NASA

Aeronautical Engineering
A Continuing Bibliography with Indexes

NASA SP-7037 (104)
January 1979

National Aeronautics and Space Administration

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STAR (N-10000 Series)	N78-32036—N78-34034
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NASA SP–7037(104)

AERONAUTICAL ENGINEERING

A Continuing Bibliography

Supplement 104

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 December 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 532 reports, journal articles, and other documents originally announced in December 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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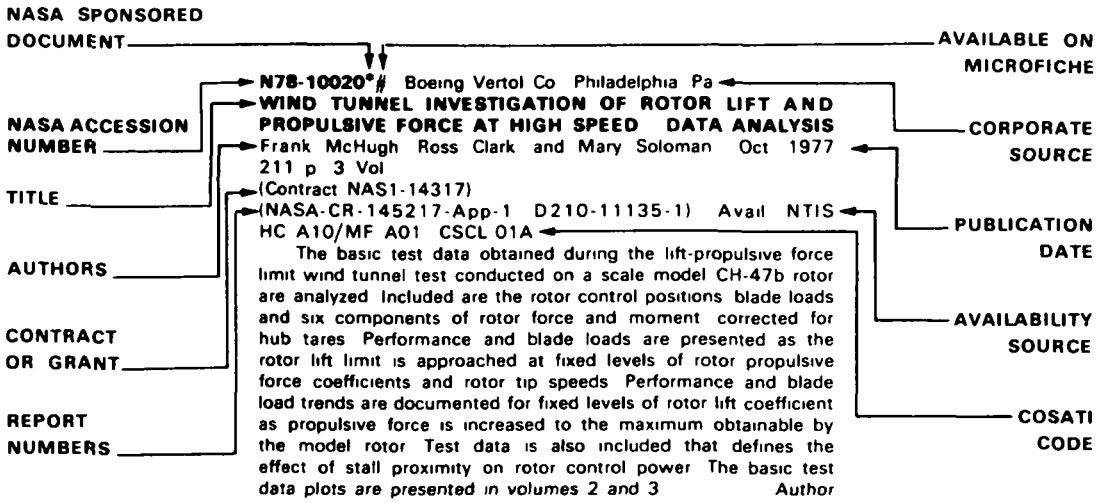

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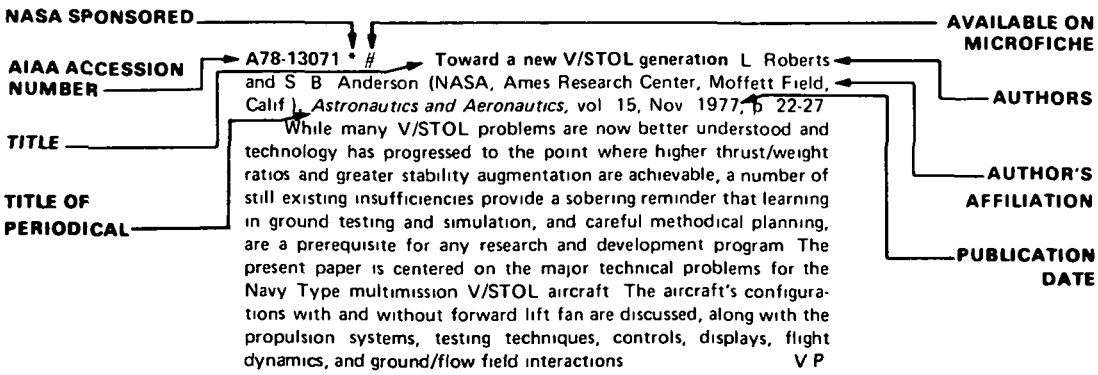

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 104)

JANUARY 1979

IAA ENTRIES

A78-50263 **Aircraft guidance and flight safety - Current and future problems for research and industry (Flugfuhrung und Flugsicherung - Gegenwartige und zukunftige Aufgaben fur Forschung und Industrie)** F Thomas (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Braunschweig, West Germany) *DFVLR-Nachrichten,* Aug 1978, p 2-9 In German

The paper reviews state-of-the-art and future-generation design innovations which will lead to improvements in aircraft control and flight safety Some of the innovations discussed are data bus systems, advanced engine concepts, the use of improved onboard computer systems, tracking radar, in-flight simulators, strapdown technology, electrohydraulic control of control surfaces, microwave landing systems, the utilization of communication and navigation systems, and the automation of flight safety functions B J

A78-50264 **Improved safety in air transportation through the extension and automation of flight safety systems (Hohere Sicherheit im Luftverkehr durch Ausbau und Automatisierung der Flugsicherung)** K Platz (Bundesanstalt fur Flugsicherung, Frankfurt am Main, West Germany) *DFVLR-Nachrichten,* Aug 1978, p 9 13 In German

The contribution of flight safety systems (primarily radar guidance systems) to overall safety in air transportation is discussed After a brief review of technical improvements of flight safety systems in recent years, the paper describes planning goals and system concepts for flight safety systems in the 1980s A block diagram of a radar-based flight safety system proposed for the 1980s is presented B J

A78-50265 **Current and future navigation and landing systems (Gegenwartige und zukunftige Navigations- und Landesysteme)** M Bohm (Standard Elektrik Lorenz AG, Stuttgart, West Germany) *DFVLR-Nachrichten,* Aug 1978, p 13-19 In German

The basic problems and techniques of aircraft navigation and landing are reviewed from the standpoints of communications, navigation systems, and tracking The state of the art of air navigation is reviewed with particular reference to systems in West Germany Future systems, involving ground-based guidance, autonomous on-board systems, and satellite navigation systems, are discussed B J

A78-50266 **Digital flight control system - Advanced technology of flight control (Digitales Flugfuhrungssystem - Verbesserte Technologie der Flugfuhrung)** J Filz (Deutsche Lufthansa AG, Hamburg, West Germany) *DFVLR-Nachrichten,* Aug 1978, p 19-23 In German

The paper reviews the advantages of digital flight control systems (DFCS) The standard architecture - consisting of flight management computer, flight control computer, and thrust control computer - for a DFCS is described Consideration is given to the system architecture for the A300 B 10 Airbus, it includes flight control computer, energy management computer, and flight augmentation computer West German contributions to advanced flight control technology are briefly reviewed B J

A78-50276 * **Assess II - A simulated mission of Spacelab** H M Wegmann, R Hermann (Deutsche Forschungs und Versuchs anstalt fur Luft und Raumfahrt, Institut fur Flugmedizin, Bonn, West Germany), C M Wingett (NASA, *Ames Research Center,* Moffet Field, Calif), M de Muizon, D Rouan, P Léna (Meudon, Observatoire, Meudon, Hauts-de Seine, France), J Wijnbergen (Groningen, Rijksuniversiteit, Groningen, Netherlands), H Olthof, K W Michel (Max-Planck-Institut fur Extraterrestriche Physik, Garching, West Germany), and Ch Werner (Deutsche Forschungs- und Versuchsanstalt fur Luft und Raumfahrt, Institut fur Physik der Atmosphare, Oberpfaffenhofen, West Germany) *Nature,* vol 275, Sept 7, 1978, p 15-19 10 refs

For Assess II, the Spacelab mission simulation conducted in mid-1977, four payload specialists aboard a Convair 990 research aircraft performed six American and six European experiments during nine research flights each of six hours duration in order to evaluate the compatibility of training and experimental design Mission organization and some initial data from the European experiments are reported The experiments, conducted over the western U S , involved infrared astronomy, solar brightness temperature, lidar, airglow TV, and a medical experiment for which physiological parameters were monitored Conclusions concerning general principles of experiment design are discussed M L

A78-50288 **Three dimensional free convection flow and heat transfer along a porous vertical plate** P Singh, V P Sharma, and U N Misra (Indian Institute of Technology, Kharagpur, India) *Applied Scientific Research,* vol 34, Spring 1978, p 105-115

In the present paper, the three dimensional free convection flow over a porous vertical plate with transverse sinusoidal suction is analyzed in the case where the difference in wall and flow temperatures gives rise to buoyancy forces acting in the direction of the flow Skin friction in the flow direction and heat transfer intensity to the flow are calculated for asymptotic flow conditions The wall shear stress is calculated as a function of the buoyancy parameter V P

A78-50302 **Visual flight simulator for the investigation of the learning process during aircraft landing (Ein Sichtsimulator zur Untersuchung des Lernvorgangs bei der Flugzeuglandung)** W Heumann (Darmstadt, Technische Hochschule, Darmstadt, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, July-Aug 1978, p 228-242 17 refs In German

In training, a pilot must learn two basic landing skills (1) how to estimate height above ground from exterior visual cues, and (2) how to control the dynamic response of the aircraft This paper describes a visual flight simulator for the separate training of these two skills A side-view simulator allows the pilot to become familiar with the dynamic characteristics of the aircraft, without the problem of height estimation, a runway simulator projects the correct wide-angle view of the runway during final approach and landing B J

A78-50303 **Blockage correction for aerodynamic measurements in a closed subsonic wind tunnel (Eine Blockierungskorrektur fur aerodynamische Messungen in geschlossenen Unterschallwindkanalen)** E Mercker and H Fiedler (Berlin, Technische Universitat, Berlin, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, July-Aug 1978, p 242-248 11 refs In German Research supported by the Deutsche Forschungsgemeinschaft

A simple method is described by which the influence of wind-tunnel blockage for flow around bodies of arbitrary shape can be corrected The correction factor n is obtained experimentally Thus the geometrical blockage ratio F/A, the thickness of the boundary layer at the model as well as at the tunnel walls and lastly the model shape do not enter into the correction scheme explicitly but are taken care of by the correction factor The method can be applied for total blockage ratios up to 25% It has been tested for flows about two-dimensional wedges and cylinders In principle the method is also applicable to flows around three-dimensional bodies (Author)

A78-50304 **Real-gas version of the gasdynamic formulas of Saint-Venant and Wantzel (Eine Realgas-Version der gasdynamischen Formeln von de Saint-Venant und Wantzel)** P A Thompson (Max-Planck-Institut fur Stromungsforschung, Gottingen, West Germany) *Zeitschrift fur Flugwissenschaften und Weltraumforschung,* vol 2, July-Aug 1978, p 249-253 14 refs In German

The elementary formulas of Saint-Venant and Wantzel for M equals 1 are reformulated for real gases The real-gas effects in the formulas are incorporated in a small parameter b, determined from the temperature-dependent virial coefficients and heat capacity Calculations using three standardized virial coefficients show good accuracy for gas densities up to approximately one-fourth the density at the critical point B J

A78-50311 **Two extensions of a theorem of Levi-Civita to gyroscopic systems and some applications (Sur deux extensions d'un théorème de Levi-Civita aux systèmes gyroscopiques et quelques applications)** P Capodanno (Besancon, Université, Besançon, France) *Journal de Mécanique,* vol 17, no 3, 1978, p 433-454 11 refs In French

The author gives two extensions of Levi-Civita's theorem on the Hamiltonian systems of gyroscopic systems The extension is direct in the case when there is only one invariant relation When there are many such relations, sufficient conditions are given for the existence of such extension Some applications of these results are studied a generalization of Routh's motions, a problem of profile dynamics, and a generalization of Hess's case of the motion of a heavy body about a fixed point (Author)

A78-50400 **The potential of advanced technology for aircraft structures /10th J D North Memorial Lecture/** W G Molyneux (Royal Aircraft Establishment, Aircraft Structures Dept , Farnborough, Hants , England) *Aerospace* (UK), vol 5, Sept 1978, p 17-24 8 refs

Consideration is given to a series of recent developments in aircraft structural materials (fiber resin and metallic), the use of the computers in structural design, active control technology, and fatigue monitoring It is predicted that these developments will lead, by the turn of the century, to an aircraft structure which, for a specified operational task, may be up to 50% lighter, of lower first cost, of improved fatigue life, and of lower maintenance cost than its present-day equivalent B J

A78-50434 **Glass airports** D Wegler (Architekturburo Rodl-Kieferle, Boblingen, West Germany) *Airport Forum,* vol 8, Aug 1978, p 13, 15-17 (4 ff) 16 refs. In English and German

The use of glass in airport buildings is discussed, and several photographs of airport buildings are presented Characteristics of glass are surveyed, special properties of some new glasses are described, possible ways of using glass are considered, and the benefits associated with access to sunlight are examined It is suggested that glass helps people feel that the airport building is a friendly environment M L

A78-50435 **Airports in the year 2000 - Suggestions for improving capacity** P Walmsley *Airport Forum,* vol 8, Aug 1978, p 39, 40, 42 (4 ff) In English and German

Recommended airport modifications derived from consideration of the airport as a factory are discussed with attention to the proposals presented in an earlier report, 'Towards 2000' The suggestions for the year 2000 include development of large nodal airports, particularly in Europe, the building of single large terminals capable of accomodating 60 million originating and terminating passengers as well as 40 million transfer passengers a year, and automated ticket processing, baggage handling, and passenger movement within the terminal Minimization of airport space requirements is considered to be a chief goal M L

A78-50436 **Toulouse combines elegance with economy.** *Airport Forum,* vol 8, Aug 1978, p 57-60, 62-64 In English and German

The new airport terminal at Toulouse, France is described with attention to the separate levels for arriving and departing passengers Air passenger volume data for this city which is the center of the French aircraft industry are presented Terminal layout and opportunities for future expansion, costs and financing, architects, consultants, and contractors, and the development of adjoining land are discussed M L

A78-50437 **Improved passenger flow through simulation** A G Edge and D R Coleman (System Logistics, Inc , Honolulu, Hawaii) *Airport Forum,* vol 8, Aug 1978, p 93-98 In English and German

The described simulation model for passenger movements in the International Arrivals Building at Honolulu is applied to the problem of reducing long waits at the immigration and customs desk Although features specific for Honolulu airport are taken into account, use of the generalized approach is recommended for determining the efficient use of resources at other airports Application of the model is discussed in terms of planning for long term, tactics for medium term, and operations in short term M L

A78-50447 # **Strategic or tactical air traffic control** S Ratcliffe (Royal Signals and Radar Establishment, Malvern, Worcs , England) *Journal of Navigation,* vol 31, Sept 1978, p 337-347

The reported investigation has the object to determine the payoff from an optimal strategy as a function of the accuracy with which the future situation can be predicted The costs of delay are assumed to involve two components, one of which is independent of the time at which ATC attempts to deal with predicted congestion at the destination and a variable component, where savings are possible if there is advance notice of impending delay This variable component is mainly the difference in fuel consumed when flying, in cruise or descent, at the speed for minimum fuel consumption and that consumed in normal flight followed by a 'hold' at relatively low flight level The study examines the sensitivity of the results to the assumed ratio of the variable component to the other cost penalties associated with traffic delays G R

A78-50448 # **Airborne equipment for all weather operations** D V Warren (Civil Aviation Authority, London, England) *Journal of Navigation,* vol 31, Sept 1978, p 480-483

The Runway Visual Range (RVR) is selected so as to provide for a reasonable probability of being able to continue the approach from the decision height, with sufficient visibility for a safe landing and roll-out along the runway It is, therefore, largely dependent on the decision height, and on visual aids which are to be used below the decision height Category I operations are based on the use of decision heights down to 200 ft, and the associated values of RVR are usually in the order of 500-600 m The lowest minima are normally only achieved with the use of an automatic pilot or a flight director coupled to the ILS beam Most aircraft types designed before the late sixties are fitted with 'simple' autopilots in which critical failures can cause significant control surface movement and aircraft response An outline of aircraft guidance equipment for all weather operations is presented in a table G R

A78-50449 # **The Turboclair process** M Bernard (Aéroport de Paris, Département Exploitation Aérienne, Paris, France) *Journal of Navigation*, vol 31, Sept 1978, p 483-488

Poor visibility is still the basic problem affecting air transport regularity The employment of suitable fog dispersal techniques together with the use of appropriate automatic landing systems for aircraft, should make it possible to eliminate almost all the disadvantages resulting from fog One possible method of fog dispersal is to clear the fog by vaporizing the water droplets suspended in the atmosphere A fog dispersal process, called Turboclair, has been developed by using this approach The Turboclair system makes use of a thermokinetic fog-dispersal process, in which hot gases are diffused above a runway The ambient temperature is raised a few degrees, thus enabling the suspended water droplets to be vaporized The hot gases are generated by means of turbojet engines which have been withdrawn from flight G R

