Fairfield Conn
CF6 JET ENGINE PERFORMANCE DETERIORATION RESULTS
R J Lewis, C E Humerickhouse, and J E Paas *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 25-44 refs
(Contract NAS3-20631)
Avail NTIS HC A22/MF A01 CSCL 21E

The use of the performance baseline from the flight planning manual as a reference to measure changes in cruise fuel flow rates was discussed For the CF6-6D engine the introduction of design changes for performance and durability reasons was seen to introduce an average increment relative to this baseline of 3 2% WFM increase at NI, 2 5% Fn increase at NI 0 8% specific fuel consumption (SFC) increase at Fn and 7 C EGT increase at NI while maintaining sufficient SFC margin of the delivered airplane The effect of revenue service deterioration and performance restoration relative to the reference was shown to be an adder on top of these design effects A schematic of typical CF6-6D performance through revenue service and airline maintenance is presented in terms of percent cruise SFC relative to an airline datum point (average level upon entering revenue service) The typical changes in SFC margin are shown for airline revenue service through for installations and refurbishments J M S

N78-27050*# Pratt and Whitney Aircraft Group East Hartford Conn Commercial Products Div
JT9D JET ENGINE PERFORMANCE DETERIORATION
A Jay, E S Todd, and G P Sallee *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 45-58

(Contract NAS3-20632)
Avail NTIS HC A22/MF A01 CSCL 21E

The analytical techniques utilized to examine the effects of flight loads and engine operating conditions on performance deterioration are presented The role of gyroscopic gravitational and aerodynamic loads are shown along with the effect of variations in engine build clearances These analytical results are compared to engine test data along with the correlation between analytically predicted and measured clearances and rub patterns Conclusions are drawn and important issues are discussed J M S

N78-27051*# General Electric Co Fairfield Conn Aircraft Engine Group
CF6 PERFORMANCE IMPROVEMENT
Dean J Lennard *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 59-78

Avail NTIS HC A22/MF A01 CSCL 21E
Potential CF6 engine performance improvements directed at reduced fuel consumption were identified and screened relative to airline acceptability and are reviewed The screening process developed to provide evaluations of fuel savings and economic factors including return on investment and direct operating cost is described In addition assessments of development risk and production potential are made Several promising concepts selected for full-scale development based on a ranking involving these factors are discussed J M S

N78-27052*# Pratt and Whitney Aircraft Group East Hartford Conn
ENGINE COMPONENT IMPROVEMENT JT8D AND JT9D PERFORMANCE IMPROVEMENTS
W O Gaffin *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 79-80 ref

Avail NTIS HC A22/MF A01 CSCL 21E
A feasibility analysis screening method for predicting the airline acceptance of a proposed engine performance improvement modification was developed Technical information derived from available test data and analytical models is used along with conceptual/preliminary designs to establish the predicted performance improvement, weight and installation characteristics the cost for new production and retrofit maintenance cost and qualitative characteristics of the performance improvement concepts being evaluated These results are used to arrive at the payback period which is the time required for an airline to recover the investment cost of concept implementation and to predict the amount of fuel saved by a performance improvement concept The assumptions used to calculate the payback period and fuel saved are discussed A summary of the results when the screening method is applied is presented for several representative JT8D and JT9D performance improvement concepts An example of the input information used to develop the summary results is shown J M S

N78-27053*# Pratt and Whitney Aircraft Group East Hartford Conn
ENERGY EFFICIENT ENGINE PRELIMINARY DESIGN AND INTEGRATION STUDIES
David E Gray *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 89-110

Avail NTIS HC A22/MF A01 CSCL 21E
A mixed exhaust direct drive fan turbofan configuration was selected from four candidates This choice was based on its ability to exceed study goals of 12% lower thrust specific fuel consumption and 5% lower direct operating cost by the 1990s with commercially acceptable technical risk and relative mechanical simplicity The evaluation leading to configuration selection is discussed Necessary technology advancements are identified and related to the goals J M S

N78-27054*# General Electric Co Fairfield Conn
ENERGY EFFICIENT ENGINE PRELIMINARY DESIGN AND INTEGRATION STUDIES
R P Johnston and M C Hemsworth *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 111-138 refs
Avail NTIS HC A22/MF A01 CSCL 21E
The characteristics and systems benefits of an energy efficient engine (E3) suitable for use on advanced subsonic transport aircraft were determined Relative to a current CF6-50C engine the following benefits were estimated 14 4% reduction in installed cruise specific fuel consumption and a reduction in direct operating cost of more than 5% The advanced technology E3 system would also permit compliance with FAR 36 (1977) noise limits and compliance with 1981 EPA emission standards J M S

N78-27055*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
STATUS OF ADVANCED TURBOPROP TECHNOLOGY

J F Dugan B A Miller and D A Sagerser *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 139-166 refs
Avail NTIS HC A22/MF A01 CSCL 21E
Research is reviewed in the following areas turboprop powered transport aircraft wind tunnel aerodynamic and acoustics tests of model propellers turboprop maintenance and wind tunnel tests on airframe-turboprop interactions Continued development of the technology for advanced turboprop transport was emphasized J M S

N78-27056*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
PROPULSION SYSTEMS NOISE TECHNOLOGY
C E Feiler *In* NASA Langley Res Center CTOL Transport Technol. 1978 Jun 1978 p 167-185 refs

Avail NTIS HC A22/MF A01 CSCL 21E
Turbofan engine noise research relevant to conventional aircraft is discussed In the area of fan noise static to flight noise differences were discussed and data were presented for two different ways of simulating flight behavior Experimental results from a swept rotor fan design are presented which show that this concept has potential for reducing the multiple-pure-tone or buzz-saw noise related to the shock waves on a fan operating at supersonic tip speeds Acoustic suppressor research objectives centered around the effect of the wave system generated by the fan stage that is the input to the treatment A simplifying and unifying parameter mode cutoff ratio was described Results are presented which show that suppressor performance can be improved if the input wave is more precisely described In jet noise calculated results showing the potential noise reduction from the use of internal mixer nozzles rather than separate flow nozzles are presented J M S

N78-27057*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
ADVANCED MATERIALS RESEARCH FOR LONG-HAUL AIRCRAFT TURBINE ENGINES
R A Signorelli and C P Blankenship *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 187-204 refs
Avail NTIS HC A22/MF A01 CSCL 21E
The status of research efforts to apply low to intermediate temperature composite materials and advanced high temperature materials to engine components is reviewed Emerging materials technologies and their potential benefits to aircraft gas turbines were emphasized The problems were identified and the general state of the technology for near term use was assessed J M S

N78-27058*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
GAS TURBINE ENGINE EMISSION REDUCTION TECHNOLOGY PROGRAM
Donald A Petrash and Larry A Diehl *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 205-216

Avail NTIS HC A22/MF A01 CSCL 21E
Progress in the development of combustor technology to meet the standards for the allowable pollutant emission levels

of aircraft gas turbine engines is reported The high-bypass-ratio turbofan engines which power the large commercial aircraft were emphasized along with efforts to reduce emission for near term applications Recommendations for continuing research to reduce emissions to meet far term needs are given J M S

N78-27059*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
IMPACT OF BROAD-SPECIFICATION FUELS ON FUTURE JET AIRCRAFT
Jack Grobman *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 217-233 refs

Avail NTIS HC A22/MF A01 CSCL 21D
The effects that broad specification fuels have on airframe and engine components were discussed along with the improvements in component technology required to use broad specification fuels without sacrificing performance reliability maintainability or safety J M S

N78-27061*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
ENVIRONMENTAL EFFECTS ON COMPOSITES FOR AIRCRAFT
Richard A Pride *In its* CTOL Transport Technol 1978 Jun 1978 p 239-258 refs

Avail NTIS HC A22/MF A01 CSCL 11D
The influence of the operational environment on the behavior of composite materials and aircraft components fabricated with these composite materials was considered Structural weight savings manufacturing cost savings and long-term environmental durability are among the factors examined The flight service experience to date of composite components is evaluated In addition the influence of a number of worldwide ground based outdoor exposures on the physical and mechanical properties of six composite materials is discussed In particular the current extent of the ultraviolet surface degradation and the moisture gained by diffusion is shown J M S

N78-27062*# Lockheed-California Co Burbank
DEVELOPMENT OF ADVANCED COMPOSITE STRUCTURES
Warren A Stauffer and Arthur M James *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 259-279
Avail NTIS HC A22/MF A01 CSCL 11D
Composite structure programs the L-1011 Advanced Composite Vertical Fin (ACVF) the L-1011 Advanced Composite Aileron and a wing study program were reviewed These programs were structured to provide the technology and confidence for the use of advanced composite materials for primary and secondary structures of future transport aircraft The current status of the programs is discussed The results of coupon tests for both material systems are presented as well as the ACVF environmental (moisture and temperature) requirements The effect of moisture and temperature on the mechanical properties of advanced composite materials is shown The requirements set forth in the FAA Certification Guidelines for Civil Composite Aircraft Structures are discussed as they relate to the ACVF J M S

N78-27063*# Douglas Aircraft Co Inc Santa Monica Calif
KEY ISSUES IN APPLICATION OF COMPOSITES TO TRANSPORT AIRCRAFT
M Stone *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 281-310 refs

Avail NTIS HC A22/MF A01 CSCL 01C
The application of composite materials to transport aircraft was identified and reviewed including the major contributing disciplines of design manufacturing and processing Factors considered include crashworthiness considerations (structural integrity postcrash fires and structural fusing) electrical/avionics subsystems integration lightning and P-static protection design manufacturing development evaluation selection and refining of tooling and curing procedures and major joint design considerations Development of the DC-10 rudder DC-10 vertical stablizer and the DC-9 wing study project was reviewed The Federal Aviation Administration interface and the effect on component design of compliance with Federal Aviation Regulation 25 Composite Guidelines are discussed J M S

N78-27064*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
ADVANCED STRUCTURAL SIZING METHODOLOGY
W Jefferson Stroud and Jaroslaw Sobieszczanski-Sobieski *In its* CTOL Transport Technol 1978 Jun 1978 p 311-330 refs
Avail NTIS HC A22/MF A01 CSCL 01C
Research in computerized structural sizing technology was reviewed Areas covered include overall design structural subassembly design thermal structures and stiffened panels In each case sample results are presented J M S

N78-27065*# Boeing Commercial Airplane Co Seattle Wash
TRANSITION FROM GLASS TO GRAPHITE IN MANUFACTURE OF COMPOSITE AIRCRAFT STRUCTURE
Harvey E Buffum and Vere S Thompson *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 331-347
Avail NTIS HC A22/MF A01 CSCL 01C
The transition from fiberglass reinforced plastic composites to graphite reinforced plastic composites is described Structural fiberglass design and manufacturing background are summarized How this experience provides a technology base for moving into graphite composite secondary structure and then to composite primary structure is considered The technical requirements that must be fulfilled in the transition from glass to graphite composite structure are also included J M S

N78-27066*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
LAMINAR FLOW CONTROL OVERVIEW
Ralph J Muraca *In its* CTOL Transport Technol 1978 Jun 1978 p 349-356
Avail NTIS HC A22/MF A01 CSCL 01A
Application of laminar flow control technology to future CTOL long range transport aircraft was considered Topics covered include (1) airfoil development and test (2) development and improvement of design methods (3) evaluation of leading edge contamination and (4) laminar flow control system definition and concept evaluation J M S

N78-27067*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
FLIGHT INVESTIGATION OF INSECT CONTAMINATION AND ITS ALLEVIATION
John B Peterson Jr and David F Fisher *In its* CTOL Transport Technol 1978 Jun 1978 p 357-373 refs