A78-50450 # **Estimating the average taxi speed of departing aircraft** S Nagaoka, P T Muto, and E Yoshioka (Ministry of Transport, Tokyo, Japan) *Journal of Navigation*, vol 31, Sept 1978, p 494-499

A description is presented of a theoretical method for estimating the average taxi speed of departing aircraft The method is based on the use of simplified models Data concerning the time and motion of departing aircraft obtained at an airport traffic control tower for 138 jet aircraft were analyzed for the purpose of studying the relation between average taxi speed and taxi distance It was found that the average taxi speed is approximately proportional to the square root of the distance The observations show that the time-speed curve for each type of aircraft can be regarded as a triangle or trapezoid Equations are presented for estimating average taxi speed from the known distance G R

A78-50451 # **Transverse compressional damping in the vibratory response of elastic-viscoelastic-elastic beams** B E Douglas (U S Naval Material Command, David W Taylor Naval Ship Research and Development Center, Annapolis, Md) and J C S Yang (Maryland, University, College Park, Md) *AIAA Journal*, vol 16, Sept 1978, p 925-930 9 refs

The effects of transverse compressional damping in the vibratory response of three-layer elastic-viscoelastic-elastic beams are considered both analytically and experimentally in a mechanical impedance format The relative importance of this type of damping is assessed through comparison with the shear damping mechanism inherent in the composite using the Mead and Markus model Results of this investigation suggest that the effects from transverse compressional damping have a relatively narrow frequency bandwidth dependent on the elastic loss tangent of the damping core and are centered at the compressional (delamination) frequency of the composite Compressional damping is shown to have a minimal effect on the transverse dynamic response of thin three-layer damped beams for frequencies significantly less than the compressional frequency where a shear damping model provides a more accurate prediction of the composite loss factor (Author)

A78-50455 # **Effect of temperature-dependent heat capacity on aerodynamic ablation of melting bodies** A Prasad (Regional Institute of Technology, Jamshedpur, India) *AIAA Journal*, vol 16, Sept 1978, p 1004-1007 11 refs

The influence of temperature-dependent heat capacity on the ablation and temperature buildup at the surface of melting bodies is considered for the case where melting occurs due to aerodynamic heating The melting body is assumed to be a semiinfinite solid having a constant cross-sectional area Solutions are found by a variational method which predicts the surface-temperature time history and the melting-distance time history Results in closed form are presented along with numerical solutions S C S

A78-50456 # **Unsteady three-dimensional compressible stagnation-point boundary layers** G Nath (Indian Institute of Science, Bangalore, India) and M Kumari *AIAA Journal*, vol 16, Sept 1978, p 1007-1009 9 refs

Unsteady three-dimensional laminar compressible stagnation-point boundary layers are examined for the case when the wall temperature and the incident stream vary arbitrarily with time Equations governing flow are numerically solved using an implicit finite-difference scheme It is assumed that the dissipation terms are negligible at the stagnation point and that the external flow is homentropic It is concluded that (1) the skin-friction and heat-transfer parameters are greatly influenced by variations of the density-viscosity product across the boundary layer and the nature of the stagnation point, (2) wall temperature greatly influences the heat-transfer parameter although it does not significantly influence the skin-friction parameter, and (3) skin-friction parameters are more sensitive to fluctuations of the freestream velocity than to the heat-transfer parameter S C S

A78-50457 # **Investigation of a side force due to ablation** W C Ragsdale and E V Horanoff (U S Navy, Naval Surface Weapons Center, White Oak Laboratory, Silver Spring, Md) *AIAA Journal*, vol 16, Sept 1978, p 1010, 1011

A study has been made of the effects of ablation-induced side forces on reentry vehicle stability Ablating and nonablating spherically blunted cone models were examined at Mach 18 in hypervelocity wind tunnels The model was spun to the desired rate while the wind-tunnel supply pressure and temperature were brought to the run condition When the conditions were achieved, the model was injected into the tunnel flow and force data were recorded Side force data were plotted with and without ablation, with ablation at different spin rates, and with ablation at different Reynolds numbers S C S

A78-50459 # **Integral equation formulation for transonic flow past lifting wings.** S K Chakrabartty (Indian Institute of Technology, Kharagpur, India) *AIAA Journal*, vol 16, Sept 1978, p 1015, 1016 6 refs

The paper presents an analytical solution to the transonic small perturbation equation in reduced coordinates derived by Norstrud (1973) In this derivation the reduced perturbation velocity potential is used as the unknown function In the present paper the formulation is extended to the case of transonic flow past lifting wings S.C S

A78-50461 # **Generalized area rules and integral theorems for hypersonic wing-bodies** N D Malmuth (Rockwell International Science Center, Thousand Oaks, Calif) *AIAA Journal*, vol 16, Sept 1978, p 1019-1022 9 refs Contract No F44620-71-C-0021

With reference to complex configurations such as the Shuttle Orbiter, generalized relationships and integral theorems are obtained for a nonconical body and a conically supersonic conical shape Attention is given to the work of Kutler et al (1973) concerning the calculation of Space Shuttle flowfields via noncentered finite difference schemes and that of Malmuth (1973) concerning pressure fields over hypersonic wing bodies at moderate incidence S C S

A78-50474 # **Visibility observations at Bombay Airport during the winters of 1974-75 and 1975-76 when a skopograph was in operation** C V V S Rao and A Thiruvengadathan (Meteorological Office, Bombay, India) *Indian Journal of Meteorology, Hydrology and Geophysics*, vol 28, July 1977, p 391-394

A78-50503 **Unsteady laminar compressible boundary-layer flow at a three-dimensional stagnation point** M Kumari and G Nath (Indian Institute of Science, Bangalore, India) *Journal of Fluid Mechanics*, vol 87, Aug 29, 1978, p 705-717 16 refs

Consideration is given to the unsteady laminar compressible boundary-layer flow in the region of the stagnation points on a class of three-dimensional bodies including spheres, cylinders, and saddle shapes. Both cold and hot walls have been studied for the case when the velocity of the incident stream varies with time An implicit finite-difference scheme is used to solve the partial differential equations describing the flow It is found that the changes in the density-viscosity product across the boundary layer, the characteristics of the stagnation point, and the wall temperature influence the skin-friction and heat-transfer properties S C S

A78-50560 * # **Calculation of CO concentration for liquid fueled gas turbine combustor** P B Patil, M Sichel, and J A Nicholls (Michigan, University, Ann Arbor, Mich) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 17 p 7 refs Grant No NsG 3148

The extensive computation time required for the numerical integration of the differential equations obtained in studies of the concentrations of pollutants emitted by gas turbine combustors, can be reduced significantly by assuming the heat releasing hydrocarbon reactions to be in local equilibrium In determining the CO and NO concentrations produced in spray combustion, it is, therefore, tempting to use the same local equilibrium assumption in order to simplify the kinetic calculations An investigation of the validity of the local equilibrium assumption is conducted by using a simple analytical model, and then by actually carrying out the kinetic and local equilibrium calculations for typical case G R

A78-50561 # **Rotary combustion engine hydrocarbon source studies** R J Bayer, S F DeNagel, and J C Steiner (GM Research Laboratories, Warren, Mich) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 41 p 5 refs

A description is presented of the experimental apparatus and procedures for the time-resolved measurements and the flame photography studies conducted in connection with the considered investigation The results of the experiments are evaluated It is concluded that time resolved exhaust sampling can only measure the concentration of constituents in the exhaust as a function of engine rotation The changing concentrations at the sampling location can be related back to events which occurred earlier in the combustion chamber only in a general, qualitative way The hydrocarbon concentration existing at a particular location in the chamber at the completion of combustion is subsequently modified during the expansion and exhaust strokes by seal leakage, mixing, and oxidation processes G R

A78-50564 # **Design and verification of a turbofan Swirl augmentor** W J Egan and J H Shadowen (United Technologies Corp , Pratt and Whitney Aircraft Group, West Palm Beach, Fla) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 11 p

The initial development of the Swirl augmentor concept from combustion centrifuge testing through subscale turbojet (single stream) rig verification has been discussed by Lewis et al (1977) A description is presented of an extension of that work to the design and initial testing of a full-scale Swirl augmentor on an F100 turbofan engine A full-scale Swirl augmentor has been designed for an existing augmented turbofan engine to enable direct comparison of Swirl and conventional augmentor performance characteristics Initial testing was done at sea level The objective was to verify the Swirl augmentor concept in full size on a turbofan engine Altitude testing was also performed G R

A78-50568 # **Combustor performance of high availability fuels** C A Moses and D W Naegeli (U S Army, Fuels and Lubricants Research Laboratory, San Antonio, Tex) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 10 p

In connection with shortages which might occur with respect to currently used jet fuels, investigations have been conducted regarding the feasibility to employ other fuels, which are available in adequate quantities The reported study is concerned with the effect which the substitution of such fuels will have on combustor performance A 2-inch diameter cylindrical research combustor designed for high temperatures and pressures was used in the study It was found, however, very difficult to draw significant conclusions about the effects of fuel properties on combustion efficiency This difficulty was related to the geometry of the combustor which was such that if the flame could be stabilized in the primary zone, combustion was very efficient Even the two fuels with the highest end points and viscosities were not significantly different G R

A78-50569 # **Variability of emissions measurements on a small gas turbine engine** G Opdyke, Jr (Avco Corp , Avco Lycoming Stratford Div , Stratford, Conn) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 15 p

A turboprop engine, rated at 620 equivalent shaft horsepower at takeoff, configured with a shaft engine gearbox for test convenience, was tested twenty times in a one-month period for measurement of emission levels Ten different fuel manifold and injector assemblies were tested The obtained results show that changing fuel injectors will have an impact on emission levels The variability which results is larger than that caused by injector design differences or by the differences in the physical characteristics between Jet A and DF 2 fuels The fuel injector effect could not be explained by the variation of fuel flow between individual injectors It is concluded that the fuel spray droplet spatial distribution, probably unique to each single injector, is such that hydrocarbon emissions are significantly affected by fuel droplet or vapor impingement in the wall cooling film, and CO emissions vary because of reaction quenching in the mainstream and in the cooling film G R

A78-50570 # **Aircraft afterburner catalytic flame stabilization** T J Rosfjord (United Technologies Research Center, East Hartford, Conn) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 11 p 9 refs

A technique for stabilizing aircraft afterburner catalytic flames is presented The performance of the porous, catalytically-active flameholder is discussed in terms of increased efficiency without a simultaneous increase in pressure loss Values are given for variations in afterburner efficiency and pressure loss for a series of operating conditions S C S

A78-50571 # **Alternative fuel effects upon combustion efficiency in continuous combustors** D A Schmidt and A M Mellor (Purdue University, West Lafayette, Ind) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 8 p 5 refs Army-supported research

The ability of the gas turbine engine to burn a variety of fuels is an important asset in connection with considerations which take into account the undesirability of a dependency on foreign crude oil A gas turbine engine will, therefore, power the next generation Army main battle tank Effects related to the use of different fuels are to be investigated A systematic study is in this connection conducted of fuel volatility and viscosity relationships with efficiency It is found that an increase in combustion inefficiency with heavier fuels is due to the larger droplets in the spray penetrating through the shear layer into the relatively cooler free stream air where CO and HC oxidation reactions are quenched Results to date show that Jet A blended exhibits slightly higher combustion inefficiency then no 2 diesel fuel The 90% distillation point appears to be the important distillation regime relevant to combustion inefficiency G R

A78-50574 # **Performance of the Vortex-Controlled Diffuser /VCD/ in an annular combustor flowpath** A J Verdouw (General Motors Corp , Detroit Diesel Allison Div , Indianapolis, Ind) *Combustion Institute, Spring Technical Meeting, West Lafayette, Ind , Apr 3, 4, 1978, Paper* 15 p

The Vortex Controlled Diffuser (VCD) represents an advanced diffuser concept which employs bleed at a flowpath step to accomplish low pressure loss diffusion in a short length A description is presented of an investigation concerning the aerodynamic performance of the VCD as applied to a realistic gas turbine annular combustion system flowpath VCD component parametric performance results show that effectiveness increases with secondary duct length and bleed amount The VCD performance data were employed to design a complete annular combustion system flowpath incorporating a VCD This system was fabricated and tested for aerodynamic performance The VCD performance results obtained with the VCD as applied to a realistic gas trubine combustor flowpath with realistic diffuser inlet conditions indicate that the VCD is applicable to gas turbine combustion systems and offers significant diffuser pressure loss reduction G R

A78-50576 **Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings** Congress sponsored by the Gas Turbine Society of Japan, JSME, and ASME Tokyo, Gas Turbine Society of Japan 1977 630 p $61 50

Consideration is given to the following areas of gas turbine research heat transfer in regenerators, combustors, gas emissions, gas turbine design and performance, steady and unsteady internal flow, noise, instrumentation control and mechanical design, and materials and thermal stress Particular papers are presented on such topics as the development program for the FJR 710 turbofan engine, film cooling of turbine blades, interaction of jets with a mainstream turbulent flow, the application of impingement cooling to combustor design, and the static and dynamic performance of rotary regenerators B J

A78-50577 **Recent status on research and development of FJR 710 turbofan engine.** M Matsuki (National Aerospace Laboratory, Chofu, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings
Tokyo, Gas Turbine Society of Japan, 1977, p 1-11

The paper reviews phase I (1971-1976) of a program to develop the FJR 710 five-ton-class high-bypass-ratio turbofan engine Performance results are presented and attention is given to research on engine components, including the fan, the high-pressure test compressor, the combustor, the high-pressure turbine, the low-pressure turbine, the engine control system, and the noise abatement system A brief outline of the phase II program (1976-1981) is presented B J

A78-50578 **Measurements of film cooling effectiveness distributions for exhausting through a double row of holes** N Hirata (Tokyo Shibaura Electric Co , Ltd , Toshiba Research and Development Center, Kawasaki, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings
Tokyo, Gas Turbine Society of Japan, 1977, p 20-23, Discussion, p 23

Experiments were carried out on a flat plate to determine adiabatic wall film cooling efficiency, with hot air exhausting through a double row of holes The test facility consisted of boundary layer control section, exhaust section, and measuring section, results on time-average velocity and fluctuation distributions were obtained It was found that cooling efficiency increased with increasing exhaust velocity B J

A78-50579 **Near-hole region heat transfer in full-coverage film cooling** T Morimatsu, M Hirata (Tokyo, University, Tokyo, Japan), and I Katsumata (Ishikawajima Harima Heavy Industries Co , Ltd , Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings
Tokyo, Gas Turbine Society of Japan, 1977, p 24 28, Discussion, p 28, 29 7 refs

This paper presents a model for the conduction heat transfer within the full-coverage film-cooled wall for the use of high temperature gas turbines The present model based on the idea of thermal symmetry planes is analyzed by using the finite element method and is verified experimentally The investigation has been conducted under the conditions that the injection holes are distributed in staggered array with the hole spacing of 4 times the diameter and that the hole axis is normal to the surface of the wall which has a thickness of twice the hole diameter The experimental results of the temperature distribution in the film-cooled wall with the mass velocity ratio of M = 0 094 show good agreement with the calculated values and, in addition, the significant effect of heat conduction in the near-hole region is mentioned (Author)

A78-50580 **Film cooling of a gas turbine blade** S Ito, R J Goldstein, and E R G Eckert (Minnesota, University, Minneapolis, Minn) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 30-37, Discussion, p 37 13 refs
Contract No N00014-76-C-0246

The local film-cooling produced by a row of jets on a gas turbine blade is measured by a mass transfer technique The density of the secondary fluid is from 0 75 to two times that of the mainflow and the range of the mass flux ratio is from 0 2 to three The effect of blade-wall curvature on the film-cooling effectiveness is very significant On the convex wall, a near tangential jet is pushed towards the wall by the static pressure force around the jet For a small momentum flux ratio, this results in a higher effectiveness compared with that on a flat wall At a large momentum flux ratio, however, the jet tends to move away from the curved wall because of the effect of inertia of the jet resulting in a smaller effectiveness on the convex wall On the concave wall, the effects of curvature are reverse of those described for the convex wall (Author)