Avail NTIS HC A22/MF A01 CSCL 01C
An investigation of leading edge contamination by insects was conducted with a JetStar airplane instrumented to detect transition on the outboard leading edge flap and equipped with a system to spray the leading edge in flight The results of airline type flights with the JetStar indicated that insects can contaminate the leading edge during takeoff and climbout The results also showed that the insects collected on the leading edges at 180 knots did not erode at cruise conditions for a laminar flow control airplane and caused premature transition of the laminar boundary layer None of the superslick and hydrophobic surfaces tested showed any significant advantages in alleviating the insect contamination problem While there may be other solutions to the insect contamination problem the results of these tests with a spray system showed that a continouous water spray while encountering the insects is effective in preventing insect contamination of the leading edges J M S

N78-27068*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
DEVELOPMENT OF ADVANCED STABILITY THEORY SUCTION PREDICTION TECHNIQUES FOR LAMINAR FLOW CONTROL
Andrew J Srokowski *In its* CTOL Transport Technol 1978 Jun 1978 p 375-394 refs

Avail NTIS HC A22/MF A01 CSCL 01A
The problem of obtaining accurate estimates of suction requirements on swept laminar flow control wings was discussed A fast accurate computer code developed to predict suction requirements by integrating disturbance amplification rates was described Assumptions and approximations used in the present computer code are examined in light of flow conditions on the swept wing which may limit their validity J M S

N78-27069*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
DESIGN OF A LAMINAR-FLOW-CONTROL SUPERCRITICAL AIRFOIL FOR A SWEPT WING
Dennis O Allison and John R Dagenhart *In its* CTOL Transport Technol 1978 Jun 1978 p 395-408 refs

Avail NTIS HC A22/MF A01 CSCL 01C
An airfoil was analytically designed and analyzed for a combination of supercritical flow and laminar flow control (LFC) by boundary layer suction A shockless inverse method was used to design an airfoil and an analysis method was used in lower surface redesign work The laminar flow pressure distributions were computed without a boundary layer under the assumption that the laminar boundary layer would be kept thin by suction Inviscid calculations showed that this 13 5 percent thick airfoil has shockless flows for conditions at and below the design normal Mach number of 0 73 and the design section lift coefficient of 0 60 and that the maximum local normal Mach number is 1 12 at the design point The laminar boundary layer instabilities can be controlled with suction but the undercut leading edge of the airfoil provides a low velocity constant pressure coefficients region which is conducive to laminar flow without suction The airfoil was designed to be capable of lift recovery with no suction by the deflection of a small trailing edge flap J M S

N78-27070*# Boeing Commercial Airplane Co, Seattle, Wash
APPLICATION OF LAMINAR FLOW CONTROL TECHNOLOGY TO LONG-RANGE TRANSPORT DESIGN
L B Gratzer and D George-Falvy *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 409-447 refs
Avail NTIS HC A22/MF A01 CSCL 01C
The impact of laminar flow control (LFC) technology on aircraft structural design concepts and systems was discussed and the corresponding benefits were shown in terms of performance and fuel economy Specific topics discussed include (1) recent advances in laminar boundary layer development and stability analysis techniques in terms of suction requirements and wing suction surface design (2) validation of theory and realistic simulation of disturbances and off-design conditions by wind tunnel testing (3) compatibility of aerodynamic design of airfoils and wings with LFC requirements, (4) structural alternatives involving advanced alloys or composites in combinations made possible by advanced materials processing and manufacturing techniques, (5) addition of suction compressor and drive units and their location on the aircraft, and (6) problems associated with operation of LFC aircraft, including accumulation of insects at low altitudes and environmental considerations J M S

N78-27071*# Lockheed-Georgia Co Marietta
TOWARD A LAMINAR-FLOW-CONTROL TRANSPORT
R F Sturgeon *In* NASA Langley Res Center CTOL Transport Technol, 1978 Jun 1978 p 449-495 refs

(Contract NAS1-14631)
Avail NTIS HC A22/MF A01 CSCL 01C
Analyses were conducted to define a practical design for an advanced technology laminar flow control (LRC) transport for initial passenger operation in the early 1990s Mission requirements appropriate design criteria, and level of technology for the study aircraft were defined The characteristics of the selected configuration were established, aircraft and LFC subsystems compatible with the mission requirements were defined and the aircraft was evaluated in terms of fuel efficiency A wing design integrating the LFC ducting and metering system into advanced composite wing structure was developed manufacturing procedures for the surface panel design were established, and environmental and structural testing of surface panel components were conducted Test results revealed a requirement for relatively minor changes in the manufacturing procedures employed but have shown the general compatibility of both the selected design and the use of composite materials with the requirements of LFC wing surface panels J M S

N78-27072*# Douglas Aircraft Co Inc Santa Monica Calif
APPLICATION OF POROUS MATERIALS FOR LAMINAR FLOW CONTROL
Wilfred E Pearce *In* NASA Langley Res Center CTOL Transport Technol 1978 Jun 1978 p 497-522 refs

Avail NTIS HC A22/MF A01 CSCL 01C
Fairly smooth porous materials were elected for study Doweave Fibermetal Dynapore, and perforated titanium sheet Factors examined include surface smoothness, suction characteristics porosity surface impact resistance, and strain compatibility A laminar flow control suction glove arrangement was identified with material combinations compatible with thermal expansion and structural strain J M S

N78-27074 Texas Univ at Austin
FLIGHT MEASUREMENTS OF THE WING TIP VORTEX Ph D Thesis
Nikola Soskic 1977 139 p
Avail Univ Microfilms Order No 7807388
Velocity measurements were made in the wing tip vortex generated by a DHC-2 (rectangular wing span 48 ft, chord 62 4 inches) Data were taken under very stable atmospheric conditions at three downstream locations The vortex Reynolds number was practically the same for all tests Three three-dimensional hot film probes were used for the velocity measurements Tangential velocity data were fitted by the Lamb vortex equation based on a constant eddy viscosity Extremely high maximum tangential velocities as high as 54-72% of the free stream velocity were found Dissert Abstr

N78-27075 Kansas Univ, Lawrence
A THERORETICAL INVESTIGATION OF THE AERODYNAMICS OF LOW ASPECT-RATIO WINGS WITH PARTIAL LEADING-EDGE SEPARATION Ph D Thesis
Sudhir Chandra Mehrotra 1977 88 p
Avail Univ Microfilms Order No 7809419
A numerical method is developed to predict distributed and total aerodynamic characteristics for low aspect-ratio wings with partial leading-edge separation The flow was assumed to be steady and inviscid The wing boundary condition was formulated by the quasi-vortex-lattice method The leading-edge separated vortices were represented by discrete free vortex elements which are aligned with the local velocity vector at mid-points The wake behind the trailing-edge was also force free The flow tangency boundary condition was satisfied on the wing, including the leading- and trailing-edges Comparison of the predicted results with complete leading-edge separation second good agreements For cases with partial leading-edge separation the lift is found to be highly nonlinear with angle of attack Dissert Abstr

N78-27077 Stanford Univ Calif
EFFECT OF CHORDWISE FORCES AND DEFORMATIONS AND DEFORMATION DUE TO STEADY LIFT ON WING FLUTTER Ph D Thesis
William Newsome Boyd 1978 256 p
Avail Univ Microfilms Order No 7808767
The aeroelastic stability of a uniform cantilever wing was analyzed in terms of the dynamically uncoupled natural modes

of vibration of the uniform cantilever Dynamic stability in the case of incompressible strip-theory airloads was determined by the Vg method and by obtaining the complex eigenvalues of the aeroelastic modes at any flight condition Two idealized examples based upon existing sailplanes are analyzed Steady drag loads lower the flutter speed for larger aspect ratios but increase it for aspect ratios less than a certain value Divergence speed is more sensitive to steady drag and for very high aspect ratio wings it can fall below the bending-torsion flutter speed Steady deformations due to lift always decrease the flutter speed by an amount dependent upon the aspect ratio and the fore-and-aft bending stiffness Leading-edge suction forces increase flutter speed Dissert Abstr

N78-27079*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
WIND-TUNNEL INVESTIGATION OF EFFECTS OF TRAILING-EDGE GEOMETRY ON A NASA SUPERCRITICAL AIRFOIL SECTION
Charles D Harris Washington Sep 1971 78 p refs
(Proj FEDD)
(NASA-TM-X-2336 L-7814) Avail NTIS HC A05/MF A01 CSCL 01A

Wind-tunnel tests have been conducted at Mach numbers from 0 60 to 0 81 to determine the effects of trailing-edge geometry on the aerodynamic characteristics of a NASA supercritical airfoil shape Variations in trailing-edge thicknesses from 0 to 1 5 percent of the chord and a cavity in the trailing edge were investigated with airfoils with maximum thicknesses of 10 and 11 percent of the chord Author

N78-27081*# National Aeronautics and Space Administration Washington D C
A FINITE VOLUME METHOD FOR CALCULATING TRANSONIC POTENTIAL FLOW AROUND WINGS FROM THE PRESSURE MINIMUM INTEGRAL
Albrecht Eberle Jul 1978 68 p refs Transl into ENGLISH of "Eine Methode der Finiten Volumen zur Berechnung der Transsonischen Potentialstromung um Flugel aus dem Druckminimumintegral" report no MBB-UFE1407(0) Messerschmitt-Bolkow-Blohm GmbH West Germany 27 Feb 1978 p 1-70 Transl by Kanner (Leo) Associates Redwood City Calif
(Contract NASw-2790)
(NASA-TM-75324) Avail NTIS HC A04/MF A01 CSCL 01A

Analysis of the pressure minimum integral in the calculation of three-dimensional potential flow around wings makes it possible to use non-rectangular mesh networks for distributing the three-dimensional potential into discrete points The method is comparatively easily expanded to the treatment of realistic airplane configurations Shock-pressure affected pressure distributions on any wings are determined with accuracy using this method G G

N78-27084*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
AERODYNAMIC CHARACTERISTICS OF A COUNTER-ROTATING, COAXIAL, HINGELESS ROTOR HELICOPTER MODEL WITH AUXILIARY PROPULSION
Arthur E Phelps and Raymond E Mineck May 1978 85 p refs
(NASA-TM-78705) Avail NTIS HC A05/MF A01 CSCL 01A

A wind-tunnel model test at advance ratios from 0 to 0 3 with and without auxiliary jet engine thrust is reported At each advance ratio and engine thrust both the control power and the aircraft stability were measured The results indicate that there is a cross-coupling for collective pitch and longitudinal cyclic pitch inputs The control power for these inputs increased with advance ratio There was also cross-coupling for differential collective pitch inputs The airframe was longitudinally unstable, but the instability was less at the highest advance ratio tested The airframe showed both positive effective dihedral and positive directional stability G G

N78-27085*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
A BRIEF SURVEY OF ROTARY WING INDUCED-VELOCITY THEORY
Harry H Heyson Jun 1978 67 p refs Presented at seminar on Aerodyn of V/STOL Aircraft and Helicopters, University Park, Pa, 31 Jul - Aug 1978
(NASA-TM-78741) Avail NTIS HC A03/MF A01 CSCL 01A

An attempt is made to summarize the state of rotary wing flow fields The theory is traced from its origin as a momentum theory estimate of average interference, through simple vortex theory, to its present status where it is indispensible in calculating blade loads A comparison of the theory with flow measurements are presented The modern efforts toward using more detailed digital methods to obtain blade load distribution are described G Y

N78-27086*# National Aeronautics and Space Administration, Washington D C
STUDIES IN EXPERIMENTAL AERODYNAMICS
S M Gorlin ed Aug 1978 92 p refs Transl into ENGLISH from Nauch Tr Mosk Gos Univ (Moscow) no 4 1970 p 1-81 Sponsored by Franklin Book Programs Inc Cairo
(Contract NSF C-724)
(NASA-TT-F-17158) Avail NTIS HC A05/MF A01 CSCL 02A