A78-50581 **Temperature profiles of rotating cooled blade** Y Shiota, Y Nagashima, Y Morigami, and T Tsuboi (Mitsui Engineering and Shipbuilding Co , Ltd , Tamano, Okayama, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 38-44, Discussion, p 44, 45 7 refs

By carrying out rotating tests of the cooled blade on a one-stage air turbine engine, the temperature profiles of a blade can be measured by means of an infrared camera for a rotating object This paper describes the accuracy of the thermal images of the blade taken by the camera and the blade temperature profiles of all surfaces The temperature profile of a blade can be obtained by superposing three thermal images, namely the suction side, the pressure side and the tip and platform (Author)

A78-50582 **On the nature of jets entering a turbulent flow A - Jet-mainstream interaction B - Film cooling performance** K Kadotani and R J Goldstein (Minnesota, University, Minneapolis, Minn) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 46-59, Discussion, p 53, 54 32 refs
Research supported by the Komatsu, Ltd and U S Navy

An experiment was devised to study the effects on mainstream turbulence intensity between 0 3% and 20 6% and turbulence scale normalized by the injection tube diameter between 0 06 and 0 33 on heated and unheated subsonic jets issuing from a row of inclined holes into a turbulent boundary layer The mainstream turbulence scale has a significant effect on the temperature distribution of the injected jets and on the instantaneous velocity profiles of the flow following injection In addition, consideration is given to the effects of mainstream turbulence on film cooling effectiveness This effect is manifested through changes of (1) boundary layer thickness, (2) mixing between mainstream and injected flow, (3) shape of the injected flow due to vortex formation, and (4) penetration height of the injected flow B J

A78-50583 **Experimental verification of a blade cooling system and comparison with design calculation** D K Mukherjee (Brown, Boveri et Cie AG, Baden, Switzerland), A Suzuki, and K Aizawa (Tokyo Shibaura Electric Co , Ltd , Turbine Development Dept , Yokohama, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings
Tokyo, Gas Turbine Society of Japan, 1977, p 60-67, Discussion, p 68

High cooling effectiveness is required in first-row turbine blades Special test vanes using a combined convective and film cooling system were prepared and tested in the high temperature facility at Toshiba Test results demonstrate the reliability of the calculation method used B J

A78-50584 **Impingement cooling and its application to combustor design** C O Folayan and J H Whitelaw (Imperial College of Science and Technology, London, England) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 69-75, Discussion, p 76 21 refs

Measured and calculated values of adiabatic wall effectiveness and heat-transfer coefficient are reported for the case of a plane,

two-dimensional jet impinging on a flat surface The influence of jet Reynolds number, the ratio of the distance from the jet to the plate to the jet width and the angle of impingement are quantified by measurement and preliminary calculations, based on the solution of elliptic differential equations incorporating a two equation turbulence model, shown to represent carefully the trends of the normal-impingement results The implications of impingement, used in conjunction with film cooling, for the protection of the walls of combustors are demonstrated and shown to be reasonable (Author)

A78-50587 The development of a regenerator seal for vehicular use M Kitano, H Okano (Toyota Motor Co , Ltd , Shizuoka, Japan), T Otani (Hino Motors, Ltd , Hino, Tokyo, Japan), and Y Kondo (Nippon Denso Co , Ltd , Kariya, Aichi, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 97-103, Discussion, p 104 5 refs

The development of a regenerator seal for the GT-21 two-shaft regenerative gas turbine engine for the Hino RL bus is described It was very important for seal durability that the mean contact pressure of the seal against the core should be small and that local contact pressure should not be excessive Candidate materials were surveyed and graphite was found to be the most suitable for a cold side seal and for the peripheral part of the hot side seal A modified seal, whose peripheral part was made of graphite and a thin metal plate, showed good performance and seemed to have good durability B J

A78-50588 Aluminous keatite - A durable ceramic material for rotary regenerator cores D G Grossman and J G Lanning (Corning Glass Works, Corning, N Y) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 105-110 7 refs

Operating characteristics of rotary ceramic regenerator cores in small gas turbines are discussed Included in the discussion are material, configurations and structural considerations Core performance in several different engine designs is described (Author)

A78-50590 Development of the can-type gas turbine combustors K Mori, J Kitajima (Kawasaki Heavy Industries, Ltd , Technical Institute, Akashi, Japan), S Kajita, and H Sone (Kawasaki Heavy Industries, Ltd , Jet Engine Div , Akashi, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 120-127, Discussion, p 128 7 refs

A basic design computer program for gas turbine combustors has been developed by the authors, and its usefulness was testified through the development of the reverse-flow can-type gas turbine combustors Flow-visualization techniques were used to detect the causes of overheating or cracking of the combustor liner and further to find out the appropriate configurations of the guide vanes These vanes have been devised to straighten or to control the complex airflow at the combustor inlet and they were the most practical and effective solution for the improvement of the liner durability in this type of combustors (Author)

A78-50591 Experimental investigation on the scale effects of gas turbine combustion chambers G T Sato, O Kawaguchi (Keio University, Yokohama, Japan), K Suzuki (National Aerospace Laboratory, Chofu, Tokyo, Japan), A Saima (Nihon University, Tokyo, Japan), M Nakayama (Gumma University, Kiryu, Japan), and N Nagai (Tohoku University, Sendai, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 129-135, Discussion, p 135, 136 6 refs

It is very significant at the design and development of a gas turbine combustion chamber to estimate the scale effects From this view point an experimental study has been made on scale effects, using combustion chamber models with four different sizes (flame tube diameter ranged from 125 to 500 mm) but similar forms, simulating the primary portions of practical gas turbine combustion chambers From the experimental results it has been found that the flow patterns in cold state are similar to each other and same types of flames are observed for all the chambers Moreover, the flame temperatures and gas concentrations measured have almost the same values and tendencies over a wide range of operating condition except for the case of the smallest chamber (Author)

A78-50592 A study on a premixed combustor for a vehicular gas turbine T Morishita (Toyota Motor Co , Ltd , Susono, Shizuoka, Japan), K Nakamura (Toyota Motor Co , Ltd , Toyota, Aichi, Japan), and Y Tanasawa (Toyota Central Research and Development Laboratories, Inc , Nagoya, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 137-141, Discussion, p 142 6 refs

A study on premixed combustion and its characteristics are presented Its marginal air temperature and pressure at its flash back limits are quite high up to 700 C and 5 ata which are the conditions required to the premixed combustor as a component of a regenerative gas turbine engine with low pressure ratio And also, combustion characteristics of a premixed annular combustor developed on this concept of the premixed combustion are presented as well (Author)

A78-50593 A new air blast type combustor - Design, performance and emission T Tamaru, K Suzuki, H Yamada (National Aerospace Laboratory, Chofu, Tokyo, Japan), and S Nakano (Ishikawajima-Harima Heavy Industries Co , Ltd , Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 143 150, Discussion, p 150, 151 14 refs
Research supported by the Ministry of International Trade and Industry of Japan

A new type combustor for an aero gas turbine engine was designed and was investigated by a segment model being aimed at high performance and low emission level of pollutants The fuel is atomized in ducts, provided outside of the combustion chamber, and the premixed air fuel mixture is injected so as to make a steady flame holding flow in its dump head Experimental investigation was made on a series of combustors with different directed injectors, and the effect was examined The test results of these combustors at atmospheric condition were satisfactory as the first phase of the development This mixture preparation system was found prosperous for further development for high pressure combustors The exhaust gas analysis results show that emission of NOx is deeply related to the combustion inefficiency Plotting the NOx with respect to the combustion inefficiency is recommended to investigate emission levels of any combustor (Author)

A78-50594 Properties and evaporation of jet-engine fuels at pressurized conditions T Aiba (National Aerospace Laboratory, Chofu, Tokyo, Japan) and Y Enzaki (Kawasaki Heavy Industries, Ltd , Akashi, Hyogo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings
Tokyo, Gas Turbine Society of Japan, 1977, p 152-159, Discussion, p 160 13 refs

Thermal and physical properties of jet-engine fuels JP-4 and JP-5 at pressurized conditions up to 30 atm are evaluated based on the general evaluation methods described by Sato (1958) The relevant properties are the critical temperatures, critical pressures, boiling points, densities, thermal conductivities, specific heats, latent heats of vaporization, and diffusion coefficients These kinds of property are essential for the calculation of evaporation processes of fuel droplets in aircraft gas turbine combustors The results obtained showed the dependence of the values on the distillation characteristics of the fuels, complex variations of the values at high pressures, and fairly good agreement with several data in other works Evaporation processes of stationary or moving single fuel droplets in pressurized hot air were calculated based on the indicated fuel properties Calculated evaporation rate of a stationary droplet showed a good agreement with experimental results (Author)

A78-50598 **Smoke and nitric oxide control for gas turbine engines burning light/heavy fuels** K Kawaguty (Mitsubishi Heavy Industries, Ltd , Nagasaki Technical Institute, Nagasaki, Japan), C Turuto, and N Sato (Mitsubishi Heavy Industries, Ltd , Takasago Technical Institute, Takasago, Hyogo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 184-191, Discussion, p 192, 193 15 refs

This paper summarizes our gas turbine clean combustor pro gram, covering smoke visibility analysis and practical solutions in minimizing exhaust emissions for use of distillate and heavier residual fuels A semi-empirical technique for predicting smoke levels has been developed which shows considerable promise as a design criterion Commercial gas turbine tests, consisting of smokeless combustors based on this analytical model, offer good combustion performance as well as the common reduction of both NOx and smoke levels It is also proved that water mixed combustion systems proposed provide the additional control of smoke and NOx levels burning light/heavy fuels (Author)

A78-50599 **Aerodynamic and cooling performances of a film cooled turbine** H Nouse, K Takahara, Y Yoshida, A Yamamoto, K Sakata, S Inoue, F Mimura, and H Usui (National Aerospace Laboratory, Chofu, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 206-214 5 refs

A high temperature turbine testing was conducted by using a full scale, air-cooled turbine test apparatus Film cooling was employed in the leading edge, either of the stator vane and the rotor blade of the turbine which was designed for the first stage core turbine of a turbofan engine The design value of the turbine inlet temperature was 1523 K This paper presents the basic aerodynamic data obtained from cold air tests and the experimental temperature data of the film cooled stator vane and rotor blade that were taken at high temperature conditions The aerodynamic adverse effects due to coolants are discussed by comparing the experimental data with a predicted turbine performance and the results of a convection cooled turbine testing The cooling characteristics of the vane and blade are compared with the results of two dimensional cascade testings conducted at the reduced temperature condition (Author)

A78-50600 **Experiment on aerodynamic and heat transfer characteristics of a cooled turbine cascade losing a few blades** K Hiraoka, T Morishita, and S Kan (Ship Research Institute, Mitaka, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 215-222

The effect of blade failure on the aerodynamic and heat transfer characteristics of the cooled turbine cascade was investigated experimentally and theoretically When a few blades are lost from normally operating cascade, the aerodynamic force exerted to and the heat transfer coefficient of the blade which faces the convex surface to the place with a few blades lost increase sharply The method to calculate the aerodynamic and heat transfer characteristics of the cascade with some blades lost is given A calculation shows there exists serious rise of stress and temperature in the blade adjacent to the place with the blades lost and it may cause continuous failure of blades (Author)

A78-50601 **Development of the experimental gas turbine bus** S Yamazaki and T Itoh (Nissan Motor Co , Ltd , Central Engineering Laboratories, Yokosuka, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 223-229, Discussion, p 230

Nissan Motor Company has designed and built the experimental gas turbine buses to evaluate the performance of vehicles equipped with gas turbines The purposes of developing a gas turbine bus are to purify exhaust gas emissions, eliminate smoke and odor, reduce driving noise, and ultimately to manufacture a bus that permits greater riding comfort, with less pollution and less vibration This paper describes the construction, performance, noise reduction and emission control of the Nissan Gas Turbine Bus (Author)

A78-50602 **Advantages of 3-shaft KTT gas turbine configurations for automotive applications** S O Kronogard (United Turbine AB and Co , Malmo, Sweden) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 231 238, Discussion, p 238 240 6 refs

This paper gives a brief description of an experimental version of the KTT turbine system, its components and their relative arrangement as well as some of the basic thinking behind this new concept The paper also gives a short description of the possibilities with this system to introduce ceramics at an early stage It also describes a new way of obtaining fast acceleration, low idling speed and low part load fuel consumption (Author)

A78-50603 **A development of advanced radial gas turbine for automobile** S Sasaki, K Takizawa (Toyota Motor Co , Ltd , Susono, Shizuoka, Japan), and N Mizumachi (Tokyo, University, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 241-247, Discussion, p 247, 248 5 refs

A performance estimation of a radial inflow turbine based commonly on the assumption in which the flow at rotor-exit was one-dimensional having no rotor-exit swirl Through the investigation of the test results obtained from the turbine designed with this design procedure, it was found to be expectable to have some improvements by having an alternative design approach The new design procedure would be described as follows The flow at rotor-exit was analyzed two dimensionally in which the loss distribution from the rotor hub to tip was assumed to be a function of rotor-exit radius The optimum rotor exit swirl corresponding to the maximum efficiency was obtained by estimating performances for various intensities of swirl The efficiency of the turbine designed with the improved design procedure indicated the improvement by about 7 percent compared to the case of the turbine designed by using the conventional procedure (Author)

A78-50604 **Energy economy with high temperature gas-turbine** H G Munzberg (Munchen, Technische Universitat, Munich, West Germany) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 249-258, Discussion, p 259 5 refs

Techniques for cooling high-temperature gas turbines are considered, and a comparison of air cooling and liquid-metal cooling of gas turbines with hollow blades shows the superior advantages of the latter technique An optimization study for the liquid-metal cooling is reported, and the utilization of the liquid-metal heat and of the exhaust heat is considered Gas turbines with good fuel consumption characteristics are compared with gas turbines with optimized construction features M L

A78-50605 **Thermodynamical performances of closed-cycle gas-turbine** T Shirakura and S Awano (Nihon University, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 260 267, Discussion, p 268-270 5 refs

This paper reports the analytical results on the thermodynamical performances of a closed-cycle gas-turbine, which comprises a compressor, heat-exchangers, gas heater and pre cooler worked by various working gases such as air, helium, argon and carbon-dioxide The performance changes with the choice of working gas are made clear under two kinds of conditions, one of which is the case wherein the working volume of the circuit is varied so that the total pressure loss coefficients of the heat-exchangers will be held constant, and the other is the case wherein the working volume is held constant and

the total pressure loss coefficients of the heat-exchangers are changed with the adopted working gases The results show that helium is the most favorable gas, because it produces high efficiency and output at a low pressure ratio such as 2 5 to 3 8 The total pressure loss of heat-exchanger for helium is about one tenth of that for air, and its power loss decreases to about 21% of that for air Air is another favorable gas, producing nearly the same thermal efficiency and output as those of helium at a higher pressure ratio such as 5-6 (Author)

A78-50606 Calculation of cascade flow by means of spline fit singularity M Inoue and M Kuroumaru (Kyushu University, Fukuoka, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 288-295 14 refs

This paper includes a calculation of the potential flow through a cascade of airfoils by means of an improved singularity method The continuous distribution of vortex as the solution can be obtained by use of the spline fit function The accuracy becomes higher without a drastic increase of the number of surface elements as usual methods The velocity distribution along the blade surface is represented by a set of cubic polynominals so as to facilitate computation of the boundary layer It is possible to deal with a trailing edge condition in viscous flow by selecting appropriate end conditions of the spline fit The method has been applied to turbine cascades and possible extension to the problem of the viscous trailing edge flow has been discussed (Author)

A78-50607 Numerical analysis of flow through turbine cascade by the Modified FLIC Method T Nagayama and T Adachi (Mitsubishi Heavy Industries, Ltd , Nagasaki Technical Institute, Nagasaki, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 296-300 7 refs

This paper presents a numerical method for a calculation of flow through turbine cascades The method, named the Modified FLIC Method, uses the triangular finite difference mesh pattern which is different from the rectangular mesh pattern for the usual FLIC Method Starting with a given flow distribution, the calculation is repeated until a steady state solution is obtained (Time-Marching) The numerical results are compared with the optical experimental data using a shock tunnel Satisfactory agreements are shown between the calculation and the experiment (Author)

A78-50608 Three-dimensional and relaminarization effects in turbine blade cascades - An experimental study L Belik (Vysoka Skola Strojni a Elektrotechnicka, Plzen, Czechoslovakia) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 301-309, Discussion, p 309, 310 14 refs

The wind tunnel experiments described were carried out to study the phenomena occurring in three-dimensional boundary layers within the blade apertures of linear turbine blade cascades with aspect ratios between 0 25 and 1 5 at flow velocities ranging from 15 to 60 m/sec Shearing stresses were measured with a heated film element Reverse transition in the turbulent blade-aperture boundary layer was observed at high flow velocities even in the case of high inlet-flow turbulence and nonuniform velocity profiles V P

A78-50609 Development of velocity profile through a stage of axial flow turbomachinery T Ikui, M Inoue, and M Kuroumaru (Kyushu University, Fukuoka, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 311-318 26 refs

A single-stage axial flow fan has been used to evaluate the effect of the inlet velocity profile on the stage performance with the development through the stage It is found that the development of the inlet velocity profile influences the pressure rise and the efficiency but not the shaft power In order to predict the flow condition in the merged velocity profile, a calculation method has been devised It utilizes cascade data and the radial equilibrium equation It accounts for the effect of secondary flow, tip clearance, wall stall, and viscous shear stress S C S

A78-50610 An experimental study of the annular diffusers in axial-flow compressors and turbines A Takehira, M Tanaka, T Kawashima, and H Hanabusa (Kawasaki Heavy Industries, Ltd , Technical Institute, Akashi, Hyogo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 319-326, Discussion, p 327, 328

A study has been made of diffuser assemblies having annular cross sections and used in axial-flow compressors and turbines The testing configuration consisted of a blower, main and bypass valves, an orifice pipeline, a settling section, and a working section Measurements were made of total and static pressure in inlet and outlet measuring planes, static pressure on the surfaces of the entry length and the diffuser, and the pressure difference across the orifice The results are presented on performance charts which may be used to predict the performance of any diffuser with a standard configuration S C S

A78-50611 Radial equilibrium of flows in shock-in-rotor type rotors T Hashimoto and S Otsuka (Nagoya University, Nagoya, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 329-336, Discussion, p 336

The necessity of radial equilibrium is pointed out in the treatment of such flows as in shock-in-rotor type rotors Based on the assumptions that the flow is quasi-axisymmetric and the meridional streamline is parallel to the axis, an analysis is done of the flow in the axial-flow type rotor and the basic equations are derived The establishment of radial equilibrium of quasi-axisymmetric flows are investigated in the entire passage of rotor containing supersonic region, normal shock, and subsonic region Two examples, one with the known enthalpy addition to the flow from the rotor and another with the known turning angle, are calculated The results show the possibility of the application of ideas stated in this report to the design of a shock-in-rotor type rotor (Author)

A78-50612 A research on centrifugal compressor for small gas turbine - The effect of recirculating flow S Higuchi (Toyota Motor Co , Ltd , Susono, Shizuoka, Japan) and K Nakamura (Toyota Motor Co , Ltd , Toyota, Aichi, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 337-342, Discussion, p 342, 343

The recirculating flow in centrifugal compressor was investigated on its effects to the performance through both the empirical and theoretical studies The effects on compressor performance were investigated here by considering it for impeller and diffuser separately This study indicated that the compressor stage characteristics were continuously deteriorated as the recirculating flow rate increased, which would adversely affects on the performance of a gas turbine engine especially when the engine size is small Since the recirculating flow effects tend to increase as mass flow rate reduces This study also indicated that the effects were predictable by considering both the pressure drop at diffuser inlet and the resulting mismatching of diffuser inlet angle due to the recirculating flow It was suggested that the degree of the deterioration due to the recirculating flow would be minimized by guiding the recirculating flow towards radial direction at rotor tip (Author)

A78-50613 Pressure at shroud and flow in a supersonic centrifugal impeller Y Senoo, Y Kinoshita, H Hayami (Kyushu University, Fukuoka, Japan), K Hara (Nissan Motor Co , Ltd , Tsurumi, Yokohama, Japan), H Kobayashi (Hitachi, Ltd , Mechanical Engineering Laboratory, Tsuchiura, Ibaraki, Japan), and T Ishiuchi In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 344-351, Discussion, p 352 8 refs

The impeller of a supersonic centrifugal compressor was tested in a casing without the diffuser so that the flow range was not limited by the diffuser In the case of supersonic inlet-relative velocity, the impeller ran into surge as soon as the inducer stalled However, it was demonstrated that if the inlet-relative velocity was

subsonic, the impeller ran stably even when the inducer was stalled and the surge limit was decided by the ratio of the relative velocities at the exit and the inlet of the impeller It was demonstrated that the choked flow-rate was predictable by a one-dimensional flow-analysis providing that the preswirl is weak Furthermore, the variation of shroud pressure with respect to time was utilized to guess the flow behavior between impeller blades A detached shock-wave and a shock wave in the blade channel were clearly recognized, where the shock wave in the channel moved downstream as the back pressure was reduced (Author)

A78-50614 Investigation of flow in centrifugal impeller with tandum inducer M P Boyce (Texas A & M University, College Station, Tex) and A Nishida (Komatsu, Ltd , Technical Research Laboratories, Kawasaki, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 353-361, Discussion, p 361, 362 17 refs

In this paper, both theoretical and experimental investigations of flow in a centrifugal impeller with a modified tandem inducer have been carried out with a view to gain a possible reduction of flow separation in the impeller The compressor characteristics are obtained with the inducer section rotated relative to the radial impeller, and are compared with the unmodified impeller characteristics As a result of the studies, the tandem inducer increases the stall-to-surge margin and improves the efficiency (Author)

A78-50616 Surge responsibility and range characteristics of centrifugal compressors T Yoshinaka (Pratt and Whitney Aircraft of Canada, Ltd , Longueuil, Quebec, Canada) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 381-388, Discussion, p 389, 390 15 refs Research supported by the Department of Industry, Trade and Commerce of Canada

This paper presents an analysis of the surge and range characteristics of centrifugal compressors based on a diagram comparing the inducer inlet flow coefficient to the diffuser leading edge flow angle for each compressor speed This diagram readily identifies component responsible for compressor surge and choke, because of the geometric divergence of the choke and stall loci of both the diffuser and inducer Using this diagram, experimental data for centrifugal compressors up to 12 1 pressure ratio are presented which support the proposed model The effects of inducer inlet prewhirl and diffuser vane resetting on compressor surge and range characteristics are also discussed (Author)

A78-50617 Unsteady dynamic responses of subsonic cascades to sinusoidal gust III - Stator and rotor blade cascades in oscillation T Nishiyama (Tohoku University, Sendai, Japan) and T Kobayashi (Tokyo Shibaura Electric Co , Ltd , Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 409-417 12 refs

The unsteady aerodynamic characteristics by mutual interferences between stator and rotor blade cascades in bending and torsional oscillations are analyzed in subsonic flow by acceleration potential method As its result, the compressibility effects on unsteady aerodynamic forces and also the flutter characteristics are clarified by numerical examples (Author)

A78-50618 A modification of flutter characteristics by changing elastic nature of neighbouring blades in cascade Y Hanamura and H Tanaka (Tokyo, University, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 418-425, Discussion, p 426, 427

A new method to improve the flutter characteristics of the cascade is developed It is confirmed in both theory and experiment that, by changing the elastic nature of the neighbouring blades, the flutter velocity is increased greatly compared with the case of uniform elastic nature Nonuniformity of natural frequency suppresses the aerodynamic coupling between adjacent blades and delays the occurrence of flutter Though too much discrepancy of natural frequency of course diminishes the merit, an increment of natural frequency ratio of a neighbouring blades up to some value (eg 1 2-1 3) makes the flutter velocity higher conspicuously If both ratios of mass and natural frequency of the neighbouring blades are changed at the same time, the more merits are gained than in case of changing either ratio only (Author)

A78-50619 Some considerations on pure tone noise generation in an axial-flow fan S Fujii, H Nishiwaki, M Watanabe, and H Kobayashi (National Aerospace Laboratory, Chofu, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 428-436, Discussion, p 436 16 refs

Acoustic survey data with flow measurements were obtained for a fan test rig operated in an anechoic room These experimental data were then evaluated by an analytical method for the pure tone noise generation due to the upstream wake cut by the rotor blade The analysis employed the Sears' and Horlock's lift forces as well as the flowing medium effect In order to obtain more accurate solutions, the combined effects of turbulent shear force and rotor induced pressure were taken into consideration in estimating the wake profile Agreements with the measured data were good (Author)

A78-50620 A study of fan-rotating noise reduction K Ishizawa, M Uyama, K Higashi (Ishikawajima Harima Heavy Industries Co , Ltd , Tokyo, Japan), and R Sasaki (Japan Defense Agency, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22 27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 437 441, Discussion, p 442, 443 6 refs

The characteristics of fan-rotating noise are evaluated in order to determine the optimal acoustic treatment of engine inlets and to reduce aircraft noise levels The study is conducted on the basis of a high-bypass-ratio, subsonic turbofan engine It is found that contrary to a previous study based on the plane-wave theory, acoustically treated splitter rings are not required to reduce aircraft noise To explain this disparity, it is assumed that fan inlet noise behaves according to the spinning-mode theory The number of fan rotor blades determines the spinning-mode number S C S

A78-50621 Noise control analysis for gas turbine installations F Y Tsuchiya (Donaldson Co , Inc , Minneapolis, Minn) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 444-448 9 refs

The reported study was conducted in connection with the objective to assure consistency in noise measurement practices throughout the industry A basic analysis procedure for sound measurement is shown Problem determination or problem definition initially describes the general reason for desiring sound measurements Once the problem is defined, it is then necessary to determine the type or magnitude of the sound survey needed to obtain the required data and information Attention is given to the definition of the problem, the gas turbine noise, the measurement technique, and the microphone response curve G R

A78-50622 Noise from separated flow of flat plate Y Maruta, S Kotake (Tokyo, University, Tokyo, Japan), and K Takeda (National Aerospace Laboratory, Chofu, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 449-454, Discussion, p 454 7 refs Research supported by the Japan Society of Mechanical Engineers

Measurements are made of the separated flow of a flat plate immersed in a uniform flow with a large attack angle The noise is characterized by the acoustic radiation of a dipole source distributed on the plate surface The flow condition around the plate determines its intensity The time derivative of the fluctuating pressure on the plate surface is nearly the same as the acoustic field The position of the intensive acoustic source on the separated region retreats from the leading edge to the chord center with increasing attack angle S C S

A78-50623 **An automatic processing system for vibration data analysis of gas turbine engines** K Jinboh, H Aono, and T Kawashima (Ishikawajima-Harima Heavy Industries Co , Ltd , Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 455-460

A new system to process vibration and acoustic data of gas turbine engines has been developed and installed at IHI to accelerate gas turbine engine development In order to get rapid and accurate results, the system combines the power of a digital computer together with a real time frequency analyzer This system accepts analog input data representing engine rotational speed and vibration, analyzes them in frequency domain and illustrates in Campbell diagram on Strage Scope automatically Practical application of this system to several engine behavior such as blade vibration, shaft vibration, casing vibration and others have been made with favorable results this system can save analysis time, improve engineering understanding and enable a more rapid turnround of engine tests In this paper, the system and its typical applications are described (Author)

A78-50625 **Assessment of the structural-mechanical design of commercial aircraft gas turbine engines** K Schuppisser (Boeing Co , Seattle, Wash) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 471-482, Discussion, p 483 19 refs

The reported investigation has the objective to provide a guideline through the structural-mechanical design complexity of aircraft gas turbine engines A frame of reference is established by presenting an overview of the salient structural-mechanical aspects of engine design and operation as applicable to commercial aircraft propulsion The structural buildup of an engine is considered along with the choice of materials, aspects of mechanical design and engine reliability, mechanical design requirements, engine development experience, engine performance experience, engine maintenance experience, technical information requirements, engineering skill requirements, and questions of engine assessment G R

A78-50626 **Research and development of digital jet-engine controls** M Endo, K Nishio, N Sugiyama, T Koshinuma, and Y Matsuda (National Aerospace Laboratory, Chofu, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 493-500, Discussion, p 501 6 refs

The research and development program of digital jet engine controls at the National Aerospace Laboratory, Tokyo, Japan is discussed Attention is given to (1) the real time simulation of jet engines, (2) the step responses of engine speeds, turbine inlet and outlet gas temperatures, and compressor discharge pressure, and (3) the general-purpose digital mini-computer The prototype hardware electronic engine controls are described noting demand and sensing devices, the digital electronic computer section, and variable stator vanes control S C S

A78-50630 **Silicon nitride ceramics for gas turbine engines** K Komeya, A Tsuge, H Hashimoto, T Kubo (Tokyo Shibaura Electric Co , Ltd , Toshiba Research and Development Center, Kawasaki, Japan), and T Ochiai (Tokyo Shibaura Electric Co , Ltd , Metal Products Div , Yokohama, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 538-542, Discussion, p 543 21 refs

A specified Si3N4 ceramic that retains its mean bending strength of more than about 100 kg/sq mm at temperatures up to 1300 C was developed by applying a new Grain-Boundary Crystallization (GBC) hot pressing process to Si3N4 powder compacts with Y2O3 and Al2O3 additives Microstructural and mechanical properties of the material were investigated Weibull modulus values, calculated from high temperature strength data, were 13 to 17 This ceramic was not deformed at up to 1500 C and a strain rate of approximately 2 8-4 9 x 10 to the -5th power/min at 1600 C under a stress of 33 5 kg/sq mm It could be thrown into water without any damage Applicability of the Si3N4 to gas turbine uses was discussed (Author)

A78-50632 **Development of ceramic components for an automotive gas turbine** P Walzer (Volkswagenwerk AG, Wolfsburg, West Germany) and S Forster (Kernforschungsanlage Julich GmbH, Julich, West Germany) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 550-557, Discussion, p 557, 558 14 refs Research sponsored by the Bundesministerium fur Forschung und Technologie

The article surveys the development of components made from high-temperature ceramics for applications in automotive gas turbines Requirements for ceramic turbine components are identified for both steady-state and unsteady operation Various high-temperature ceramics are described including Si3N4 (hot pressed, reaction sintered), SiC (hot pressed, reaction bonded, Si infiltrated), and glass ceramics Current research on the development of ceramic combustion chambers, turbine rotors, and rotors with metallic hubs and ceramic blades is reviewed S C S

A78-50633 **Application of self-cleaning air cleaners to aircraft and vehicular gas turbines** G Bishop (Aircraft Porous Media, Inc , Glen Cove, N Y) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 559-564, Discussion, p 564, 565

The investigation demonstrates the ability of inertial separators and mist eliminators systems to provide a means of supplying compact, economical low maintenance air cleaning to a wide variety of gas turbine applications The design objectives with respect to these systems are related to helicopter and aircraft operational experience in dirty, sandy environments, which has drawn attention to the acute need for adequate cleaning of gas turbine inlet air The principle of separation is considered along with particle size vs separation efficiency, performance vs scavenge flow, the multitube inertial air cleaner panel, and aspects of mist removal G R

A78-50634 **An experiment of deposit formation on surface of an air-cooled gas-turbine blade** M Nomura, T Morishita, and S Kan (Ship Research Institute, Mitaka, Tokyo, Japan) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 566-572, Discussion, p 573

An experimental investigation was made to study deposit formation around an air-cooled turbine blade by using a two-dimensional cascade Residual fuel oil was used to make actual corrosive combustion gases The experiment was done at the stream temperatures of 800 to 1100 C, the total pressures of 1 6 and 3 0 atm, and the cascade Reynolds numbers of 1 5 x 10 to the 5th power and 2 0 x 10 to the 5th power Distinct deposits were formed in the turbulent boundary layer region on the convex surface These deposits were influenced by the temperature of the cooled surface of the blade at a constant stream temperature and pressure In the vicinity of the leading edge and on the concave surface, deposits were scarcely formed The principal constituents of the deposits were Na2O V2O4 5V2O5, V3O5 and Na2SO4 (Author)