The results are presented of studies carried out on the aerodynamic characteristics and the flow-past of different bodies at subsonic velocities The influence of the initial turbulence of flow on the aerodynamic characteristics as well as the influence of a screen on the development of a jet flow and a flow-past were considered The aerodynamic characteristics of cylindrical structures and rapid trains are given D L G

N78-27087*# Boeing Commercial Airplane Co Seattle Wash
A MACH LINE PANEL METHOD FOR COMPUTING THE LINEARIZED SUPERSONIC FLOW OVER PLANAR WINGS
F E Ehlers and Paul E Rubbert May 1978 91 p
(Contract NAS2-7729)
(NASA-CR-152126 D6-46373) Avail NTIS HC A05/MF A01 CSCL 01A

A method is described for solving the linearized supersonic flow over planar wings using panels bounded by two families of Mach lines Polynomial distributions of source and doublet strength lead to simple, closed form solutions for the aerodynamic influence coefficients and a nearly triangular matrix yields rapid solutions for the singularity parameters The source method was found to be accurate and stable both for analysis and design boundary conditions Similar results were obtained with the doublet method for analysis boundary conditions on the portion of the wing downstream of the supersonic leading edge, but instabilities in the solution occurred for the region containing a portion of the subsonic leading edge Research on the method was discontinued before this difficulty was resolved Author

N78-27088# ARO Inc Arnold Air Force Station, Tenn
DEVELOPMENT OF IMPROVED 3DOF ANALYSIS CAPABILITIES IN THE AEDC-VKF CONTINUOUS WIND TUNNELS Final Report, Jul 1976 - Sep 1977
M O Varner AEDC Apr 1978 183 p refs
(AD-A053939 AEDC-TR-78-10) Avail NTIS HC A09/MF A01 CSCL 14/2

This report presents improved data reduction and analysis procedures for 3DOF data from continuous wind tunnels The Chapman-Kirk method is employed in the development of programs designed to extract aerodynamic coefficients from 3DOF motion Noise sources inherent in the 3DOF gas bearing measurement system and found in typical test environments are studied The validity of extracted aerodynamic coefficients in the presence of these noise sources is addressed Author (GRA)

N78-27089# Ohio State Univ, Columbus Aeronautical and Astronautical Research Lab
ADVANCED TWO-PHASE INVESTIGATION IN AN EROSION-ABLATION FACILITY INCLUDING FLOW DIAGNOSTICS Final Technical Report, Jul 1954 - Dec 1976
K D Korkan, S L Petrie, T S Rice, and E McCovey Aug 1977 99 p refs
(Contract F33615-76-C-3002)
(AD-A053809 AFFDL-TR-77-78) Avail NTIS HC A05/MF A01 CSCL 20/4

Theoretical and experimental research was conducted to investigate the geometrical and fluid mechanical parameters important in the acceleration of solid particles to hypersonic velocities A combination-heated erosion-ablation facility providing flows with reservoir enthalpies up to 2000 Btu/lb was assembled and techniques for injecting well-controlled amounts of silicon dioxide particles into the nozzle flow were developed A laser doppler velocimeter was at the nozzle exit A digital signal processor capable of measuring particle velocities up to 8000 ft/sec was designed and assembled Performance characteristics of the various system components are discussed
Author (GRA)

N78-27091# National Technical Information Service Springfield, Va
LIGHTER THAN AIR VEHICLES CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar 1978
Guy E Habercom Jr May 1978 239 p Supersedes NTIS/PS-77/0374
(NTIS/PS-78/0409/9 NTIS/PS-77/0374) Avail NTIS HC $28 00/MF $28 00 CSCL 01C

An updated bibliography containing 234 abstracts is presented Design and applications of balloons dirigibles and airships were investiagated Passenger or cargo transport timbering, tethering and fabric selection were among the aspects examined
GRA

N78-27092 Materials Research Labs Melbourne (Australia)
SAFE AIR-SPACE REQUIREMENTS ABOVE AN EXPLOSIVE-ORDNANCE TEST FACILITY
J D Oliver Feb 1978 16 p refs
(MRL-R-711 AR-000-887) Copyright Avail Issuing Activity

Rules are presented which provide reasonably reliable guidance for the prediction of the minimum safe height for aircraft in the vicinity of an explosive-ordnance test facility
G G

N78-27093*# National Aeronautics and Space Administration Marshall Space Flight Center Huntsville, Ala
WIND SHEAR MODELING FOR AIRCRAFT HAZARD DEFINITION Final Report, Apr 1976 - Feb 1978
Walter Frost (FWG Assoc Inc), Dennis W Camp and S T Wang (FWG Assoc Inc) Feb 1978 256 p
(Contracts NAS8-32217, DOT-FA76WA1-620)
(NASA-TM-78523 AD-A053178, FAA-RD-78-3) Avail NTIS HC A12/MF A01 CSCL 01C

Mathematical models of wind profiles were developed for use in fast time and manned flight simulation studies aimed at defining and eliminating these wind shear hazards A set of wind profiles and associated wind shear characteristics for stable and neutral boundary layers thunderstorms, and frontal winds potentially encounterable by aircraft in the terminal area are given Engineering models of wind shear for direct hazard analysis are presented in mathematical formulae, graphs, tables and computer lookup routines The wind profile data utilized to establish the models are described as to location, how obtained, time of observation and number of data points up to 500 m Recommendations, engineering interpretations and guidelines for use of the data are given and the range of applicability of the wind shear models is described
G G

N78-27094*# California Univ, Berkeley Institute of Transportation Studies
AN INVESTIGATION OF SHORT HAUL AIR TRANSPORTATION IN THE SOUTHEASTERN UNITED STATES
Abib Kanafani and Huey-Shin Yuan Jul 1977 202 p ref
(Grant NsG-2127)
(NASA-CR-152166, UCB-ITS-RR-77-6) Avail NTIS HC A10/MF A01 CSCL 05C

The specific objectives of this stage of the study are numerous First an attempt is made to characterize the travel patterns in the study region both in terms of origin destination patterns, and connecting and through trip patterns Second, the structure of the air service in the region is characterized in an attempt to develop an understanding of the evolution of the short haul air transportation network Finally a look is taken at the socioeconomic environment of Atlanta and the region in order to seek an explanation for the historic evolution of short haul air travel activities and the rather high growth rates experienced in recent years
G Y

N78-27095# National Transportation Safety Board Washington D C
AIRCRAFT ACCIDENT REPORT COMMONWEALTH OF PENNSYLVANIA, PIPER PA-31T, N631PT, BRESSLER, PENNSYLVANIA, 14 FEBRUARY 1977
5 Jan 1978 27 p
(NTISUB/D/104-001 NTSB-AAR-78-1) Avail NTIS HC A03/MF A01 CSCL 01B

About 0924 e s t on February 24 1977 a Commonwealth of Pennsylvania Department of Transportation Piper PA-31T Cheyenne (N631PT) crashed shortly after takeoff from runway 8 at the Capital City Airport New Cumberland Pennsylvania The aircraft crashed in a populated area in the town of Bressler a suburb of Harrisburg Pennsylvania All occupants of the aircraft six passengers and two pilots, were killed A woman was also killed when the house in which she lived was destroyed during the crash The National Transportation Safety Board determines that the probable cause of the accident was the flightcrew s failure to insure that the aircraft was loaded properly and that its center of gravity was within certificated limits
GRA

N78-27096# Lake Charles-McNeese Urban Observatory La
AN AIR PASSENGER AND AIR FREIGHT SERVICE STUDY FOR THE LAKE CHARLES MUNICIPAL AIRPORT AUTHORITY Final Report
John C Young and Cherry K Owen 8 Dec 1977 38 p Prepared in cooperation with League of Cities - Conference of Mayors Inc, Washington D C
(Contract HUD-H-2196R)
(PB-278857/8, UO-LCCN-LAC-77-017 HUD/RES-1305) Avail NTIS HC A03/MF A01 CSCL 01B

An area s overall air traffic varies accordingly to many variables, industry, population, highway conditions proximity to major city, etc It is concluded that the overall air traffic that is provided to the Lake Charles area by the regional air line Texas International and the commuter airline Royal, is good This conclusion was established by talking with different travel agencies industry businessmen comparing flight schedules with other cities and talking to the individual airlines The return flights from Houston and New Orleans were studied It is recommended that the different air lines talk to the U S Postal Service in Lake Charles to see if some of the mail can again be sent by air
GRA

N78-27098 Texas Univ at Austin
PROBLEM-SOLVING WITH SIMULATION IN THE WORLD OF AN AIR TRAFFIC CONTROLLER Ph D Thesis
Robert Bell Wesson 1977 245 p
Avail Univ Microfilms Order No 7807407

A theory which suggests an approach to solvingtime dependent problems was developed Such problems occur frequently in real world domains and are characterized by theneed to perform timely actions based upon incomplete information If the rules of change reflect how the problem solver s actions modify the world then simulating the effects of all possible actions and evaluating the predicted outcomes enables an informed choice of the best action to be made This theory was implemented as a computer program which solved problems occurring in the world of the enroute air traffic controller A simulation of a typical airspace sector provided the basis for a planning routine which performed the aircraft cordination and separation tasks usually required of professional controllers
Dissert Abstr

N78-27100*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
THE EFFECT OF LANDING SYSTEM COVERAGE AND PATH GEOMETRY ON LATERAL POSITION ERRORS AT THE RUNWAY THRESHOLD
Dan D Vicroy Jun 1978 25 p refs
(NASA-TM-78744) Avail NTIS HC A02/MF A01 CSCL 17G

The results of an analytical study performed to determine the effect of the azimuth coverage of a Microwave Landing System (MLS) on the ability of an airplane, with an initial navigation position estimate error to navigate to the runway threshold are presented The test path chosen for this study consists of an initial straight segment leading into a 130 deg turn with a 2286 m radius and ending in a straight-in final approach segment The test path configuration was varied by changing the MLS azimuth coverage angle and the final approach length The aircraft was positioned with an inital offset to the left or right of the desired path along the line of intersection with the MLS azimuth coverage A fast time computer simulation program, using a simplistic point mass model of the airplane, was used for this study The data from this study indicates that the lateral position errors at the runway are primarily a function of the final approach length The effect of the azimuth coverage on the lateral position errors was restricted by the turn characteristics of the horizontal steering control laws G Y

N78-27101# Westinghouse Defense and Electronic Systems Center, Baltimore Md

STUDY OF ROUGH GROUND AND GRADING CRITERIA FOR ILS GS SITE PREPARATION Interim Report

G J Moussally, R A Moore, J T Godfrey and H F Hartley Mar 1978 68 p refs

(Contract DOT-FA74WA-3353)

(AD-A053294 FAA-RD-78-42) Avail NTIS HC A04/MF A01 CSCL 01/5

The scattering of electromagnetic radiation from rough surfaces was studied The diffuse and specular components of the scattered field were treated separately Current grading of ILS sites requires rather stringent preparation of the ground Criteria are developed that reflect the statistical nature of the disturbance in observed signal rather than simply to consider the maximum allowable phase differences as the basis for establishing a grading criterium G G

N78-27103# National Aviation Facilities Experimental Center, Atlantic City, N J

COMPARISON OF SLANT AND RUNWAY VISUAL RANGE RELATIONSHIPS FOR 100, 124, AND 155 FEET Final Report, May 1977 - Jul 1977

William Lewis Apr 1978 18 p refs

(FAA Proj 151-462-060)

(AD-A052870 FAA-NA-78-1 FAA-RD-77-191) Avail NTIS HC A02/MF A01 CSCL 17/7

Ratios of slant visual range measured from heights of 100, 124, and 155 feet to horizontal visual range measured at 15 feet were computed for low-visibility regimes These ratios were found to be related to the linear fog density profile expressed as the difference in horizontal atmospheric transmittance between the top (100, 124 and 155 foot) and bottom (15 foot) levels Useful estimates of slant visual range can be provided through these relationships The predictions would be most accurate when the visibility decreased with height (most common fog structure) A slight increase in accuracy would also be expected with decreasing slant height A R H

N78-27104# National Aviation Facilities Experimental Center, Atlantic City, N J Systems Test Branch

LAS VEGAS GRAPHIC STUDY Final Report, Jan - Feb 1977

John J Maurer, Victor J Misiewicz and Robert W Tack Jan 1978 128 p

(AD-A052772, FAA-NA-77-27, FAA-RD-77-182) Avail NTIS HC A07/MF A01 CSCL 17/7

A number of new procedural plans for the control of air traffic operating within the Las Vegas terminal area are reported A plan was also developed for a head-on type departure/arrival operation for Nellis Air Force Base A controller opinion questionnaire was developed that take into consideration the users, controllers, and the area Each plan was evaluated by a panel of 14 air traffic control specialists The new plans for the terminal area, along with the present operating procedures were evaluated for each of four directions of operation or runway configurations and then statistically compared with each other The results indicate that, overall, plans 1 and 2 were significantly preferred over the present system and plan 2 was also significantly preferred over plan 1 The present system, at Nellis AFB was significantly preferred over plan 3 (head-on procedures) Basic reasons for the choice of the Nellis present system over the head-on procedure were safety complexity of operation controller workload and adverse effects to missions due to delays G G

N78-27105*# Analytical Mechanics Associates Inc Mountain View, Calif

DEVELOPMENT AND FLIGHT TESTS OF A KALMAN FILTER FOR NAVIGATION DURING TERMINAL AREA AND LANDING OPERATIONS

Stanley F Schmidt, Paul F Flanagan, and John A Sorenson Jul 1978 136 p refs

(Contract NAS2-8862)

(NASA-CR-3015) Avail NTIS HC A07/MF A01 CSCL 17G

A Kalman filter for aircraft terminal area and landing navigation was implemented and flight tested in the NASA Ames STOLAND avionics computer onboard a Twin Otter aircraft This system combines navaid measurements from TACAN MODILS, air data, radar altimeter sensors along with measurements from strap-down accelerometer and attitude angle sensors The flight test results demonstrate that the Kalman filter provides improved estimates of the aircraft position and velocity as compared with estimates from the more standard complementary filter The onboard computer implementation requirements to achieve this improved performance are discussed Author

N78-27106# Facility Checking Squadron (1866th) (AFCS), Scott AFB, Ill

TRACALS EVALUATION REPORT COMMUNICATIONS STATION EVALUATION REPORT, LITTLE ROCK AFB, ARKANSAS Final Report

Kenneth G Mason 17 Apr 1978 63 p

(AD-A053938 Rept-78/66C-116) Avail NTIS HC A04/MF A01 CSCL 17/7

A Traffic Control and Landing System (TRACALS) Communications Station Evaluation was performed at Little Rock AFB, Arkansas (2151 Comm Sq) from 17-27 January 1978 The purpose of the evaluation was to define the capabilities and limitations of the communications system servicing the ground control approach (GCA) and control tower Included in this report are the results and analysis of equipment checks system line level diagrams line-of-sight coverage data analysis of airborne measurements of signal strength and plots of UHF and VHF radiations patterns Other items which are discussed in this report, and are common problems with most other systems, include system alignment procedures and antenna maintenance problems The data and diagrams used in this report can be used as a guide for anticipated performance of the communication system at Little Rock AFB until there is a deletion addition relocation of equipment or a change in horizon profile which would affect the system Author (GRA)

N78-27109# Advisory Group for Aerospace Research and Development Paris (France)

TECHNICAL EVALUATION REPORT ON THE 24TH GUIDANCE AND CONTROL PANEL TECHNICAL MEETING SYMPOSIUM ON APPLICATIONS OF ADVANCES IN NAVIGATION TO GUIDANCE AND CONTROL

Jun 1978 11 p ref Symp held at Stuttgart 10-13 May 1977

(AGARD-AR-115) Avail NTIS HC A02/MF A01

A symposium was held to study advances in navigational techniques with relation to guidance and control Specific topics of discussion were some of the following (1) improvements in inertial navigation systems and their applications (2) improvements in radar and radio navigation aids and (3) major systems, specific functions and concepts B B

N78-27110 Stanford Univ, Calif

GUIDANCE LOGIC FOR DECELERATING SPIRAL APPROACH OF A TILT-ROTOR AIRCRAFT IN THE PRESENCE OF WIND Ph D Thesis

Jacques Beser 1978 201 p

Avail Univ Microfilms Order No 7808764

The nominal control commands necessary to fly a steady descending turn (or straight segment) were calculated and

additional commands required for deviation in descent rate, deceleration and flight in a steady wind were determined Feedback control commands proportional to the difference between the estimated state and the nominal state were added to the nominal commands The gain matrix was piece-wise constant i e constant for each of the eight reference models used during the approach Simulations of approach flights for different mean winds and random gusts strengths, assuming perfect state information in the feedback signal, indicated satisfactory performance
Dissert Abstr

N78-27111*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
GROUND-BASED AND IN-FLIGHT SIMULATOR STUDIES OF LOW-SPEED HANDLING CHARACTERISTICS OF TWO SUPERSONIC CRUISE TRANSPORT CONCEPTS
William D Grantham Luat T Nguyen, Perry L Deal M J Neubauer, Paul M Smith (Vought Corporation Hampton Technical Center, Hampton Va) and Frederick D Gregory Jul 1978 101 p refs
(NASA-TP-1240 L-12165) Avail NTIS HC A06/MF A01 CSCL 01C
Conventional and powered lift concepts for supersonic approach and landing tasks are considered Results indicated that the transport concepts had unacceptable low-speed handling qualities with no augmentation and that in order to achieve satisfactory handling qualities considerable augmentation was required The available roll-control power was acceptable for the powered-lift concept
G G

N78-27112# National Aviation Facilities Experimental Center, Atlantic City N J
GENERAL AVIATION (FAR 23) COCKPIT STANDARDIZATION ANALYSIS Final Report, Jul 1976 - Jan 1977
Robert J Ontiveros Roman M Spangler and Richard L Sulzer Mar 1978 113 p refs
(AD-A052803 FAA-NA-77-38) Avail NTIS HC A06/MF A01 CSCL 01/3
Cockpit design features amenable to standardization in small general aviation aircraft were studied with the goal of increasing safety A list of 101 cockpit design features was presented to 82 experienced pilots who indicated where they believed increased standardization was warranted Features cited by half or more of the pilots were studied further and reduced to nine design areas considered to warrant near-term action Selection of these areas was based on analysis of accident reports and practicality considerations in addition to pilot comments Three of the design areas relate to the cockpit functions of housing and protecting the pilot (improved body restraint system, more positive action and positive latching of adjustable pilot seats and door latching with a visible locked state) The remaining six areas relate to the other major cockpit function of providing the man-machine interface required to operate the aircraft (fuel management system powerplant controls flight instruments, powerplant instruments instrument lighting, and electrical circuit breakers) Separate sections of the report summarize the data assembled to justify the recommendation for standardization actions in each of the nine areas
Author

N78-27113*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
APPLICATION OF SPECIAL-PURPOSE DIGITAL COMPUTERS TO ROTORCRAFT REAL-TIME SIMULATION
D Brain Mackie and Seth Michelson (Computer Sci Corp, Mountain View Calif) Jul 1978 37 p refs
(NASA-TP-1267 A-7343) Avail NTIS HC A03/MF A01 CSCL 01C
The use of an array processor as a computational element in rotorcraft real-time simulation is studied A multilooping scheme was considered in which the rotor would loop over its calculations a number of time while the remainder of the model cycled once on a host computer To prove that such a method would realistically simulate rotorcraft, a FORTRAN program was constructed to emulate a typical host-array processor computing configuration The multilooping of an expanded rotor model, which included appropriate kinematic equations resulted in an accurate and stable simulation
G G

N78-27114# Air Force Flight Dynamics Lab, Wright-Patterson AFB Ohio
MODAL INVESTIGATION OF LIGHTWEIGHT AIRCRAFT STRUCTURES USING DIGITAL TECHNIQUES Final Report, Feb 1974 - Mar 1976
Robert W Gordon, Howard F Wolfe, and Richard D Talmadge Dec 1977 66 p refs
(AD-A053782 AFFDL-TR-77-124) Avail NTIS HC A04/MF A01 CSCL 20/11
Digital impact response test techniques were used to measure the dynamic properties of lightweight aircraft structures to include natural frequencies mode shapes and modal damping Two different types of structures were tested honey-comb and skin-stiffened panels The digital impact response method used consisted of applying a transient force pulse to the structure measuring the structure s response at various points digitizing calculating the transfer functions using fast Fourier transforms and determining the dynamic properties from these data A second method was used on these same structures for direct comparison purposes This method was an analog technique using sine sweep tests and accelerometer mapping The comparison indicated close agreement in the results The use of the digital technique has resulted in a considerable savings in the manhours required to obtain the dynamic properties of the structures
Author (GRA)

N78-27115# Boeing Aerospace Co Seattle Wash
ADAPTIVE LANDING GEAR FOR IMPROVED TAXI PERFORMANCE Final Technical Report, Jan 1976 - Sep 1977
P T Somm H H Straub and J R Kilner Oct 1977 70 p (Contract F33615-76-C-3004 AF Proj 1369)
(AD-A053733 D180-20795-1 AFFDL-TR-77-119) Avail NTIS HC A04/MF A01 CSCL 01/3
Taxi performance in terms of airplane CG acceleration for the KC-135 T-43A and YC-14 type main gear are calculated with a digital simulation Simple landing gear oleo modifications such as bypass orifices and dual stage air chambers are proposed and evaluated and reduce CG (RMS) acceleration by as much as 47% Improved taxi performance also results in reduced gear loads when bomb crater repair patches are encountered with the KC-135 and YC-14 type gear Fatigue damage due to taxi on austere fields decreases by 6% or more However fatigue damage due to taxi on prepared fields is not affected by the proposed oleo modification
Author (GRA)

N78-27116# General Accounting Office Washington D C Procurement and Systems Acquisition Div
IS PRODUCTION OF THE CH-53E HELICOPTER WARRANTED Report to the Congress
23 Mar 1978 36 p
(PB-278815/6 PSAD-78-27) Avail NTIS HC A03/MF A01 CSCL 01C
The CH-53E is being developed to provide a shipboard compatible helicopter with double lift capability Testing and program costs are discussed in detail
GRA

N78-27118# Vought Corp Dallas, Tex
APPLICATION OF AIDS TO THE A-7E AND A PROJECTED FUTURE TACTICAL AIRCRAFT Final Report, Jun - Dec 1977
P E Greer and J R Hanking Dec 1977 145 p refs
(Contract N62269-77-C-0186)
(AD-A053775 Rept-2-37100/7R-3442, NADC-78032-60) Avail NTIS HC A07/MF A01 CSCL 01/3
A study program to evaluate the application of the AIDS concept to the A-7E as well as a future tactical aircraft has been completed The study evaluated the physical characteristics of the AIDS as applied to the A-7E and selected the Type A V/STOL as the future tactical aircraft to evaluate physical compatibility, interface requirements display format analysis cockpit ambient lighting, and unique display system requirements associated with the V/STOL application The study results reported

in this document verify the feasibility of utilizing the integrated display concept in the A-7E aircraft as well as the Type A' V/STOL Certain physical incompatibilities were noted for the V/STOL application with regard to component sizes and several unique display requirements are identified relative to V-mode operations Author (GRA)

N78-27119# National Bureau of Standards Washington D C Applied Mathematics Div
PROBLEMS IN WORLD-WIDE STANDARDIZATION OF THE UNITS OF ALTITUDE MEASUREMENT
Judith F Gilsinn Feb 1978 25 p refs
(Contract DOT-FA76WAI-594)
(PB-277982/5, NBSIR-77-1386) Avail NTIS HC A02/MF A01 CSCL 01D