A78-50635 **Aerodynamic effects on erosion in turbomachinery** W Tabakoff and A Hamed (Cincinnati, University, Cincinnati, Ohio) In Tokyo Joint Gas Turbine Congress, Tokyo, Japan, May 22-27, 1977, Proceedings Tokyo, Gas Turbine Society of Japan, 1977, p 574-580, Discussion, p 581 11 refs Grant No DAAG29-76-G-0229, Contract No E(49-18)-2465

A unique erosion test facility was designed such that the aerodynamic effects are an integral part of the test parameters The alloys studied in this investigation are 2024 aluminum, 410 stainless steel and 6Al-4V titanium High-speed-movies were used to examine and determine the impact and rebound characteristics of the solid particles The effects of particle velocity and impact angle were

found to be statistical in nature The statistical distributions of these impact parameters were determined experimentally The rebound data was then related to the erosion damage incurred In addition, the effect of temperature on the erosion of the alloys was also studied (Author)

A78-50650 **Broadband noise in axial-fan blade cascade** N Yamaguchi, M Nishimura, T Tominaga, and M Kataoka (Mitsubishi Heavy Industries, Ltd , Takasago Technical Institute, Takasago, Hyogo, Japan) *Mitsubishi Heavy Industries Technical Review,* vol 15, June 1978, p 120-129 9 refs

In order to obtain a prediction method of axial-fan aerodynamic noise, the broadband noise, one of the important components of the fan noise, was estimated with a similarity relation using 'normalized blade noise' The normalized blade noise is derived by two-dimensional cascade tests conducted on a low-speed wind tunnel in the large anechoic room of Takasago Technical Institute of Mitsubishi Heavy Industries and tests of actual fans as annular cascade The normalized blade noise was found to be nearly constant regardless of cascade geometry The difference between the two-dimensional and the annular value was small, and was considered to correspond with the difference in operating conditions of their respective blade element Usefulness is shown of the noise prediction method using the normalized blade noise (Author)

A78-50659 # **Circles, texture, etc - Alternate approaches to CIG scene detail** W M Bunker (General Electric Co , Daytona Beach, Fla) and M L Ingalls (USAF, Human Resources Laboratory, Wright-Patterson AFB, Ohio) In Flight Simulation Technologies Conference, Arlington, Tex , September 18-20, 1978, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 49-58 Contract No F33615-76-C-0038 (AIAA 78-1578)

The original goals of the discussed investigations were related to the development of techniques for providing the missing, and badly needed, scene detail over large gaming areas As the effort proceeded and insight was gained, the goals were expanded to take advantage of the broader applicability of the techniques developed Approaches to surface detail are discussed along with noise textures, details of computer image generation (CIG) processing, ellipsoidal features, surface-map texture, and the application of scene detail to training from the user's viewpoint In an evaluation of the results of the investigations it is found that the effort to develop new primitives for CIG scene detail has been fruitful The ellipsoidal features and surface-map texture have significant areas of application in which they are more efficient and more effective than edges in contributing to training requirements G R

A78-50660 # **COMPUTROL - A *new technique in image* generation** R Swallow (Human Resources Research Organization, Alexandria, Va), R Goodwin, and R Draudin (Austin Co , Advanced Technology Systems, Roselle, N J) In Flight Simulation Technologies Conference, Arlington, Tex , September 18-20, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 59-67 (AIAA 78-1579)

The inadequacies of current daytime computer generated image (CGI) techniques led to the development of the COMPUTROL *Day/Dusk/Night Image Display and Control System The goal of this* development was increased capability for the real time manipulation of perspective views of three-dimensional objects The resulting system design will be capable of generating enhanced detail for terrain, cultural features, and moving target models while also displaying such special effects as weapon impacts and transparencies The COMPUTROL system is a special purpose design and does not use general purpose hardware other than standard peripheral equipment such as magnetic tape or disk units Attention is given to design capabilities, the basic system hardware configuration, and the functional operation of the CGI system G R

A78-50661 # **Advanced Tactical Air Combat Simulation /ATACS/ - An overview of Project 2363** W B Albery and G J Dickison (USAF, Human Resources Laboratory, Wright Patterson AFB, Ohio) In Flight Simulation Technologies Conference, Arlington, Tex , September 18-20, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 68-72 (AIAA 78-1580)

The objective of ATACS is to develop and to demonstrate the technology necessary to provide full visual simulation of Tactical Air (TACAIR) combat missions, at an affordable cost, suitable for the next generation fighter/attack visual simulators TACAIR combat *missions are missions involving visual contact for delivery of* air-to-surface weapons and visual air-to air combat The key components which must be developed and integrated to provide the TACAIR simulation capability include high-resolution, high-brightness color projectors capable of producing multiple high-resolution targets on a color background Attention is given to a liquid crystal light valve projector, a trichromatic holographic pancake window, and details of computer image generation G R

A78-50662 # **Correlated data bases for the present and future** T W Hoog (USAF, Aeronautical Systems Div , Wright Patterson AFB, Ohio) In Flight Simulation Technologies Conference, Arlington, Tex , September 18-20, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 73-78 (AIAA 78-1583)

An analysis is conducted of the part of the overall simulation problem that deals with topographical data used in the simulation of ground mapping sensors, out the window visual scenes, electronic warfare environments, and navigation aids environments A solution to the problem of maintaining correlation of these functional areas is proposed which emphasizes correlation of data bases at the source A *demonstration is provided of problems which can arise if the radar,* visual, electronic warfare, and navigational aids environments are modeled independently without regard for each other A representation is given of the data sources used in a typical modern Air Force simulator G R

A78-50669 # **Test instrumentation system for flight simulator handling characteristics** W L Curtice (USAF, Aeronautical Systems Div , Wright-Patterson AFB, Ohio) In Flight Simulation Technologies Conference, Arlington, Tex , September 18-20, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 164-168 (AIAA 78-1595)

The Air Force is now developing the Simulator Data Test Instrumentation System as an in-house project at the Aeronautical Systems Division Air Force engineers started detail design tasks in June of 1978 Development completion is targeted for June of 1979 The causes for poor simulation handling qualities fidelity are examined, taking into account the use of inaccurate aero data bases, model shortcutting, cue phasing and magnitude, and the lack of a comprehensive test and measurement capability Attention is given to time delay measurements performed, the strengths and weaknesses identified, new system requirements/capabilities, and the system design approach employed G R

A78-50671 # **Optical simulator with a holographic component** J A LaRussa (Farrand Optical Co , Inc , Valhalla, N Y) and A T Gill (USAF, Human Resources Laboratory, Wright Patterson *AFB, Ohio) In Flight Simulation Technologies Conference, Arling*ton, Tex , September 18-20, 1978, Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 176-179 (AIAA 78 1581)

The considered optical simulator was found to be very successful as an infinity display system in many applications where performance and cost are important In connection with its minimal depth and, therefore, relatively flat appearance the device has been called Pancake Window A typical Pancake Window system can provide a number of characteristics related to eye relief, a maximum *decollimation of 9 arc minutes, and the absence of color or*

distortion over an 84 deg total field where the only significant aberration is the spherical aberration Pancake Windows as first developed, both classical and holographic, suffer imperfections such as ghosts and bleedthrough However, a recent improvement in Pancake Window design has succeeded in eliminating both bleed-through and ghost images from the viewing volume G R

A78-50673 # **Prediction of pressure field induced by lifting surfaces with unsteady airloads and its application** S Chu (National Taiwan University, Taipei, Nationalist China) *National Science Council, Proceedings,* vol 2, July 1, 1978, p 293 299 12 refs National Science Council of Nationalist China Contract No 66E 0401-02(01)

The subsonic unsteady flow is characterized by the phenomenon that there is a complicated wake system consisting of both trailing and shedding vortices behind lifting surfaces Therefore, in order to avoid the impractical task of applying Biot Savart law to each vortex element of this wake system, the perturbation pressure in the flow field is determined directly by formulating a boundary-value problem with unsteady pressure distributions on lifting surfaces as boundary conditions In this approach, Galilean-Lorentz transformation is first taken to reduce the governing equation to the form of an acoustic wave equation Then a general solution is obtained by superimposing acoustic sources and/or doublets with their respective strengths being the Neumann and/or Dirichlet boundary conditions in the transformed space By applying the result obtained, the pressure distribution on the body surface of a wing body combination, which is induced by the unsteady airload acting on the wing, can be calculated The wing-body interaction in unsteady flow can thus be determined (Author)

A78-50691 # **Numerical study on the stability dependence of geostrophic drag and cross-isobar angle** N Yamada (Nihon University, Narashino, Japan) *Meteorological Society of Japan, Journal,* vol 56, June 1978, p 197-205 24 refs

The equation of motion on the unstably stratified PBL under stationary, horizontally homogeneous, and barotropic conditions is numerically solved with the use of so-called simple K theory The numerical predictions on the stability dependences of the geostrophic drag coefficient and the surface cross isobar angle agree with the observational data of Wangara and AMTEX on the average In addition, the present calculations predict that the surface cross isobar angle decreases as the value of ratio of the actual height of PBL to the dynamical scale height increases This tendency is found in the data of Wangara but not in those of AMTEX (Author)

A78-50717 # **Natural frequencies of a soft heavy cylindrical shell under the effect of internal pressure (Sobstvennye chastoty miagkoi tiazheloi tsilindricheskoi obolochki pri deistvii vnutrennego davleniia)** A A Chakhoian (Leningradskii Korablestroitel'nyi Institut, Leningrad, USSR) *Akademiia Nauk Armianskoi SSR, Izvestiia, Mekhanika* vol 31, no 2, 1978 p 13-18 In Russian

The plane problem of the free vibrations of a soft heavy cylindrical shell subjected to internal pressure is solved Particular emphasis is placed on the influence of the weight of the shell on its dynamic behavior The relationship between shell weight and natural frequencies is examined B J

A78-50751 **Some problems of continuum mechanics (Nekotorye voprosy mekhaniki sploshnoi sredy)** Edited by S S Grigorian Moscow, Izdatel'stvo Moskovskogo Universiteta, 1978 291 p In Russian

The papers compiled in the present volume deal with theoretical and experimental studies of actual problems of continuum mechanics The topics studied include such fields as gasdynamics, hydrodynamics, the theory of plasticity, the development of models, and fluid flows involving electric, magnetic, and chemical effects V P

A78-50752 # **Basic model concepts of fluid mechanics in wing theory (Ob osnovnykh model'nykh predstavleniiakh mekhaniki zhidkosti i gaza v teorii kryla)** G Iu Stepanov In Some problems of continuum mechanics Moscow, Izdatel'stvo Moskovskogo Universiteta, 1978, p 5-28 26 refs In Russian

In the present paper, the principal model concepts of wing theory are reviewed with emphasis on two-dimensional flows past wings Some common features and relationships of representative models are examined, along with theoretical considerations concerning the formulation of some problems within the framework of classical ideal and viscous fluid models V P

A78-50757 # **Contribution to the theory of three-dimensional hypersonic viscous gas flow past blunted bodies in the presence of injection (K teorii prostranstvennogo obtekaniia zatuplennykh tel giperzvukovym potokom viazkogo gaza pri nalichii vduva)** E A Gershbein In Some problems of continuum mechanics Moscow, Izdatel'stvo Moskovskogo Universiteta, 1978, p 144-156 16 refs In Russian

In the present paper, the equations of the three-dimensional hypersonic shock layer are written in an arbitrary system of coordinates, normally coupled to the surface of the body, with Dorodnitsyn transforms applied to the coordinates An integral method of successive approximations is proposed for solving the equations An analytical first-approximation solution is obtained to the problem of hypersonic flow past a triaxial ellipsoid, an elliptical paraboloid, and a hyperboloid in the presence and absence of injection V P

A78-50777 # **A theoretical and experimental analysis of the influence of coolant discharge from perforated turbine blades on their aerodynamic behavior (Raschetno-opytnyi analiz vliianiia sbrosa okhladitelia iz perforirovannykh turbinnykh lopatok na ikh aerodinamicheskie kharakteristiki)** R S Agachev and B A Kumirov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 10-15 In Russian

A method for calculating the velocity loss coefficient in the steady two dimensional flow behind air-cooled turbine blades is proposed, and the theoretical assumptions employed are verified experimentally Experimental results obtained with blades perforated at the leading edge showed that the cooling-air blowing intensity has a very small effect on the velocity losses and the blade exit angle Likewise, the influence of coolant discharge on the pressure distribution over a perforated blade was found to be insignificant V P

A78-50778 # **Theory on the two-frequency ranges for the unsteady fluctuations of the turbulent combustion process in a jet-engine combustion chamber II - Analysis of the characteristic equation, comparison with the experiment (Teoriia dvukh chastotnykh diapazonov neustoichivykh kolebanii protsessa turbulentnogo goreniia v kamere reaktivnogo dvigatelia II - Analiz kharakteristicheskogo uravneniia, sravnenie s eksperimentom)** S K Aslanov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 16-21 6 refs In Russian

A78-50779 # **Distortion of a flat jet in a bounded cross-stream in the presence of a wake space (Iskrivlenie ploskoi strui v ogranichennom snosiashchem potoke pri nalichii zastoinoi zony)** E N Bogomolov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 22-30 5 refs In Russian

In the present paper, the equation of motion along the normal to an element of a plane jet distorted by a cross-wind is integrated with allowance for the low-density region arising in the eddy zone below the jet Formulas are derived for calculating the coordinates of the mean streamline of the jet The pressure coefficient in the eddy zone is determined experimentally V P

A78-50780 # **Experimental investigation of the thermo-acoustic fluctuations in heated channels at supercritical pressures (Eksperimental'noe issledovanie termoakusticheskikh kolebanii v obogrevaemykh kanalakh pri sverkhkriticheskikh davleniiakh)** V A Gerliga and V I Vetrov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 31-36 11 refs In Russian

The thermoacoustic pressure fluctuations arising in heated kerosene-cooled channels at supercritical pressures were studied experimentally The influence of the position of the heating center (region) on the excitation of the fluctuations is identified, along with the influence of the heat carrying agent's rate of flow, the heat flux, pressure, and inlet temperature on the frequency and amplitude of the pressure fluctuations V P

A78-50781 # **Unsteady fluid flow in a swirl injector (O neustoichivosti techeniia zhidkosti v tsentrobezhnoi forsunke)** B S Drobiazko and V P Pavlovskii *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 37-41 In Russian

The spontaneous changes in the mode of operation of two-component swirl injectors, leading to abrupt changes in flow rate and pressure gradient, were studied experimentally This phenomenon is shown to be associated with the instability of the continuous swirling flow and rapid transition of the swirling flow to a cavitating flow V P

A78-50782 # **Calculations of flows in flat asymmetric nozzles for overexpanded conditions (Raschety techenii v ploskikh asimmetrichnykh soplakh na rezhimakh pererasshireniia)** V V Duganov and V V Poliakov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 42-48 9 refs In Russian

In the present paper, the overexpanded flow of an ideal perfect gas in axisymmetric flat nozzles with a rectilinear wall is calculated, using a straight-through difference analog The calculated nozzle pressures, thrust coefficients, and flow patterns are diagrammed and discussed The influence of the Mach number at the nozzle inlet on the flow characteristics is studied both for rectilinear and profiled walls V P

A78-50787 # **Influence of the bypass ratio on jet-engine weight (Vliianie stepeni dvukonturnosti na ves reaktivnogo dvigatelia)** N S Lamekin and A S Bogdanov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 68-73 In Russian

In the method proposed for calculating the weight of a bypass turbojet engine, the weight is expressed as a cubic polynomial in the characteristic dimension The calculation of the weight of a bypass engine is illustrated by an example The influence of the thrust and the bypass ratio on engine weight is evaluated It is shown that bypass ratios between 5 and 7 should be used in minimum weight design V P

A78-50788 # **Mechanism of pulsating combustion of the liquid fuel fed to the airflow through the circulation zone behind the flame stabilizer (Mekhanizm vibratsionnogo goreniia zhidkogo topliva, podavaemogo v potok vozdukha cherez zonu tsirkuliatsii za stabilizatorom plameni)** V V Tokarev and A P Shaikin *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 74-80 10 refs In Russian