The United States commitment to a voluntary conversion to metric units raises changeover problems in the fields of air traffic control and airspace management Current practice in altitude measurement and the rules for height maintenance in effect worldwide are discussed Desirable features are given for an altitude measurement system encompassing both the units of height measurement and the designation of cruising levels Alternative bases for the design of such a system are summarized and related to the desirable characteristics Problems associated with each of the approaches are presented and the many factors to be considered and interrelationships involved examined GRA

N78-27122*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
SUPERCRITICAL FUEL INJECTION SYSTEM Patent Application
C J Marek and L P Cooper inventors (to NASA) Filed 19 Jun 1978 10 p
(NASA-Case-LEW-12990-1 US-Patent-Appl-SN-916654) Avail NTIS HC A02/MF/A01 CSCL 21E

A fuel injection system for gas turbines or the like which includes a pair of high pressure pumps which provide fuel and a carrier fluid such as air at pressures above the critical pressure of the fuel was developed A supercritical mixing chamber mixes the fuel and carrier fluid and the mixture is sprayed into a combustion chamber for burning therein The use of fuel and a carrier fluid at supercritical pressures promotes rapid mixing of the fuel in the combustion chamber so as to reduce the formation of pollutants and promote cleaner burning NASA

N78-27123# Toronto Univ (Ontario) Inst for Aerospace Studies
A TRANSONIC PROPELLER OF TRIANGULAR PLAN FORM AN EXTENSION
Herbert S Ribner May 1978 29 p refs
(UTIAS-TN-218 CN-ISSN-0082-5263) Avail NTIS HC A03/MF A01

An isosceles triangle twisted into a screw surface about its axis was proposed as a propeller for transonic flight speeds The mathematical analysis is extended to cover aerodynamic and structural effects of a feasible camber distribution The basic camber is localized near the leading edge, the camber is determined in such a way that the theoretical infinite pressure peak along the leading edge is eliminated An auxiliary camber or rake is derived for the alleviation of the deflection caused by the centrifugal forces The earlier formulas were derived on the assumption that the triangle is narrow compared with the Mach cone from its vertex A factor to correct approximately for the breadth of the triangle is introduced herein The selection of the advance-diameter coefficient and pitch-diameter ratio for maximum efficiency is treated Finally the design of a 3 5 foot diameter model propeller for wind-tunnel tests at a stream Mach number of 0 9 is carried through in a numerical example G G

N78-27124*# Boeing Commercial Airplane Co Seattle Wash
JT9D ENGINE DIAGNOSTICS TASK 2 FEASIBILITY STUDY OF MEASURING IN-SERVICE FLIGHT LOADS
P G Kafka M A Skibo and J L White 15 Oct 1977 68 p refs
(Contract NAS3-20632)
(NASA-CR-135395 D6-44664) Avail NTIS HC A04/MF A01 CSCL 21E

The feasibility of measuring JT9D propulsion system flight inertia loads on a 747 airplane is studied Flight loads background is discussed including the current status of 747/JT9D loads knowledge An instrumentation and test plan is formulated for an airline-owned in-service airplane and the Boeing-owned RA001 test airplane Technical and cost comparisons are made between these two options An overall technical feasibility evaluation is made and a cost summary presented Conclusions and recommendations are presented in regard to using existing inertia loads data versus conducting a flight test to measure inertia loads Author

N78-27125*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
INLET-ENGINE MATCHING FOR SCAR INCLUDING APPLICATION OF A BICONE VARIABLE GEOMETRY INLET
Joseph F Wasserbauer and William H Gerstenmaier 1978 23 p refs Presented at the 14th Propulsion Conf Las Vegas, Nev 25-27 Jul 1978 cosponsored by the AIAA and the SAE Engr
(NASA-TM-78955 E-9706) Avail NTIS HC A02/MF A01 CSCL 21E

Airflow characteristics of variable cycle engines (VCE) designed for Mach 2 32 can have transonic airflow requirements as high as 1 6 times the cruise airflow This is a formidable requirement for conventional, high performance axisymmetric, translating centerbody mixed compression inlets An alternate inlet is defined where the second cone of a two cone center body collapses to the initial cone angle to provide a large off-design airflow capability, and incorporates modest centerbody translation to minimize spillage drag Estimates of transonic spillage drag are competitive with those of conventional translating centerbody inlets The inlet s cruise performance exhibits very low bleed requirements with good recovery and high angle of attack capability Author

N78-27126*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
A COMPUTER PROGRAM FOR FULL-COVERAGE FILM-COOLED BLADING ANALYSIS INCLUDING THE EFFECTS OF A THERMAL BARRIER COATING
Jun 1978 11 p refs To be presented at the Winter Ann Meeting of ASME San Francisco, 10-15 Dec 1978
(NASA-TM-78951 AVRADCOM-TR-78-31(PL), E-9696) Avail NTIS HC A02/MF A01 CSCL 21E

The program input coolant flow and heat transfer model and the program output are discussed As an example, sections of the suction and pressure sides of a high temperature, high pressure turbine vane are analyzed to show the effects of a thermal barrier coating Compared to the uncoated design, the coating halves the required coolant flow while simultaneously reducing metal outer temperatures by over 111 K Author

N78-27127*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
FUEL CONSERVATIVE AIRCRAFT ENGINE TECHNOLOGY
Donald L Nored 1978 39 p refs Proposed for presentation at 11th Congr of the Intern Council of Aeronautical Sci Lisbon Portugal 10-16 Sep 1978, sponsored by AIAA
(NASA-TM-78962, E-9719) Avail NTIS HC A03/MF A01 CSCL 21E

Technology developments for more fuel-efficiency subsonic transport aircraft are reported Three major propulsion projects were considered (1) engine component improvement - directed at current engines (2) energy efficient engine - directed at new turbofan engines and (3) advanced turboprops - directed at technology for advanced turboprop-powered aircraft Each project is reviewed and some of the technologies and recent accomplishments are described G G

N78-27128*# Hamilton Standard Windsor Locks Conn
PROP-FAN DATA SUPPORT STUDY Final Report
J A Baum P J Dumais, M G Mayo F B Metzger A M Shenkman and G G Walker 28 Feb 1978 111 p
(Contract NAS2-9750)
(NASA-CR-152141) Avail NTIS HC A06/MF A01 CSCL 01C

Updated parametric prop-fan data packages are presented and the rationale used in developing the new prop-fan data is detailed These data represent Hamilton Standard s projections of prop-fan characteristics for aircraft that are expected to be in-service in the 1985 to 1990 time frame The basic prop-fan configuration was designed for efficient cruise operation at 0 8 Mach number and 10 668M altitude The design blade tip speed is 244 mps and the design power loading is 301 KW/M squared G G

N78-27129*# Pratt and Whitney Aircraft Group East Hartford Conn Commercial Products Div
FABRICATION AND TEST OF DIGITAL OUTPUT INTERFACE DEVICES FOR GAS TURBINE ELECTRONIC CONTROLS Final Report
D M Newirth and E W Koenig May 1978 59 p
(Contract NAS3-19898)
(NASA-CR-135427 PWA-5544-13) Avail NTIS HC A04/MF A01 CSCL 21E

A program was conducted to develop an innovative digital output interface device a digital effector with optical feedback of the fuel metering valve position for future electronic controls for gas turbine engines A digital effector (on-off solenoids driven directly by on-off signals from a digital electronic controller) with optical position feedback was fabricated coupled with the fuel metering valve and tested under simulated engine operating conditions The testing indicated that a digital effector with optical position feedback is a suitable candidate with proper development for future digital electronic gas turbine controls The testing also identified several problem areas which would have to be overcome in a final production configuration Author

N78-27130*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
REVERSE-FLOW COMBUSTOR FOR SMALL GAS TURBINES WITH PRESSURE-ATOMIZING FUEL INJECTORS
Carl T Norgren Edward J Mularz (AVRADCOM Res and Technol Labs), and Stephen M Riddlebaugh Aug 1978 30 p refs
(NASA-TP-1260 AVRADCOM-TR-78-22(PL) E-9458) Avail NTIS HC A03/MF A01 CSCL 21E

A reverse flow combustor suitable for a small gas turbine (2 to 3 kg/s mass flow) was used to evalute the effect of pressure atomizing fuel injectors on combustor performance In these tests an experimental combustor was designed to operate with 18 simplex pressure atomizing fuel injectors at sea level takeoff conditions To improve performance at low power conditions, fuel was redistributed so that only every other injector was operational Combustor performance emissions and liner temperature were compared over a range of pressure and inlet air temperatures corresponding to simulated idle cruise, and takeoff conditions typical of a 16 to 1 pressure ratio turbine engine B B

N78-27131# Civil and Environmental Engineering Development Office, Tyndall AFB Fla
PHOTOGRAPHIC MEASUREMENTS OF USAF AIRCRAFT PLUME RISE Final Report, 1 Jul - 22 Nov 1977
Paul D Music John S Hunt and Dennis F Naugle Nov 1977 35 p refs
(AD-A054004, CEEDO-TR-77-57) Avail NTIS HC A03/MF A01 CSCL 04/1

This report includes data and results which were obtained during plume rise experimentation Aircraft plumes were photographed using the smoke-producing F-102 drones and Thunderbird T-38 aircraft The second set of experiments indicated that under low wind and unstable conditions the aircraft plume not only rises but completely separates from the ground The other studies, however, indicate that under high wind and neutral conditions the plume rise is greatly retarded and there is no significant ground separation Differences in micrometeorology apparently account for these plume rise variations Since the 13 tests performed are inadequate to understand the causes for the plume rise and ground separation it is recommended that this study be extended in order to provide an explanation for this phenomenon GRA

N78-27132# Civil and Environmental Engineering Development Office Tyndall AFB Fla Detachment 1 ADTC
SUBISOKINETIC SAMPLING ERRORS FOR AIRCRAFT TURBINE ENGINE SMOKE PROBES Final Report, 15 Sep 1977 - 15 Jan 1978
Joseph A Martone Apr 1978 21 p refs
(AD-A053867 CEEDO-TR-78-20) Avail NTIS HC A02/MF A01 CSCL 21/5

Experimental evidence that isokinetic sampling can be important for submicrometer particles in high speed flows was presented in CEEDO-TR-77-48 This report applies those results to gas turbine engine smoke measurement The analysis predicts a 15 to 30 percent subisokinetic sampling error at a take-off engine power setting It is concluded that subisokinetic errors do not greatly affect smoke number determinations but should be considered when true smoke density is measured Author (GRA)

N78-27133# Naval Air Test Center Patuxent River, Md
AIRCRAFT ENGINE DRIVEN ACCESSORY SHAFT COUPLING IMPROVEMENTS USING HIGH-STRENGTH NONMETALLIC ADAPTER/BUSHINGS Progress Report
Aleck Loker 31 Mar 1978 41 p refs
(AD-A053834 NATC-TM-78-1-SY) Avail NTIS HC A03/MF A01 CSCL 21/5

Engine driven accessories such as generators, starters and pumps are commonly connected to their respective power takeoff shafts by spline couplings These shaft couplings which allow rapid installation and removal of the accessory are capable of high torque transmission and are considered to be selfcentering this Technical memorandum presents information pertaining to manufacturing techniques contains previously unpublished test data and includes all of the new spline designs produced and evaluated by NAVAIRTESTIGEN Extensive laboratory testing and 40 000 hr of flight on six aircraft types have demonstrated the value of the new spline designs Some of the benefits of the new coupling technique are, (1) higher accessory power system reliability (2) elimination of wear and premature failure (3) reclamation of gearboxes at the organizational level, and (4) reduction of maintenance induced failures A series of nonmetallic couplings are available for a large number of accessory equipment applications due to the expanding size/rating range of coupling designs GRA