A78-50790 # **Comparison of the characteristics of bypass turbojet engine employing a small size gas-turbine in the outer duct with those of a turbojet engine in supersonic cruising flight (Sravnenie kharakteristik TRDDM i TRD v kreiserskom sverkhzvukovom polete)** B D Fishbein *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 86-92 8 refs In Russian

The paper deals with the nonlinear programming problem of fuel minimization for a boosted bypass turbojet engine at a thrust equal to that of a conventional turbojet engine The problem is solved by a method of direct search without recourse to derivatives The results are diagrammed and discussed V P

A78-50791 # **Heat transfer from two-phase flow to the nozzle walls in the presence of a condensate film on the nozzle surface (Teploobmen dvukhfaznogo potoka so stenkoi sopla pri nalichii plenki kondensata na ego poverkhnosti)** V K Shchukin, N N Koval'nogov, V A Filin, Iu F Gortyshov, and A I Mironov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 93-99 9 refs In Russian

An approximate method is proposed for calculating the flow parameters and heat transfer characteristics of laminar films which form by inertial precipitation of condensed particles on the nozzle wall and which move under the action of tangential friction stresses at the free surface and the momentum imparted by the particles The influence of a condensate film on the heat transfer from a two-phase flow to the wall in front of the nozzle throat is calculated, and the results are analyzed V P

A78-50792 # **Convective heat transfer from a gas suspension to the flow area of a throttle with a blade-shaped throttling element (Konvektivnyi teploobmen potoka gazovzvesi v protochnoi chasti drosseliruiushchego ustroistva s povorotnym elementom v vide lopatki)** V K Shukin, A A Iakshin, V A Filin, N S Idialtullin, and N A Nadyrov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 100-104 6 refs In Russian

The experiments described were carried out to study the local convective heat transfer from a gas flow with suspended finely dispersed 0 2 to 12-micron aluminum oxide particles to the walls of a throttle whose flow area consists of two plane curvilinear supersonic nozzles The presence of the particles was found to intensify substantially the heat release to the wall V P

A78-50793 # **Operation of an axial flow compressor in the case of radially nonuniform inlet flow (O rabote osevogo kompressora pri radial'no-neravnomernom vkhode potoka)** A N Aniutin, A F Brekhov, V N Ershov, and V G Prokopovich *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 105 107 In Russian

The structure of the flow in two three stage axial flow compressors was studied at uniform and radially nonuniform inlet flows, at a peripheral speed of 118 m/sec at the blade tips Traversing of the flow behind the rotors and at the inlet was carried out The results obtained indicate that the individual stages act to equalize the flow This compensating action of the stages is quantitatively assessed V P

A78-50794 # **Influence of changes in bypass ratio on the aerodynamic behavior of a fan (Vliianie izmeneniia stepeni dvukhkonturnosti na aerodinamicheskie kharakteristiki ventiliatora)** V P Gerasimenko, V N Ershov, V A Koval', and G V Pavlenko *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 108 111 In Russian

In the wind tunnel experiments described, the influence of changes in bypass ratio on the characteristics of the main duct, the region of stable fan operation, and the incipient traveling stall was studied Bypass ratios of 0 5, 1 0, and 2 0 were used in the tests The results are plotted and discussed V P

A78-50795 # **Search-method optimization of the balancing of flexible rotors of gas turbine engines (Optimizatsiia uravnoveshivaniia gibkikh rotorov gazoturbinnykh dvigatelei metodom poiska)** A I Gleizer *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 111 113 7 refs In Russian

The paper deals with the problem of optimizing the balancing of flexible gas turbine engine rotors by rational selection of the balancing parameters A solution is obtained by a search technique where a point in the parameter space is defined by means of numbers which form a specific sequence (the so-called LP-sequence) The effectiveness of the balancing technique proposed is demonstrated by examples V P

A78-50796 # **A computer-aided method of calculating temperature fields in turbine disks (Metod rascheta na ETsVM nestatsionarnykh temperaturnykh polei v diskakh turbomashin)** V V Zhuikov and V I Lokai *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 114-120 In Russian

A numerical method is proposed for calculating steady and unsteady temperature fields in the meridional cross sections of turbine disks for time-variable boundary conditions over the disk profile The temperature dependence of the disk material's heat

conductivity is taken into consideration For illustration, the method is applied to practical examples V P

A78-50797 # **Effect of wall thickness /height of the injection pipe/ on the mixing process in a system of chordal jets in a flow (O vliianii tolshchiny stenki /vysoty podvodiashchego patrubka/ na protsess smesheniia sistemy khordal'nykh strui v potoke)** V A Zhuravskii, Iu A Spiridonov, and A V Talantov *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 120-124 In Russian

A78-50798 # **Intensification of fuel evaporation in aircraft gas-turbine engines as a result of electric forces (Intensifikatsiia protsessa isparenia topliv v aviatsionnykh gazoturbinnykh dvigateliakh za schet elektricheskikh sil)** A S Kokin, B G Popov, and V A Bondar' *Aviatsionnaia Tekhnika,* vol 21, no 1, 1978, p 124 127 6 refs In Russian

A78-50822 Sounding the runway (Auscultons la piste) H Escoffier *France Transports - Aviation Civile,* vol 47, Summer 1978, p 47-49 In French

A procedure for examining runways for the effects of fatigue and aging is presented A rating system based on determining the CBR (California Bearing Ratio) is discussed Consideration is given to runway fatigue due to traffic Calculation methods are noted A systematic sounding method is outlined with reference to soil and foundation assessment, surface sounding, and laboratory analysis S C S

A78-50896 On moderate injection into a separated supersonic boundary layer, with reattachment C Diver and K Stewartson (University College, London, England) *Journal of Fluid Mechanics,* vol 88, Sept 13, 1978, p 115-132 26 refs

A semiinfinite flat plate immersed in a viscous fluid is considered The representative Reynolds number is taken to be large A second fluid is injected across a portion of the plate with a velocity in a direction normal to the mainstream An investigation is conducted concerning the problem of moderate blowing over a finite length of the plate to find an alternative solution free of a certain anomaly observed in earlier studies It is found that the solution upstream of cut-off contains an arbitrary constant and is, therefore, not independent of conditions downstream as was assumed by Amr and Kassoy (1976) This constant may be interpreted as an effective origin shift and as such its role is similar to the origin shift in the free-interaction problem studied by Stewartson (1974) G R

A78-50904 An alternative treatment of lifting-line theory as a perturbation problem T Kida and Y Miyai (Osaka Prefecture, University, Osaka, Japan) *Zeitschrift fur angewandte Mathematik und Physik,* vol 29, July 25, 1978, p 591-607

A description is presented of a method by which the lifting-line theory can be obtained without an employment of the process of matched asymptotic expansions The first step of the new method involves the derivation of the governing integral equation of the lifting-surface theory The obtained integral is expanded asymptotically in powers of the inverse of the aspect ratio The simple integral equations are solved by applying the Carleman-Betz inversion formula The described method is compared with Van Dyke's procedure for the aerodynamic forces and the velocity potential in the inner and outer flow fields The comparison shows that the present method is convenient and reliable Attention is given to basic relations, asymptotic expansions, flat-plate wings, and the perturbation potential G R

A78-50935 # **Influence of technological factors on the resistance to fracture of refractory materials in high-speed air flows (Vliianie tekhnologicheskikh faktorov na soprotivlenie razrusheniiu zharoprochnykh materialov v skorostnykh vozdushnykh potokakh)** V G Sorokin—and B N Guzanov (Ural'skii—Politekhnicheskii Institut, Sverdlovsk, USSR) *Problemy Prochnosti,* July 1978, p 76-78 6 refs In Russian

It is shown experimentally that, for gas-turbine engine materials, the real fracture stress can be increased both by high temperature thermomechanical treatment and vacuum arc melting In the first case the increase is due primarily to changes in grain-boundary structure, while in the second case the increase results from improvements in grain and boundary purity Each of these operations leads to a decrease in intergranular deformation and, hence, to a better resistance to grain-boundary separation V P

A78-50941 # **Experimental study of the endurance of the vertical-fin sections of an aircraft subjected to acoustic loads (Eksperimental'noe issledovanie vynoslivosti otsekov kilia samoleta pri akusticheskom nagruzhenii)** L E Matokhniuk, Iu M Golovanev, V G Samokhin, I A Kashchuk, B K Karpenko, and T S Elezova (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR) *Problemy Prochnosti,* July 1978, p 117-120 In Russian

The acoustic endurance of rudder fin sections differing in the arrangement of the ribs was studied at acoustic loads between 142 and 150 dB, varying the frequency from 120 to 290 Hz Symmetric attachment of the ribs to the skin is shown to greatly improve acoustic resistance V P

A78-51015 # **Natural vibrations of a rigid rotor mounted on elastic ball bearings (Svobodnye kolebaniia zhestkogo rotora v uprugikh sharikopodshipnikakh)** N A Lebedev *Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela,* May June 1978, p 29-32 In Russian

A support consisting of a rigid rotor mounted on a pair of identical radial-thrust ball bearings is examined An analytical expression relating the natural vibration frequency to the amplitude is derived for preloaded and nonpreloaded bearings V P

A78-51051 Vortex dynamics D W Moore (Imperial College of Science and Technology, London, England) *Science Progress,* vol 65, Autumn 1978, p 295-312 32 refs

Theoretical principles of vortex dynamics are discussed and applied in an analysis of the formation and properties of the trailing vortex behind aircraft A procedure for calculating vorticity fields is explained, and the production of sheets of vorticity at solid surfaces is considered Two-dimensional motion is examined, roll-up is demonstrated numerically, and it is suggested that the trailing vortices behind aircraft result from the roll-up of the shed vortex sheet Vortex filaments and strained vortex filaments are described M L

A78-51096 Approximate transonic profile flow at incidence with shock P Niyogi (Jadavpur University, Calcutta, India) and R Sen (Lady Brabourne College, Calcutta, India) *Acta Mechanica,* vol 30, no 1-2, 1978, p 65-77 17 refs

The approximate integral equation method solution proposed by Chakraborty (1975) for shock-free transonic supercritical profile flow problems is extended to the case of unsymmetric profile flow at small incidence with shock Supercritical flow past the NACA 0012 profile was calculated by the method, and the results are in satisfactory agreement with theoretical results of Garabedian and Korn P T H

A78-51127 And now 'the deregulators' - When will they learn F C Thayer (Pittsburgh, University, Pittsburgh, Pa) *Journal of Air Law and Commerce,* vol 43, no 4, 1977, p 661-689 64 refs

Deregulation of the airlines industry is opposed as a misguided preference for free competition in place of regulated public utilities Possible consequences of deregulation are discussed The competitive bidding system is criticized, and the role of supplemental airlines is examined Airline history and problems related to the aircraft manufacturing industry are considered M L

A78-51128 British Airways v Port Authority - Its impact on aircraft noise regulation R B Donin *Journal of Air Law and Commerce,* vol 43, no 4, 1977, p 691-730 150 refs

Decisions generated by the Concorde landing rights dispute (British Airways Board v Port Authority of New York and New

Jersey) are examined with attention to the effect of the decisions on aircraft noise regulation A history of court decisions and legal action is presented The nature of the Concorde noise is described, and aircraft noise regulation before, during, and after the court decision is considered The implications of this public and legal controversy for the resolution of future issues are discussed M L

A78-51129 **Aircraft noise - Federal pre-emption of local control, Concorde and other recent cases.** J A Muss *Journal of Air Law and Commerce,* vol 43, no 4, 1977, p 753-798 206 refs

The legal history of the Concorde landing rights controversy is examined, and the conflict between federal preemption and local control of noise regulation at airports is discussed Preemption doctrine is discussed, and the legislative history, administrative interpretation, and judicial background are reviewed Attention is directed to the Burbank case and to its influence on subsequent legal decisions It is suggested that the variant conclusions reached by the courts concerning this unsettled issue are a consequence of the differing perspectives in which the question has been framed M L

A78-51130 **Current state of the law in aircraft noise pollution control** M K North *Journal of Air Law and Commerce,* vol 43, no 4, 1977, p 799-822 168 refs

The paper discusses control of aircraft noise pollution with attention to traditional legal remedies, political solutions, local regulation and federal preemption, local regulation and the commerce clause, the federal aviation act and the noise control act of 1972, and the aviation noise abatement policy This policy, announced in November 1976, is intended to foster cooperation between the FAA and other groups concerned with noise control Problems involved in the implementation of this policy are considered M L

A78-51131 **Impact of federal noise abatement policy on aircraft financing** W P Whitcomb *Journal of Air Law and Commerce,* vol 43, no 4, 1977, p 823-846 149 refs

Federal Aviation Regulation Part 36 (FAR 36) noise limits and scheduled compliance are reviewed, and the financial state of the airlines industry is examined The cost of compliance with FAR 36 is discussed with reference to the effect of this cost on future growth Some proposed means of financing compliance with FAR 36 requirements are examined, and the relevance of short-term federal funding to the goal of replacing 500 aircraft is considered M L

A78-51132 **Reflections on the economic implications of current noise abatement financing proposals** J R Boyer, Jr *Journal of Air Law and Commerce,* vol 43, no 4, 1977, p 847-873 125 refs

The paper discusses congressional proposals for providing financial assistance to the airlines to meet the costs of financing the noise reductions required by the new noise regulations The Mineta proposal, the Wydler proposal, and two proposals presented by Anderson (H R 4539 and H R 8124) are discussed and compared Impediments to the enactment of a noise abatement financing bill are considered, and the conclusions reported in a study by Greenslet on the ability of airlines to purchase new aircraft are described M L

A78-51149 # **Naval structural materials - Requirements, issues, and opportunities** L R Hettche (U S Navy, Naval Research Laboratory, Washington, D C) *Naval Research Reviews,* vol 31, June 1978, p 1-25 21 refs

The paper presents a synoptic approach to the complexity and diversity of the challenges facing the U S Navy's structural materials community over the next several decades The relationships between structural material requirements and operational capabilities are examined for future high-performance ships, the next generation V/STOL aircraft, and current conventional ships Technical issues as well as research and development opportunities are explored for high-strength marine alloys, thermostructural alloys, and advanced composite materials M L

A78-51151 **Gesellschaft fur angewandte Mathematik und Mechanik, Annual Scientific Meeting, Lyngby, Denmark, May 31-June 3, 1977, Reports Part 2 (Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977, Vortrage Part 2)** Meeting sponsored by the Danish Centre for Applied Mathematics and Mechanics *Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978 260 p In German and English

Consideration is given to numerous topics in the field of fluid mechanics, including small perturbations in plane Poiseuille flow, turbulent boundary layer separation on curved airfoils, flow between rotating cylinders, viscous flow in straight divergent diffusors, MHD vortex flows, unsteady flow along a flat plate with a roughness element, experiments and theory concerning three-dimensional turbulent boundary layers, and slip flow near circular cylinders at low Reynolds numbers Also examined are self-excited oscillations in supersonic ducts, thermoconvective waves, transonic shock-boundary layer interactions, creeping waves in water wave theory, electroconductive analogies of two-dimensional thermal radiation vector fields, and the computerized design of systems with optimal structure B J

A78-51153 # **Mathematical model of vortex-excited oscillations of thin, weakly damped structures (Mathematisches Modell der Wirbelanregung schlanker, schwach gedampfter Strukturen)** H Bardowicks *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 242-T 244 5 refs In German

A78-51155 # **Turbulent boundary layer separation on a curved wall with normal compression shock (Ablosung der turbulenten Grenzschicht an der gekrummten Wand mit senkrechten Verdichtungsstoss)** R Bohning and J Zierep (Karlsruhe, Universitat, Karlsruhe, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 249, T 250 In German

A numerical three-layer model is presented for analyzing the interaction between a turbulent boundary layer on a curved airfoil and a weak normal compression-shock wave in transonic flow for different Reynolds numbers, the flow is assumed to be inviscid and compressible An explicit solution is obtained which can be used to calculate wall shear stress, the behavior of pressure disturbances within the boundary layer is investigated for different wall conditions Conditions under which boundary layer separation occurs are investigated B J

A78-51158 # **Calculation of viscous flow in straight weakly divergent diffusors (Die Berechnung reibender Stromungen in geraden Diffusoren schwacher Divergenz)** U Brandt (Hannover, Technische Universitat, Hanover, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 254-T 256 5 refs In German Deutsche Forschungsgemeinschaft Contract No SFB-61