N78-27134# Naval Postgraduate School Monterey, Calif
COMBUSTOR DESIGN AND OPERATION FOR A SUBSCALE TURBOJET TEST CELL M S Thesis
Jerry Russell Charest Mar 1978 44 p refs
(AD-A053791) Avail NTIS HC A03/MF A01 CSCL 21/5

A high pressure water-cooled ramjet-type combustor capable of producing various amounts of particulates has been designed constructed and operated in the sub-scale turbojet test cell The combustor can be utilized to perform further studies concerning the effects of engine operating characteristics and test cell design on particulate concentrations, and also the effects of fuel additives on the amount and composition of particulates emitted Author (GRA)

N78-27135# Advisory Group for Aerospace Research and Development, Paris (France)
TECHNICAL EVALUATION REPORT ON THE 50TH MEETING OF THE PROPULSION AND ENERGETICS PANEL A SYMPOSIUM ON HIGH TEMPERATURE PROBLEMS IN GAS TURBINE ENGINES
R Eggebrecht (MTU GmbH, Munich) and S Lombardo (Curtiss-Wright Corp Wood-Ridge N J) Mar 1978 19 p ref Symp held at Ankara, 19-23 Sep 1977
(AGARD-AR-116) Avail NTIS HC A02/MF A01

A symposium was held to review the main problems associated with the attainment of high temperatures in aircraft gas turbine engines Specific topics examined were the following (1) turbine cooling techniques (2) combustors afterburners and nozzles, (3) materials and coatings, (4) effect of cooling on aerodynamic performances and (5) prediction methods B B

N78-27136*# National Aeronautics and Space Administration Langley Research Center Langley Station Va

LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A FIGHTER MODEL WITH A CLOSE-COUPLED CANARD AT MACH NUMBERS FROM 0 40 TO 1 20

Richard J Re and Francis J Capone Jul 1978 80 p refs

(NASA-TP-1206 L-12081) Avail NTIS HC A05/MF A01 CSCL 01C

A Au aircraft model with a close-coupled canard mounted above the wing chord plane was considered Model angle of attack was varied from -4 deg to 15 deg, canard incidence was varied from -5 deg to 18 deg and selected canard and wing flap deflections were investigated By using the canard incidence for trim maximum trimmed lift-drag ratios of about 8 8 7 7 and 4 7 were obtained at free-stream Mach numbers of 0 40 0 90, and 1 20 respectively At a lift coefficient of 0 60 model trim angle of attack could be varied over an incremental range between 3 0 deg and 3 8 deg depending on Mach number by different combinations of control settings At high lift coefficients larger trimmed lift-drag ratios were obtained by using the deflection capability of the canard leading- and trailing-edge flaps before increasing canard incidence angle G G

N78-27137*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

REAL TIME DIGITAL PROPULSION SYSTEM SIMULATION FOR MANNED FLIGHT SIMULATORS

James R Mihaloew and Clint E Hart 1978 45 p refs Presented at the 14th Propulsion Conf Las Vegas Nev 25-27 Jul 1978 sponsored by AIAA and the Soc of Automotive Engr

(NASA-TM-78958 E-9710) Avail NTIS HC A03/MF A01 CSCL 01C

A real time digital simulation of a STOL propulsion system was developed which generates significant dynamics and internal variables needed to evaluate system performance and aircraft interactions using manned flight simulators The simulation ran at a real-to-execution time ratio of 8 8 The model was used in a piloted NASA flight simulator program to evaluate the simulation technique and the propulsion system digital control The simulation is described and results .shown Limited results of the flight simulation program are also presented Author

N78-27138*# National Aeronautics and Space Administration Langley Research Center Langley Station Va

EFFECTS OF ERRORS ON DECOUPLED CONTROL SYSTEMS

Harold A Hamer and Katherine G Johnson Jul 1978 86 p refs

(NASA-TP-1184 L-11959) Avail NTIS HC A05/MF A01 CSCL 01C

Various error sources in a decoupled control system are considered in connection with longitudinal control on a simulated externally blown jet-flap STOL aircraft The system employed the throttle horizontal tail and flaps to decouple the forward velocity pitch angle and flight-path angle The errors considered were (1) imperfect knowledge of airplane aerodynamic and control characteristics (2) imperfect measurements of airplane state variables (3) change in flight conditions, and (4) lag in the airplane controls and in engine response The effects of the various errors on the decoupling process were generally minor Significant coupling in flight-path angle was caused by control lag during speed-command maneuvers However this coupling could be eliminated by including the control lag in the design of the decoupled system Other error sources affected primarily the commanded response quantity G G

N78-27139# Air Force Inst of Tech Wright-Patterson AFB, Ohio School of Engineering

INVESTIGATION OF A DISCRETE C-STAR TRANSIENT RESPONSE CONTROLLER FOR THE YF-16 AT A SELECTED FLIGHT CONDITION M S Thesis

Paul D Monico Dec 1977 200 p refs

(AF Proj 7071)

(AD-A053441, AFIT/GGC/EE/77-8) Avail NTIS HC A09/MF A01 CSCL 01/3

The feasibility of a discrete digital flight controller for the YF-16 Lightweight Fighter Prototype aircraft at Mach 8 at sea level is investigated The investigation is limited to the longitudinal pitch axis A reduced state short period mathematical model of the YF-16 is developed from available data The open loop stability and response characteristics of the model are shown to be unacceptable necessitating the use of closed loop compensation The minimization of a discrete cost function is used to develop a recursive discrete control formula The thesis discusses and incorporates the concept of a proposed C-Star handling qualities criterion in the determination of acceptable response Digital computer simulation on a CDC 6600 computer for various sample rates using a zero order hold or first order hold control scheme, results in a stabilized system model whose output falls within the bounds of a defined C-Star envelope, and capable of performing the tracking task of following a 1-G climb pilot input command Typical results in the form of plotted time history information are discussed Also discussed are the effects on the system of variations in sample rate, and cost functional penalty parameters Control weighting is shown to be inversely proportional to the natural frequency while the trajectory weighting determines the damping ratio GRA

N78-27141*# Southampton Univ (England) Dept of Aeronautics and Astronautics

SELF STREAMLINING WIND TUNNEL FURTHER LOW SPEED TESTING AND FINAL DESIGN STUDIES FOR THE TRANSONIC FACILITY Semiannual Progress Report, period ending Dec 1977

S W D Wolf Dec 1977 37 p refs

(Grant NsG-7172)

(NASA-CR-157111) Avail NTIS HC A03/MF A01 CSCL 14B

Work has continued with the low speed self streamlining wind tunnel (SSWT) using the NACA 0012-64 airfoil in an effort to explain the discrepancies between the NASA Langley low turbulence pressure tunnel (LTPT) and SSWT results obtained with the airfoil stalled Conventional wind tunnel corrections were applied to straight wall SSWT airfoil data to illustrate the inadequacy of standard correction techniques in circumstances of high blockage Also one SSWT test was re-run at different air speeds to investigate the effects of such changes on airfoil data and wall contours Mechanical design analyses for the transonic self streamlining wind tunnel (TSWT) were completed by the application of theoretical airfoil flow field data to the elastic beam and streamline analysis The control system for the transonic facility is outlined B B

N78-27142*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

INVESTIGATION OF MEANS FOR PERTURBING THE FLOW FIELD IN A SUPERSONIC WIND TUNNEL

Gary L Cole and Warren R Hingst Jun 1978 30 p refs

(NASA-TM-78954 E-9703) Avail NTIS HC A03/MF A01 CSCL 14B

The development status of a device for generating atmospheric-type turbulences in supersonic inlet testing is summaried Elaborated are desired aerodynamic and actuation capabilities of the device and the techniques that were considered and their drawbacks G G

N78-27143*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio

DESIGN OF AN AIR EJECTOR FOR BOUNDARY-LAYER BLEED OF AN ACOUSTICALLY TREATED TURBOFAN ENGINE INLET DURING GROUND TESTING

Edward G Stakolich Jun 1978 21 p refs
(NASA-TM-78917 E-9655) Avail NTIS HC A02/MF A01 CSCL 14B

An air ejector was designed and built to remove the boundary-layer air from the inlet a turbofan engine during an acoustic ground test program This report describes, (1) how the ejector was sized (2) how the ejector performed and (3) the performance of a scale model ejector built and tested to verify the design With proper acoustic insulation, the ejector was effective in reducing boundary layer thickness in the inlet of the turbofan engine while obtaining the desired acoustic test conditions Author

N78-27144# Federal Aviation Administration Washington, D C
AIRPORT SURFACE DETECTION EQUIPMENT (ASDE-3) PROJECT PLAN
M E Perie Jan 1978 48 p
(AD-A052362 FAA-RD-78-12) Avail NTIS HC A03/MF A01 CSCL 01/5

A primary radar and display system used to provide the airport surface traffic situation to the air traffic controller are considered An ASDE-3 engineering model is being procured for testing The program for development, test, evaluation, maintenance and configuration control of the ASDE-3 engineering model is described and the responsibilities of each of the participating organizations are delineated G G

N78-27145# Sandia Labs Albuquerque N Mex
COMPUTER-CONTROLLED VIDEO INSTRUMENTATION TECHNIQUE FOR WIND TUNNEL TESTING OF FULL-SCALE LIFTING PARACHUTES
Robert H Croll and C W Peterson 1978 7 p refs Presented at AIAA Testing Conf San Diego Calif 19 Apr 1978
(Contract EY-76-C-04-0789)
(SAND-77-1773C Conf-780419-2) Avail NTIS HC A02/MF A01

Wind tunnel tests of parachutes require that aerodynamic data be obtained simultaneously on both the forebody and the parachute In particular, it is necessary to correlate the relative motion between the parachute and forebody to the loads exerted by the parachute on the forebody as a function of time during dynamic tests disreefing, and for the full-open canopy A computerized video instrumentation technique was developed to provide the correlation during a fullscale wind tunnel test of a unique parachute configuration The instrumentation consisted of a small rugged TV camera mounted on the forebody base, which tracked the positions of two lights attached to the inside of the parachute canopy The positions of the lights were digitized by an on line minicomputer and converted to yaw, pitch, and roll angles relative to the forebody ERA

N78-27183*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
COMPOSITE STRUCTURES FOR COMMERCIAL TRANSPORT AIRCRAFT
Louis F Vosteen Jun 1978 25 p refs
(NASA-TM-78730) Avail NTIS HC A02/MF A01 CSCL 11D

The development of graphite-epoxy composite structures for use on commercial transport aircraft is considered Six components three secondary structures, and three primary structures are presently under development The six components are described along with some of the key features of the composite designs and their projected weight savings G G

N78-27184*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
LOW DENSITY BISMALEIMIDE-CARBON MICROBALLOON COMPOSITES Patent Application
Demetrius A Kourtides and John A Parker inventors (to NASA) Filed 30 Jun 1978 25 p
(NASA-Case-ARC-11040-2, US-Patent-Appl-SN-920878) Avail NTIS HC A02/MF A01 CSCL 11D

A process is described for constructing for a composite laminate structure which exhibits a high resistance to heat and flame provides safer interior structures for aircraft and submarine compartments Composite laminate structures are prepared by the bismaleimide resin preimpregnation of a fiberglass cloth to form a face sheet which is bonded with a bismaleimide hot melt adhesive to a porous core structure selected from the group consisting of polyamide paper and bismaleimide-glass fabric which is filled with carbon microballoons The carbon microballoons are prepared by pyrolyzing phenolic micro-balloons in the presence of nitrogen A slurry of the carbon microballoons is prepared to fill the porous core structure The porous core structure and face sheet are bonded to provide panel structures exhibiting increased mechanical capacities and lower oxygen limit values and smoke density values NASA