The paper develops a mathematical model for treating laminar and fully turbulent two-dimensional viscous flow between the weakly divergent walls of a straight diffuser of rectangular cross section Distributions of pressure and wall shear stress are obtained for two-dimensional divergent channels in turbulent flow B J

A78-51163 # **Similarity considerations for nonequilibrium nozzle flows** M Fiebig and N K Mitra (Ruhr-Universitat, Bochum, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 269-T 271 5 refs

An attempt is made to relax the stringent similarity requirements for nonequilibrium nozzle flows so that approximate similarity still exists, but a much larger class of flows - in terms of varying initial conditions - is allowed First, it is shown that the inclusion of viscous effects does not give rise to additional requirements Then, it is demonstrated that the characteristic Damkoehler number Q (based on stagnation chamber conditions) and the throat height can be used as parameters for approximate similarity over a broad range of initial conditions Finally, consideration is given to the possibility of extending the present analysis to the vibrational nonequilibrium flow of gasdynamic laser mixtures (e g , CO2-N2-He) B J

A78-51165 # **Model calculations of the generation of self-excited oscillations in a supersonic duct with stepwise widening of cross section (Modellrechnungen zur Entstehung selbsterregter Schwingungen in einem Uberschallkanal mit stufenformiger Querschnittserweiterung)** G Grabitz (Max Planck-Institut fur Stromungsforschung, Gottingen, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 273-T 275 In German

Anderson et al (1977) have presented an experimental investigation of self excited flow oscillations in a supersonic duct with stepwise widening of the rectangular cross section The present paper describes a numerical model describing self excited oscillations in a supersonic duct with the same kind of cross section The numerical analysis is based on the continuity equation, the momentum equation transverse to the flow axis, and momentum equations along the axis and along the jet boundary Results regarding dead-water oscillations and shock wave behavior are presented B J

A78-51172 # **Some comments on sonic boom focusing** F Obermeier (Max-Planck-Institut fur Stromungsforschung, Gottingen, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 295-T 297

In the present paper, an analytical description is obtained for the pressure signature of an originally N-shaped sonic boom with a very short but finite rise time near the caustic The analysis is based on the linear equations of wave acoustics Using Fourier transforms, the problem is reduced to the description of converging harmonic waves near the caustic V P

A78-51175 # **Numerical implementation of solid-body boundary conditions for the Euler equations** A Rizzi (Forsvarsdepartementet, Flygtekniska Forsoksanstalten, Bromma, Sweden) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 301-T 304 7 refs

The transformation to a body-aligned coordinate system in fluid dynamic problems is discussed with reference to procedures for relating unknown values of pressure to pressures in the interior A general formulation, which requires no interpolation, is presented for describing this relationship An example of the use of this procedure, which only requires data for the grid points, is presented M L

A78-51176 # **Three-dimensional boundary layer theory using shell geometrical concepts** K Robert (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Cologne, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 304, T 305

A geometrical approach to boundary theory, considered as a fluid mechanical analog to elastic shell theory, is described, and techniques of shell geometrical analysis and surface tensor analysis are applied to an analysis of compressible flow Continuity and momentum equations for laminar compressible flow are presented, and the use of a monoclinic (or 'normal') coordinate system is introduced The shell geometrical concept for deriving boundary layer equations is shown to be applicable only when the maximum wall curvature is sufficiently small in comparison with the reciprocal of layer thickness The complete set of governing equations in their described shifted form must be expressed in a nondimensional manner M L

A78-51181 # **Streamline coordinates and similarity transformation for the 3-D boundary layer** W Schonauer, J Gruning, H -G Daubler, and G Glotz (Karlsruhe, Universitat, Karlsruhe, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 320, T 321 Research supported by the Volkswagenwerk-Stiftung

Metric coefficients are used to express continuity and momentum equations for a laminar three-dimensional boundary layer, and the application of streamline coordinates to arrive at a numerical solution for this parabolic system is considered The stagnation point is characterized by letting one axis stand for a streamline and the other axis stand for a potential line on the surface A similarity transformation from the boundary layer coordinates to the similarity coordinates is presented, and the mapping of the solution, whose domain is the whole surface, to a planar rectangle is discussed M L

A78-51184 # **Calculation of local three-dimensional supersonic fields (Die Berechnung lokaler raumlicher Uberschallfelder)** H Sobieczky (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Gottingen, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 331-T 333 In German

An aerodynamic design method initially developed for two-dimensional flow is extended to the three-dimensional case, enabling the solution of initial-value problems for shock-free local supersonic fields The method is based on the elliptic continuation principle for these supersonic fields A procedure for solving the flow equations of a small-perturbation parallel supersonic potential flow is presented The applicability of the method to the design of wings and cascades is discussed B J

A78-51185 # **Shock obliquity effect on transonic shock-boundary layer interaction** G R Inger and H Sobieczky (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Stromungsmechanik, Gottingen, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 333-T 335 5 refs

In the present paper, two completely different approaches - a potential outer flow model and a viscous interaction flow model are applied to the calculation of the characteristics of shock boundary layer interaction The established compatibility of these two approaches in describing shock boundary layer interactions, as well as the agreement with the experiment, points toward the feasibility of using these two theories in combination to develop a computational algorithm for analyzing transonic airfoil flows with shocks and viscous effects V P

A78-51198 # **Some mixed boundary value problems for subsonic flow past oscillating profiles (Einige gemischte Randwertprobleme fur Unterschallstromungen um schwingende Profile)** E Meister (Darmstadt, Technische Hochschule, Darmstadt, West Germany) *(Gesellschaft fur angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Lyngby, Denmark, May 31-June 3, 1977) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 58, July 1978, p T 383-T 386 8 refs In German

A mixed boundary value problem is formulated for unsteady cavitating subsonic flow past a profile The unsteady pressure distribution and the generation of a system of free vortices is taken into account The Fourier transformation is used in solving the problem B J

A78-51223 **Preventing helicopter mid-air collisions with the proximity warning device.** O Schoenberger (U S Army, Avionics Laboratory, Fort Monmouth, N J) *SAFE Journal*, vol 8, Fall, 1978, p 26-29

The use of the Proximity Warning Device (PWD) to prevent helicopter mid-air collision in US Army high aircraft density training environments is presented in this paper The Proximity Warning Device which is, in effect, a C-Band pulse beacon ranging system provides a visual and oral warning to the helicopter pilot whenever other PWD-equipped intruder aircraft enter a predetermined volume of airspace around the protected aircraft. Approximately one-million flight hours have been flown with PWD equipped helicopters With flight operations conducted in high air traffic density environments, mid-air collisions between PWD equipped aircraft have not occurred during this time (Author)

A78-51271 **Linear machine power requirements and system comparisons** E Abel, J L. Mahtani, and R G Rhodes (Warwick, University, Coventry, England) *(International Magnetics Conference, Florence, Italy, May 9-12, 1978) IEEE Transactions on Magnetics*, vol MAG-14, Sept 1978, p 918-920 7 refs

A study is conducted of the German magnetic levitation (Maglev) revenue vehicles The study evaluates and compares total substation power required by the Germany revenue vehicle designs The evidence suggests that the linear induction motor does not appear to be a good choice for a propulsion subsystem at 500 km/h or indeed at 400 km/h The long stator motor does not perform well either when loaded at 400 km/h or run at 500 km/h The electrodynamic-linear synchronous motor system, on the other hand, appears to show definite promise for the envisaged operating speed range from 400 to 500 km/h G R

A78-51280 **Thirty years of fluid dynamics** R J Emrich (Lehigh University, Bethlehem, Pa), F N Frenkiel (U S Navy, Naval Research and Development Center, Bethesda, Md), J R Dorfman (Maryland, University, College Park, Md), W C Griffith (North Carolina State University, Raleigh, N C), and G Veronis (Yale University, New Haven, Conn) *Physics Today*, vol 31, Sept 1978, p 38-44, 46 6 refs

The article presents a review of thirty years of research in fluid dynamics with emphasis on turbulence and statistical mechanics as applied to aerodynamics and geophysical flows Turbulence is discussed with reference to studies of breakdown in laminar boundary layers, spectral information behind grids in wind tunnels, and visualization techniques Studies in statistical mechanics are outlined noting the Boltzmann equation, Bogoliubov's generalized Boltzmann equation, and the time correlation function method S C S

A78-51284 # **Simple numerical model for calculation of entry vehicle trim response** T D Burton (Washington State University, Pullman, Wash) *Journal of Spacecraft and Rockets*, vol 15, Sept-Oct 1978, p 319, 320 10 refs

In the numerically efficient trim response model proposed in the present paper, allowance is made for time variations in roll rate, mass and configurational asymmetries, aerodynamic coefficients, and longitudinal principal-axis misalignments in pitch and yaw It is based on the fact that the coupling of trim and body fixed low-frequency oscillatory motion component dominates the trim-induced response The model can be incorporated into standard point-mass trajectory simulators for calculation of trim-induced dispersion and angle-of attack/load behavior V P

A78-51338 # **Some preliminary considerations on stratospheric and mesospheric circulation with regard to the analysis of the stratospheric warming of December 1976-January 1977 (Qualche considerazione introduttiva sulla circolazione stratosferica e mesosferica in vista dell'analisi del riscaldamento stratosferico del Dicembre 1976 - Gennaio 1977)** M Conte and P Ernani (Aeronautica Militare, Servizio Meteorologico, Rome, Italy) *(Scuola Internazionale di Fisica dell'Atmosfera, Corso, Erice, Sicily, May 16-31, 1976) Rivista di Meteorologia Aeronautica*, vol 38, Apr-June 1978, p 107-116 22 refs In Italian

Radiosonde and satellite data are used to study Northern-Hemisphere circulation during the stratospheric warming of December 1976-January 1977 Absolute topography charts for 30 mbar are presented for winter periods of 1974 and 1976 along with a description of cell patterns of circulation for the winter months Polar-region temperature profiles for the stratosphere and mesosphere are examined B J

A78-51341 # **Feasibility of landing at an alternate airport due to visibility conditions (Agibilità di un aeroporto e del suo alternato in funzione della visibilita)** A Fantuzi (Aeronautica Militare, Servizio Meteorologico, Rome, Italy) *(Scuola Internazionale di Fisica dell'Atmosfera, Corso, Erice, Sicily, May 16-31, 1976) Rivista di Meteorologia Aeronautica*, vol 38, Apr-June 1978, p 151, 152 In Italian

The paper examines conditions under which an aircraft will be rerouted to a landing at an alternate airport Three airports - Milano Linate, Venezia Tessera, and Torino Caselle are considered along with their respective alternates Milano Malpensa, Treviso S Angelo, and again Milano Malpensa Meteorological conditions for these airports are examined for the period September-November 1977 B J

A78-51355 # **Influence of constrained arrestors on the operation of gyroscopic stabilizers (Vliianie ogranichitel'nykh uporov na rabotu girosilovykh stabilizatorov)** E N Tokar' *Kosmicheskie Issledovaniia*, vol 16, July-Aug 1978, p 505-513 6 refs In Russian

In gyrostabilized platforms, the angles of rotation of the gyros do not exceed 10 degrees In the present paper, the influence of this limitation on the range of variation of the kinetic moment of a system of aircraft gyrostabilizers is analyzed V P

A78-51379 # **Nonlinear mathematical modeling of unsteady flow past a lifting propeller (K matematicheskomu nelineinomu modelirovaniiu nestatsionarnogo obtekaniia nesushchego vinta)** S M Belotserkovskii, V A Vasin, and B E Loktev *Akademiia Nauk SSSR, Doklady*, vol 240, June 21, 1978, p 1320 1323 6 refs In Russian

The problem of modeling unsteady flow past a helicopter propeller is solved in a nonlinear framework Each blade is simulated by an infinitely thin midsurface, it is assumed that attached and free vortices are located on each blade, and free vortices are shed from the blade as it moves Only the aerodynamic part of the problem is considered, the problem of determining deformations and Mach motions of blades is neglected Some digital simulation results are presented B J

A78-51387 # **Self-focusing of a Gaussian beam in a supersonic gas flow (O samofokusirovke Gaussova puchka v sverkhzvukovom potoke gaza)** M N Kogan and A N Kucherov (Tsentral'nyi Aerogidrodinamicheskii Institut, Moscow, USSR) *Akademiia Nauk SSSR, Doklady*, vol 241, July 1, 1978, p 48-51 9 refs In Russian

A theoretical analysis shows that, in a supersonic gas flow, acoustic disturbances can lead to the focusing of a Gaussian collimated light beam even in the absence of kinetic cooling The thermal self-focusing effect is found to behave nonmonotonically from the moment the beam enters the gas to the moment the gasdynamic flow is stabilized B J

A78-51400 # **Effect of nozzle inclination on the efficiency of a single-nozzle microturbine (Vliianie naklona sopla na effektivnost' odnosoplovoi mikroturbiny)** K G Rodin, Iu P Batkov, and V P Stashkov (Leningradskii Politekhnicheskii Institut, Leningrad, USSR) *Energetika*, vol 21, June 1978, p 140 142 In Russian

The paper presents experimental data on the effect of angle of inclination in the range minus 5 deg to plus 15 deg of a supersonic nozzle in the meridional plane on the efficiency of the microturbine An optimal inclination angle is determined, and it is shown that positive nozzle inclination is a simple design tool for improving the efficiency of a single-nozzle microturbine B J

A78-51402 # **Investigations of the intensity of oscillations of the boundary of a turbulent wake (Issledovanie intensivnosti pul'satsii granitsy turbulentnogo sleda)** V G Ivanov (Akademiia Nauk SSSR, Fiziko-Tekhnicheskii Institut, Leningrad, USSR) *Pis'ma v Zhurnal Tekhnicheskoi Fiziki,* vol 4, May 26, 1978, p 590-592 6 refs In Russian

The paper examines the principal statistical characteristics - the mean square deviation and the microscale - of the boundary of a supersonic or hypersonic turbulent wake It is shown that the intensity of oscillations of the turbulent-wake boundary is characterized by the ratio of mean-square deviation to the microscale B J

A78-51437 # **Theoretical and experimental investigation of the wake structure behind a sphere in supersonic gas flow at small Reynolds numbers (Teoreticheskoe i eksperimental'noe issledovanie struktury sleda za sferoi v sverkhzvukovom potoke gaza pri malykh chislakh Reinol'dsa)** A A Arutiunian, V M Zaikin, V V Krikunov, and Iu M Lipnitskii *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* July-Aug 1978, p 46-51 13 refs In Russian

The present paper deals with the results of a theoretical and experimental study of the wake structure behind a sphere at free-stream Reynolds numbers of 100 and free-stream Mach numbers of 3 8 and at Re numbers of 50 and M = 7 7 The experimental data are found to correlate well with data calculated on the basis of a solution of the complete system of Navier-Stokes equations V P

A78-51441 # **Axisymmetric unsteady flow past obstacles in a cylindrical tube (Osesimmetrichnoe nestatsionarnoe obtekanie pregrad v tsilindricheskoi trube)** L I Dubrovskaia and L V Komarovskii *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* July-Aug 1978, p 81 86 9 refs In Russian

In the present paper, the interaction of gas flows with bodies in tubes is studied by applying Godunov's method to the numerical integration of the unsteady gasdynamics equations The analysis is carried out for obstacles in the form of a circular cylinder having a common symmetry axis with the tube, an annulus, and a sphere whose center is situated on the symmetry axis The result obtained are applied to the problem of propelling a body by means of an unsteady gas flow V P

A78-51443 # **Linear theory of supersonic flows past ruled bodies of three-dimensional configuration (Lineinaia teoriia sverkhzvukovogo obtekaniia lineichatykh tel prostranstvennoi konfiguratsii)** M I Folle *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* July-Aug 1978, p 94-101 5 refs In Russian

A drag formula, previously derived by the author, is applied to the solution of the problem (in linear formulation) of the flow past bodies having a ruled surface, a star-shaped nose section, and a circular midsection The superiority of such bodies over conventional nose cones with respect to the drag characteristics is demonstrated V P