N78-27185*# National Aeronautics and Space Administration, Washington, D C
THE PROSPECTS FOR COMPOSITES BASED ON BORON FIBERS
R Naslain Jun 1978 24 p refs Transl into ENGLISH from Aeronaut Astronaut (Paris), no 65 1977 p 25-36 Original language document was announced as A78-12033 Transl by Kanner (Leo) Associates, Redwood City Calif Original doc prep by Lab of Solid-State Chem, Natl Center of Sci-Res Talence Ironde, France
(Contract NASw-2790)
(NASA-TM-75305) Avail NTIS HC A02/MF A01 CSCL 11D

The fabrication of boron filaments and the production of composite materials consisting of boron filaments and organic or metallic matrices are discussed Problem involving the use of tungsten substrates in the filament fabrication process the protection of boron fibers with diffusion barier cladings, and the application of aloy additives in the matrix to lessen the effects of diffusion are considered Data on the kinetics of the boron fiber/matrix interaction at high temperatures, and the influence of the fiber/matrix interaction on the mechanical properties of the composite are presented Author

N78-27278# Naval Research Lab, Washington D C Combustion and Fuel Branch
ELECTROSTATIC CHARGING OF JP-4 FUEL ON POLYURETHANE FOAMS Final Report
Joseph T Leonard and Wilbur A Affens Mar 1978 20 p refs Sponsored by the Dept of the Air Force
(AD-A053831 AD-E000148 NRL-8204) Avail NTIS HC A02/MF A01 CSCL 20/3

The electrostatic charge generating characteristics of JP-4 fuel were determined on both polyester and polyether-type polyurethane foams Eleven samples of JP-4 fuel covering a range in electrical conductivity of 0 65 to 10 27 picosiemens/m (pS/m) were tested The conductivity of one sample was increased incrementally to 200 pS/m by use of a static dissipator additive (ASA-3) The charging tendency of the fuels was determined by measuring the filter current developed by the passage of 50 ml of fuel through a cylindrical section of foam held in an electrically isolated filter holder The charging tendencies of all fuel samples were also determined using a reference paper filter It was found that JP-4 fuels can become charged electrostatically by flowing through polyurethane foam However, the magnitude of the charge cannot be predicted from the electrical conductivity of the fuel nor on the basis of its charging tendency on the reference paper filter The charging tendencies on the polyether foams were about six times greater than on the polyester foams Author (GRA)

N78-27279# AiResearch Mfg Co, Phoenix Ariz
CERAMIC TECHNOLOGY READINESS PROGRAM Monthly Technical Progress Report, 28 Nov 1977 - 1 Jan 1978
16 Jan 1978 27 p refs
(Contract EF-77-C-01-2664)
(FE-2664-3, MTPR-3) Avail NTIS HC A03/MF A01

Evidence of the ability of ceramic components to survive for lifetimes adequate for utility application in an environment of high temperature combustion products from coal derived fuels was provided Technology readiness for the application of ceramic materials technology to advanced gas turbines operating on coal derived fuel in utility base load and intermediate load service was developed and demonstrated A supply of basic ceramic powders for use in noncommercial investigations of materials properties fabrication techniques, and test methods was ensured ERA

N78-27295# Textron Bell Aerospace Co Buffalo N Y
TESTS FOR PARTICLE CONTAMINATION OF THE ENGINE INLET AIRFLOW FROM THE LACV-30 AIR MANAGEMENT SYSTEM Final Report
R F Speth Jan 1977 16 p
(Contract DAAK02-75-C-0149)
(AD-A053642, Rept-7467-928003) Avail NTIS HC A02/MF A01 CSCL 01/3

Tests were conducted to demonstrate that the LACV-30 Air Management System removes at least 95 percent of the entering sand and dust Analysis of 1 micron filters used in isokinetic sampling probes to measure entering and existing contamination levels indicated that the system removed 97 percent of the contamination entering during 22 minutes of vehicle operation in a high-sand environment Author (GRA)

N78-27311# Purdue Research Foundation, Lafayette, Ind
MICROPROCESSOR-CONTROLLED COMMUNICATIONS IN AIR TERMINAL NAVIGATION SYSTEMS Final Report, 1 Nov 1975 - 31 Dec 1977
Stephen E Belter Craig R Williams and Steven C Bass Jan 1978 181 p
(Contract DOT-FA74WA-3518)
(AD-A052819, FAA-RD-78-25) Avail NTIS HC A09/MF A01 CSCL 17/2

The implementation of some old and new techniques to the problem of command and control signaling within a Category 3 instrument landing system are reported The old techniques include the use of tone signaling over balanced lines, along with isolation transformers and gas discharge elements for lightning protection The new methods include the application of microprocessor control devices to supervise, format, and interpret all communications Additional features afforded by the microprocessor approach include automatic and manual maintenance logging at the control tower more reliable transmission error detection enhanced system status displays, and a self-contained operator training feature G Y

N78-27313# National Aviation Facilities Experimental Center, Atlantic City, N J
SATELLITE COMMUNICATIONS MODE SIMULATION TESTS FOR OCEANIC AIR TRAFFIC CONTROL Final Report, Jun - Nov 1976
Francis W Jefferson Mar 1978 48 p ref
(FAA Proj 171-252-200)
(AD-A052546, FAA-NA-77-37, FAA-RD-77-187) Avail NTIS HC A03/MF A01 CSCL 17/2

Simulated satellite system configurations and channel access control tests were conducted with air traffic control test subjects to determine controller reaction to the satellite mode of communications and their interaction with associated input/output interfaces The tests were designed to simulate an oceanic ATC environment supported by satellite communications and surveillance Data were acquired for controller test subject reactions to different voice and data communications delay/restriction situations, voice channel queuing, data communications message length and format constraints, acceptance of required communications disciplines, and the mix of voice and data communications when there was a choice between the two methods of communication Results were (1) Controller test subjects favored using data communication to accomplish routine controller-to-pilot communications transactions and voice communication to resolve difficult traffic control situations, (2) actual data from the test logs corroborated test subjects' stated preference, and (3) controller test subjects tended to adapt their communications procedure options to be compatible with the communications system disciplines G G

N78-27314# Institute for Telecommunication Sciences Boulder Colo
APPLICATIONS GUIDE FOR PROPAGATION AND INTERFERENCE ANALYSIS COMPUTER PROGRAMS (0.1 TO 20 GHz)
M E Johnson and G D Gierhart Mar 1978 184 p refs
(Contracts DOT-FA68WAI-145, DOT-FA74WAI-424)
(AD-A053242 FAA-RD-77-60) Avail NTIS HC A09/MF A01 CSCL 20/14

Ten computer programs useful in estimating the service coverage of radio systems operating in the frequency band from 0 1 to 20 GHz are reported These programs were used to obtain a wide variety of computer-generated microfilm plots such as transmission loss versus path length and the desired-to-undesired signal ratio at a receiving location versus the distance separating the desired and undesired transmitting facilities Emphasis was placed on the types of outputs available and the input parameter requirements The propagation model used with these programs is applicable to air/ground, air/air ground/satellite, and air/satellite paths It can also be used for ground-to-ground paths that are line-of-sight or smooth earth G G

N78-27337# Naval Avionics Facility, Indianapolis Ind
AN INDUSTRY SURVEY ON MANAGING THE TIMELY INTRODUCTION AND UTILIZATION OF LARGE SCALE INTEGRATED CIRCUITS IN MILITARY AVIONICS Final Report
Ronald R Jennings 1 Mar 1978 188 p
(AD-A053951, NAC-TR-2221) Avail NTIS HC A09/MF A01 CSCL 05/1

This report presents the results of an industry survey coordinated by the Naval Avionics Center to obtain information on issues involved in managing the timely introduction and utilization of large scale integrated (LSI) circuits in military avionics equipment Responses were received from individuals in many companies representing semiconductor manufacturers avionics equipment suppliers, and airframe contractors The responses covered a wide range of issues involving LSI usage in military avionics including LSI device introduction, device obsolescence LSI specifications, testing and qualification technologies needing Naval Air Systems Command development support, needed changes in MIL-specifications, standards, etc , procurement practices, and standardization Comments and suggestions receiving various degrees of concurrence among the respondents are identified and discussed Detailed answers of the respondents to the survey questions are also included Author (GRA)

N78-27369# Detroit Diesel Allison, Indianapolis Ind Detroit Diesel Allison Div
RESEARCH ON AEROELASTIC PHENOMENA IN AIRFOIL CASCADES AN EXPERIMENTAL INVESTIGATION OF THE UNSTEADY AERODYNAMIC OF A CLASSICAL AIR FOIL CASCADE IN TRANSLATION
Sanford Fleeter, Ronald E Riffel, Thomas H Lindsey, and Mark D Rothrock Apr 1978 62 p refs
(Contract N00014-72-C-0351)
(AD-A053931 EDR-9477) Avail NTIS HC A04/MF A01 CSCL 20/4

The advent of high tip-speed, high work, blading in the fan stages of advanced gas turbine engines has led to the recognition of a new type of blading instability - unstalled supersonic flutter As a result a concerted effort to develop an appropriate predictive mathematical model has taken place To determine the range of validity and to direct refinements to the basic flow model fundamental supersonic oscillating cascade data are required The experiment described herein is directed at significantly extending the range of existing supersonic cascade data to include translation mode oscillations In particular, the fundamental time-variant translation mode aerodynamics are determined for the first time for a classical airfoil cascade in supersonic inlet flow field over a range of interblade phase angles at a realistic reduced frequency value These unique experimental data are then correlated with predictions obtained from an appropriate state-of-the-art harmonically oscillating flat plate cascade aerodynamic analysis Author (GRA)

N78-27379# National Technical Information Service, Springfield Va
FLOW VISUALIZATION, VOLUME 1 A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar 1977
Guy E Habercom, Jr May 1978 276 p
(NTIS/PS-78/0425/5) Avail NTIS HC $28 00/MF $28 00 CSCL 20D

Citations of Federally-funded research cover major studies concerning flow visualization for wind tunnel, water tunnel, and shock tube testing The visualization methods described include the use of smoke water vapor dyes, oils, bubbles, phase change paints and particles While many of these studies cover flow visualization techniques for specific applications they are included because of their applicability to various research problems Schlieren and shadowgraph photography and holographic techniques are excluded from this bibliography GRA

N78-27380# National Technical Information Service Springfield Va
FLOW VISUALIZATION, VOLUME 2 A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Apr 1977 - Mar 1978
Guy E Habercom Jr May 1978 89 p Supersedes NTIS/PS-77/0342 NTIS/PS-76/0334 NTIS/PS-75/116
(NTIS/PS-78/0426/3 NTIS/PS-77/0342 NTIS/PS-76/0334 NTIS/PS-75/116) Avail NTIS HC $28 00/MF $28 00 CSCL 20D

For abstract see N78-27379

N78-27427*# Detroit Diesel Allison, Indianapolis Ind
AERODYNAMIC PERFORMANCE OF CONVENTIONAL AND ADVANCED DESIGN LABYRINTH SEALS WITH SOLID-SMOOTH ABRADABLE, AND HONEYCOMB LANDS Final Report, 21 Jul 1976 - 21 Nov 1977
H L Stocker, D M Cox and G F Holle Nov 1977 272 p refs
(Contract NAS3-20056)
(NASA-CR-135307, EDR-9339) Avail NTIS HC A12/MF A01 CSCL 11A

Labyrinth air seal static and dynamic performance was evaluated using solid abradable and honeycomb lands with standard and advanced seal designs The effects on leakage of land surface roughness abradable land porosity, rub grooves in abradable lands and honeycomb land cell size and depth were studied using a standard labyrinth seal The effects of rotation on the optimum seal knife pitch were also investigated Selected geometric and aerodynamic parameters for an advanced seal design were evaluated to derive an optimized performance configuration The rotational energy requirements were also measured to determine the inherent friction and pumping energy absorbed by the various seal knife and land configurations tested in order to properly assess the net seal system performance level Results indicate that (1) seal leakage can be significantly affected with honeycomb or abradable lands, (2) rotational energy absorption does not vary significantly with the use of a solid-smooth an abradable or a honeycomb land, and (3) optimization of an advanced lab seal design produced a configuration that had leakage 25% below a conventional stepped seal A R H

N78-27429*# SKF Industries Inc, King of Prussia, Pa Research Lab
EMERGENCY AND MICROFOG LUBRICATION AND COOLING OF BEARINGS FOR ARMY HELICOPTERS Final Report, Dec 1972 - Jun 1977
J W Rosenlieb Jan 1978 125 p refs
(Contract NAS3-17343)
(NASA-CR-135195, SKF-AL77T021) Avail NTIS HC A06/MF A01 CSCL 13I

An analysis and system study was performed to provide design information regarding lubricant and coolant flow rates and flow paths for effective utilization of the lubricant and coolant in a once-through oil-mist (microfog) and coolant air system A system was designed manufactured coupled with an existing rig and evaluation tests were performed using 46 mm bore split-inner angular-contact ball bearings under 1779N (400 lb) thrust load An emergency lubrication aspirator system was also manufactured and tested under lost lubricant conditions The testing demonstrated the feasibility of using a mist oil and cooling air system to lubricate and cool a high speed helicopter engine mainshaft bearing The testing also demonstrated the feasibility of using an emergency aspirator lubrication system as a viable survivability concept for helicopter mainshaft engine bearing for periods as long as 30 minutes Author

N78-27432# Air Force Packaging Evaluation Agency Wright-Patterson AFB Ohio
EVALUATION OF F-16 RADAR ATTACHMENT ASSEMBLIES FOR REUSABLE CONTAINERS Interim Report
James D Heck Mar 1978 10 p refs
(AD-A053424 PTPT-78-8) Avail NTIS HC A02/MF A01 CSCL 13/5

The objective of this evaluation was to determine if mounting brackets for antenna and the transmitter would maintain mounting integrity through transportation rough handling and environmental testing The results of this study indicated that the mounting brackets for the antenna and the transmitter will maintain integrity during shipment and handling Author (GRA)

N78-27455# Lehigh Univ Bethlehem Pa Inst of Fracture and Solid Mechanics
LOAD AND ENVIRONMENT INTERACTIONS IN FATIGUE CRACK GROWTH UNDER SPECTRUM LOADING Final Report, 15 Jun 1975 - 30 Sep 1977
R P Wei Jan 1978 82 p refs
(Grant AF-AFOSR-2857-75 AF Proj 2307)
(AD-A053904 IFSM-78-88 AFOSR-78-0788TR) Avail NTIS HC A05/MF A01 CSCL 11/6

The importance of delay (or retardation in the rate of fatigue crack growth) produced by load interactions in variable-amplitude loading on the accurate prediction of fatigue lives of aircraft and other engineering structures has been recognized for some time and has begun to receive greater attention in recent years Recent investigations showed that the effects of delay can be quite large and that these effects need to be taken into account in developing improved fatigue analysis procedures for aircraft and other engineering structures A number of models (based on the concepts of crack closure residual stress intensity factor etc) have been proposed to account for the effects of delay These models while successfully predicting trends in the rate of fatigue crack growth for randomized load spectra appear to break down for ordered spectra Several basic problems contributed to the lack of complete success and needs to be resolved in the development of improved models for predicting load interaction effects (chiefly delay) on fatigue crack growth GRA

N78-27456# Naval Postgraduate School Monterey Calif
FATIGUE CRACK PROPAGATION ANALYSIS OF AIRCRAFT STRUCTURES M S Thesis
Larry Don Newsome Mar 1978 50 p refs
(AD-A053835) Avail NTIS HC A03/MF A01 CSCL 01/3

This thesis is a comparative study of aircraft fatigue life calculations based upon crack propagation and upon cumulative damage The stress concentration factor which supplies sufficient geometric information for Miner s Law of cumulative damage is found to not completely specify the geometry for the crack propagation approach Effects on fatigue life of variations in initial crack length plate width hole size and hole geometry for the same stress concentration factor have been investigated also both ordered and random load histories were used to compare the two approaches Complete FORTRAN computer program input documentation for the IBM 360/67 system has been included as an appendix to enable this thesis to serve as a user s manual for CRACK s II an Air Force crack propagation program for aircraft fatigue damage Author (GRA)

N78-27457# Florida Univ Eglin AFB Graduate Engineering Center
STUDIES ON THE FAILURE OF STIFFENED CYLINDRICAL SHELLS SUBJECTED TO DYNAMIC LOADS Final Report, 1 Jan - 31 Dec 1977
C A Ross, R L Sierakowski I K Ebcioglu C C Schauble, and C F Yen 31 Dec 1977 250 p refs
(Grant AF-AFOSR-3237-77)
(AD-A053954, AFOSR-78-0697TR) Avail NTIS HC A11/MF A01 CSCL 20/11

The major objective of this study was to investigate the effects of axial stiffening of cylindrical shells subject to transverse blast loadings Two existing methods for predicting dynamic response of cylindrical shells were modified to include axial stiffening A semi-analytical energy method was chosen as a first cut design predictor and tables of normalized deflection versus external energy imparted to the structure are presented In addition a more detailed analytical energy method was modified to include axial stiffening In both cases the stiffeners were introduced by simply adding terms to the kinetic and potential energy terms of the basic shell equations rather than introducing membrane-bending coupling by use of more complicated anisotropic constitutive relations The primary results of both methods indicate that the effect of axially stiffening a cylindrical shell using stiffeners typical of those in aerospace applications is very small Both methods have been incorporated into computer algorithms which allow an investigator to determine failure modes of blast loaded shells either by an engineering approach or a more sophisticated detailed approach Author (GRA)

N78-27628# Civil and Environmental Engineering Development Office, Tyndall AFB Fla Detachment 1 ADTC
EQUIPMENT TO NEUTRALIZE AIRCRAFT FUEL SPILLS Final Report, Sep 1976 - Sep 1977
Lee R Munroe Jan 1978 40 p
(AD-A053862 CEEDO-TR-78-09) Avail NTIS HC A03/MF A01 CSCL 06/6

This report describes the selection of types and sizes of equipment for the neutralization of small and other type fuel spills Additionally it deals with the procurement of subject equipment and materials and evaluates on a competitive basis for application to collection neutralization, and fabrication of various size fuel spills Maximum use was made of US Army Mobility Equipment Research and Development Command's in-house facilities to design assemble fabricate and test a pilot model system as described in the report Author (GRA)

N78-27711# Brookhaven National Lab Upton, N Y
MEASUREMENT OF VERTICAL VELOCITY FLUCTUATIONS IN THE ATMOSPHERIC BOUNDARY LAYER WITH A SMALL AIRCRAFT
S SethuRaman R M Brown G S Raynor and W A Tuthill 1978 3 p Presented at 4th Symp on Meteorol Observations and Instrumentation, Denver, Colo, 10 Apr 1978
(Contract EY-76-C-02-0016)
(BNL-23633, Conf-780412-3) Avail NTIS HC A02/MF A01

Turbulence in the atmospheric boundary layer is one of the parameters that varies with height and depends on several factors atmospheric stability terrain wind speed, etc Measurement by aircraft is one of the methods of studying the variation of turbulence at higher elevations in the boundary layer Sensors mounted on the aircraft are used to measure high frequency velocity fluctuations The use of a simple device called a variometer to measure vertical velocity fluctuations in the atmospheric boundary layer is described The method consists of flying the variometer in a small aircraft and allowing the aircraft to be controlled by the atmospheric eddies in the vertical plane while maintaining control over the general direction of flight ERA

N78-27870*# Lockheed-Georgia Co Marietta
NOISE CHARACTERISTICS OF UPPER SURFACE BLOWN CONFIGURATIONS ANALYTICAL STUDIES Topical Report, May 1975 - Nov 1976
N N Reddy J G Tibbetts, A P Pennock and C K W Tam Jul 1978 138 p refs
(Contract NAS1-13870)
(NASA-CR-2812 LG77ER0102) Avail NTIS HC A06/MF A01 CSCL 20A

Noise and flow results of upper surface blown configurations were analyzed The dominant noise source mechanisms were identified from experimental data From far-field noise data for various geometric and operational parameters, an empirical noise prediction program was developed and evaluated by comparing predicted results with experimental data from other tests USB aircraft compatibility studies were conducted using the described noise prediction and a cruise performance data base A final design aircraft was selected and theory was developed fo, the noise from the trailing edge wake assuming it as a highly sheared layer G G

N78-27871*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
PREDICTION OF AIRCRAFT SIDELINE NOISE ATTENUATION
William E Zorumski Jun 1978 52 p refs
(NASA-TM-78717) Avail NTIS HC A04/MF A01 CSCL 20A

A computational study is made using the recommended ground effect theory by Pao Wenzel and Oncley It is shown that this theory adequately predicts the measured ground attenuation data by Parkin and Scholes which is the only available large data set It is also shown however that the ground effect theory does not predict the measured lateral attenuations from actual aircraft flyovers There remain one or more important lateral effects on aircraft noise such as sideline shielding of sources which must be incorporated in the prediction methods Experiments at low elevation angles (0 deg to 10 deg) and low-to-intermediate frequencies are recommended to further validate the ground effect theory Author

N78-27872# Federal Aviation Administration, Washington D C Office of Environmental Quality
CALCULATIONS OF MAXIMUM A-WEIGHTED SOUND LEVELS dBA
Jun 1978 69 p
Avail NTIS HC A04/MF A01

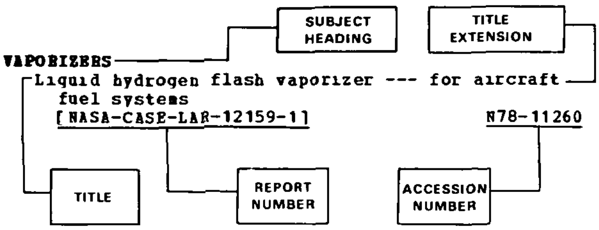
Data including aircraft flight profile information by aircraft type and mode of operation and peak noise level as a function of slant range to the aircraft are presented to assist Air Traffic and Flight Standards personnel in complying with the requirements of FAA Order 1050 lb Policies and Procedures for Considering Environmental Impacts paragraph 324b(2)(b) A procedure is described for calculating and documenting in an environmental impact statement or negative declaration the maximum A-weighted sound level (in units of A-weighted decibels or dBA) for single aircraft operations at specified noise-sensitive locations in the vicinity of civil airports A R H

N78-27979# Wright State Univ Dayton, Ohio Dept of Administrative Science and Finance
ON THE BENEFIT-TO-COST RATIO OF BASE-LEVEL STOCKING DECISIONS FOR LOW DEMAND ITEMS Interim Report
W Steven Demmy Russell M Genet Thomas D Meitzler, and Ross E Miles Apr 1978 22 p
(Grant AF-AFOSR-3011-76)
(AD-A053953, WP-76-3011-19) Avail NTIS HC A02/MF A01 CSCL 15/5

This paper explores a fundamental cause of aircraft non-availability It shows that for current Air Force aircraft a significant portion of the lack of supply availability is due to not stocking items at the base level Basic research on methods to alleviate this problem in a cost effective way is reported It is shown with specific real world examples how these methods can be applied to current inventory aircraft Author (GRA)

SUBJECT INDEX

Typical Subject Index Listing



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PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing

PERSONAL AUTHOR

BEASLEY, W. D.
An exploratory investigation of the effects of a thin plastic film cover on the profile drag of an aircraft wing panel
[NASA-TM-74073] N78-10023

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1. Report No	2. Government Accession No	3. Recipient's Catalog No
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AERONAUTICAL ENGINEERING A Continuing Bibliography (Supplement 101)	October 1978
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No
	10. Work Unit No
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D. C. 20546	11. Contract or Grant No
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15. Supplementary Notes

16. Abstract

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