A78-51444 # **Viscous carbon dioxide flow past a blunted cone (Viazkoe obtekanie zatuplennogo konusa uglekislym gazom)** N E Afonina and V G Gromov *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* July-Aug 1978, p 102-105 In Russian

A numerical analysis is carried out for the hypersonic viscous nonequilibrium flow of carbon dioxide past a spherically blunted cone The distribution of the gasdynamic and thermochemical parameters in the shock layer, obtained from the analysis, are used as a basis to calculated the basic flow characteristics and to determine the upper and lower bounds for the existence of different flow modes within the framework of a theory of continuous media V P

A78-51448 # **Numerical simulation of the unsteady two-stage axisymmetric efflux of a gas into an immersed space (Chislennoe modelirovanie nestatsionarnogo dvukhstadiinogo osesimmetrichnogo istecheniia gaza v zatoplennoe prostranstvo)** G S Romanov and V V Urban *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* July-Aug 1978, p 153-156 13 refs In Russian

The paper deals with the application of the large-particle finite-difference scheme to the numerical calculation of muzzle blast type flow fields The wave pattern of the flow during the initial expansion stage and the structure of the underexpanded supersonic jet behind the shock wave are identified V P

A78-51449 # **Measurement of the flow behind a hypersonic sphere in air, using open microwave resonators (Issledovanie techeniia za sferoi pri giperzvukovoi skorosti poleta v vozdukhe otkrytym SVCh rezonatorom)** N N Baulin, A K Dmitriev, N N Ivanchinov-Marinskii, V E Lopatin, N N Piliugin, and S Iu Cherniavskii *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza,* July-Aug 1978, p 156-160 15 refs In Russian

In the experiment described, an open microwave resonator was used to study the air flow behind a hypersonic sphere, made of a polymer material Schlieren photography was used to visualize the flow The electron concentration in the plasma and the effective collision frequency of electrons with heavy particles are determined as a function of the distance from the sphere V P

A78-51463 **Changes in conical diffuser performance by swirl addition** R S Neve and N E A Wirasinghe (City University, London, England) *Aeronautical Quarterly,* vol 29, Aug 1978, p 131-143 7 refs

It has been found that the addition of a whirl velocity component to an otherwise axial flow in a conical diffuser can lead to improvements in static pressure recovery and in efficiency, according to a restricted definition Diffusers of total conical angle 10, 20 and 30 deg were tested in detail, improvements were evident only in the last two, which would otherwise have suffered from flow separation problems caused by their relatively large divergence angles The agency for improvement seems to be a beneficial redistribution of axial velocities (Author)

A78-51464 **The aerodynamic performance of a freely hinged door between two flows** B L Hunt, S A Bizon, S A Taylor, and D A Wilson (Bristol, University, Bristol, England) *Aeronautical Quarterly,* vol 29, Aug 1978, p 144-160

This paper reports experimental results for the performance of a freely hinged door between two incompressible air flows of different total pressures and different velocities The apparatus used is a laboratory idealization of the tertiary door system for an aircraft propulsion nozzle The governing parameters are identified and the performance is presented in terms of the equilibrium door angle and the relative magnitude of the mass flow admitted Three doors of different shapes were used and results are also presented for a plain opening The main aerodynamic parameters are shown to be the velocity ratio and a nondimensional pressure difference across the door The shape of the downstream door jamb is found to have a considerable influence on the operation of the door at low angles Removal of the door results in a lower entry mass flow over most of the operating range It is shown that the mass flow ratio can be predicted quite well from the measured door angles by means of a simple theory (Author)

A78-51466 **The theory of fabric porosity as applied to parachutes in incompressible flow** P R Payne (Payne, Inc , Annapolis, Md) *Aeronautical Quarterly,* vol 29, Aug 1978, p 175-206 54 refs Contract No F44620-76-C-0020

A general correlation based on the physics of fluid flow is presented for the pressure drop across cloths, gauzes, filter screens, and similar permeable fabrics used for parachute canopies It is demonstrated that the correlation appears to work well for a very large range of porosity when the material is relatively unstrained The effect of tension on the geometric porosity of a fabric is analyzed theoretically, and tension is shown to be a likely major factor Specifically, it is found that for a given pressure drop, a stress equal to 50% of the ultimate stress can increase the air volume flow by an order of magnitude for cloths with low porosity when unloaded In general, the increase in permeability is greatest at lower pressure-drop values, indicating that tension affects the viscous term more than the dynamic term F G M

A78-51470 **Captive carriage vibration of air-to-air missiles on fighter aircraft** W G Frost (USAF, Wright-Patterson AFB, Ohio), P B Tucker, and G R Waymon (McDonnell Aircraft Co , St. Louis, Mo) *Journal of Environmental Sciences,* vol 21, Sept -Oct 1978, p 11-16 17 refs

Flight measurements obtained on F-15 fighter aircraft show that current missile vibration specifications do not adequately cover captive carriage They include vibration caused by boundary layer noise, but not vibration induced by maneuvers The latter occur at frequencies below approximately 200 hertz Vibration at these frequencies is much higher than specification test levels It is therefore considered important that these vibration levels be incorporated in vibration qualification test specifications for future air-to-air missiles Recommended vibration test levels and test procedures based on the F-15 flight measurements are provided.

(Author)

A78-51497 # **A review of human factors investigation studies in aircraft accidents during the period 1957-1977 in Aeromedical Laboratory, JASDF** Y Kakimoto (Japan Air Self Defense Force, Aeromedical Laboratory, Tachikawa, Japan) *Japan Air Self Defence Force, Aeromedical Laboratory, Reports,* vol 18, Mar 1978, p 161-176 73 refs In Japanese, with abstract in English

The investigations into human factors in aircraft studies over the past twenty years have involved (1) case studies of aircraft accidents, (2) epidemiological statistical analysis of accident data, and (3) investigation of behavior or situations involving accident potential Men were regarded as a black box and were analyzed from the viewpoint of information processing These methods are in some way related to inductive methods Future studies should involve deductive methods P T H

A78-51516 **The short-haul jet designed with ATC in mind** T K Vickers *Journal of Air Traffic Control,* vol 20, July-Sept 1978, p 6-9

The Fokker-VFW F-28 aircraft is discussed in terms of air traffic control procedures Particular attention is given to takeoff and climb specifications and the role of speedbrakers in cruising flight, descent, and approach The low approach speed, lift dumpers, and short landing distance of the F-28 are described It is noted that the absence of thrust reversers provides a noise-reduction feature S C S

A78-51517 **The missed approach** R E Burgin (National Transportation Safety Board, Washington, D C) *Journal of Air Traffic Control,* vol 20, July-Sept 1978, p 11-14

A survey of the success rate of instrument approaches in the United States is presented highlighting the so-called landing expectancy phenomenon This subconscious anticipation affects the decision making processes of both the pilot and the air traffic controller and provides the basis of perception and subsequent action An actual midair collision is discussed from the point of view of the landing expectancy phenomenon Suggestions for counteracting the phenomenon on a conscious level are made, including studying of the missed approach environment via simulator S C S

A78-51518 **Airline contributions to better air traffic control** W G Osmun (Air Transport Association of America, Washington, D C) *Journal of Air Traffic Control,* vol 20, July Sept 1978, p 16-19

The article reviews the services of the Air Transport Association of America with regard to air traffic control Attention is given to the development of airborne radar systems, ground based primary radar, and secondary radar Proposals for a system of airborne collision avoidance are described along with air ground communications systems such as radio telegraphy and the use of satellites for the relay of air-ground VHF communications Cost-effective aspects of various navigation aids are noted and Category II Instrument Landing Systems are discussed S C S

A78-51519 **Future large civil turbofans and powerplants /Seventeenth Short Bros Commemorative Lecture/** G L Wilde (Rolls-Royce, Ltd , Derby, England) *Aeronautical Journal,* vol 82, July 1978, p 281-299 13 refs

The historical development of the turbofan engine is briefly reviewed, and the major aspects of developing a large civil turbofan powerplant for future long-range subsonic transports with the aim of obtaining maximum fuel economy is discussed Some specific engine designs are examined that enable the highest efficiency components to be adapted to advanced (low fuel consumption) cycles V P

A78-51520 **European air transport up to the year 2000 /Lord Douglas of Kirtleside Lecture/** R Watts (British Airways, Heathrow, Middx , England) *Aeronautical Journal,* vol 82, July 1978, p 300-312

Factors which influence the demand for transport in Europe and the split among road, rail, and air transportation are examined Supply factors are discussed with a view toward obtaining estimates of the future demand for transport and its probable split among the transport modes The aircraft scenario for the year 2000 implies that European airlines will use an increasing number of 100 to 130 seat transports in order to maintain frequencies adequate for stimulating business travel demand V P

A78-51524 **Diffusion brazing titanium sandwich structures** M M Schwartz (United Technologies Corp , Sikorsky Aircraft Div , Stratford, Conn) *(International Institute of Welding, Colloquium on High Temperature Brazing, Copenhagen, Denmark, July 3-9, 1977) Welding Journal,* vol 57, Sept 1978, p 35-38

The joining system described in the present paper involves diffusion welding and brazing, the tools and processing required for the system, and the heating methods and equipment Products being diffusion brazed, using the new system, are vacuum bonded in a single operation directly to final component configuration, rather than formed from premanufactured titanium honeycomb planks The results are less weight, greater strength and better fatigue resistance Some typical fabrications are illustrated V P

A78-51543 # **A modular side looking airborne radar to fulfill a multitude of surveillance missions** R Vollmers (U S Coast Guard, Office of Research and Development, Washington, D C) and G V Morris (Motorola, Inc , Government Electronics Div , Scottsdale, Ariz) In European Microwave Conference, 7th, Copenhagen, Denmark, September 5-8, 1977, Proceedings
Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd , 1978, p 414 418 7 refs

It is pointed out that in most surveillance missions a variety of sensors are needed because no single one is capable of fulfilling all mission requirements Services provided by side looking airborne radar (SLAR) are related to large area coverage, operation in adverse weather, cuing to other sensors, moving target indication, day/night operation, cooperative and noncooperative surveillance, higher resolution than forward looking airborne radar, and a near real-time hard copy map Various configurations of real aperture SLAR's have been employed by the U S and other countries for various uses such as border patrol and enforcement of territorial limits, search and rescue, oil and mineral exploration, shipping and oil pollution monitoring, ice mapping, geological fault determination, and flood damage assessment Attention is given to the modular side looking radar concept, missions and their impact on radar requirements, a modular radar baseline system description, and antenna options G R

A78-51551 # **Precision approach monitoring and guidance using interferometer techniques** A J Lambell (MEL Equipment Co , Ltd , Crawley, Sussex, England) and R P Vincent (Philips Research Laboratories, Redhill, Surrey, England) In European Microwave Conference, 7th, Copenhagen, Denmark, September 5-8, 1977, Proceedings Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd , 1978, p 509 513

The PAIR (Precision Approach Interferometer Radar) system accurately measures the position of aircraft in the airfield approach

sector A ground-based interrogator transmits a conventional SSR code Aircraft transponder replies are received by an azimuth and elevation interferometer and the angular position measured to high accuracy Range is measured from the go-and-return time Aircraft identity is obtained from the SSR IDENT code Ground reflections are reduced by means of a null in the vertical pattern of the elevation interferometer Fruit and garbling effects are removed in the signal processing The aircraft positional information is processed in a mini-computer and presented to the operator on a bright graphical display, and automatic conflict detection can be provided (Author)

A78-51594 **Some effects of temperature on the erosion of metals** N Gat and W Tabakoff (Cincinnati, University, Cincinnati, Ohio) *Wear*, vol 50, Sept 1978, p 85 94 21 refs Grant No DA-ARO(D)-124-G154

The effect of temperature on the erosion of several metals was experimentally investigated Theoretical considerations based on the temperature dependence of basic metallurgical processes were applied to analyze the results obtained In general it was found that erosion damage may increase or decrease as the temperature increases, depending upon the angle at which the particles strike the material surface and upon the test temperature with respect to the thermal properties of the material (Author)

A78-51598 # **Optimization of the structure of the LOT Polish Airlines fleet for the requirements of international passenger transport (Optymalizacja struktury taboru PLL LOT dla potrzeb miedzynarodowej komunikacji pasazerskiej)** A Kiezelis *Technika Lotnicza i Astronautyczna*, vol 33, Aug 1978, p 27-30 In Polish

A linear integer programming model is described for optimizing the structure of LOT's air fleet to meet the requirements for international passenger service for the years 1976 1990, during which period the purchase of new types of aircraft is envisaged The model enables one to calculate the numerical requirement for general types of aircraft as a function of year and the route and cost structures P T H

A78-51599 # **New organization of air traffic over the North Atlantic region (Nowa organizacja ruchu lotniczego nad polnocnym rejonem Atlantyku)** A Mokrowiecki *Technika Lotnicza i Astronautyczna*, vol 33, Aug 1978, p 31-34 In Polish

The paper describes the model studies used to set up the Organized Route System for the North Atlantic The modeling took into account projected air traffic, use of conventional long range navigation equipment, and the parameters of the current air fleet P T H

A78-51600 # **Operation of oil ring seals for aircraft turbine engines under cavitation conditions II (Praca olejowych uszczelnien pierscieniowych lotniczych silnikow turbinowych w warunkach kawitacji II)** M Ostopkowicz *Technika Lotnicza i Astronautyczna*, vol 33, Aug 1978, p 34, 35 In Polish

The paper considers mechanisms of the cavitation corrosion of oil ring seals in gas turbine engines and suggested methods to protect the seals against this type of corrosion Particular attention is given to the choice and testing of seal materials The 38HMJ steel and the type-HM chromium-molybdenum alloys are considered as candidates, and attention is given to their microstructural characteristics B J

A78-51621 # **Turboexpanders for energy conservation** J Holm and J S Swearingen (Rotoflow Corp , Los Angeles, Calif) *Mechanical Engineering*, vol 100, Sept 1978, p 34-40 13 refs

It is pointed out that significant amounts of energy are wasted in industrial and gas processing facilities where pressurized gas is reduced by throttling Approaches for conserving energy are discussed, taking into account the various types of turbines and the design qualifications needed to meet energy conservation requirements Attention is given to expander applications, efficiency considerations with respect to turbine design, the direct connected compressor, and arrangement consisting of a high-speed turboexpander and a generator, turboexpander qualities, variable flow control, the expansion of condensing streams, journal bearings, thrust bearing force meters, shaft seals, and the available sizes of turboexpanders G R

A78-51670 # **Calculation of combustion efficiency in gas-turbine-engine combustion chambers (K raschetu koeffitsienta polnoty sgoraniia topliva v kamerakh sgoraniia gazoturbinnykh dvigatelei)** V P Lebedev and Iu M Pchelkin (Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR) *Energetika*, vol 21, July 1978, p 54-60 In Russian

A new heat-balance method is shown to be an effective tool for improving the calculation of combustion efficiency in a gas-turbine-engine combustion chamber The improved heat balance equation proposed here is compared to the old equation in terms of the effectiveness with which the combustion efficiency is calculated B J

A78-51687 **Investigation of the convergence of a method of computing the flow around cascades in a variable thickness layer** G I Chmyr' and A M Kuzemko (Zaporozhskii Mashinostroitel'nyi Institut, Zaporozhe, Ukrainian SSR) *(Prikladnaia Mekhanika*, vol 14, Feb 1978, p 108-114) *Soviet Applied Mechanics*, vol 14, no 2, Aug 1978 p 194-200 Translation

The paper examines the convergence of a successive-approximation method for solving the integral equation describing cascade flow in a layer of variable thickness It is demonstrated that, after certain necessary conditions are satisfied, the successive approximations of the velocity potential of the flow converge absolutely and uniformly to the function sought The velocity potential is estimated B J

A78-51688 **Irrotational flow around a spherical segment** P Ia Malits and V N Tishchenko (Simferopol'skii Gosudarstvennyi Universitet, Simferopol, Ukrainian SSR) *(Prikladnaia Mekhanika*, vol 14, Feb 1978, p 115-121) *Soviet Applied Mechanics*, vol 14, no 2, Aug 1978, p 200-205 6 refs Translation

The paper solves the problem of the potential flow of an ideal fluid which has moving in it a spherical surface with an arbitrary aperture-angle A method for solving the singular integral equations of the problem is proposed, the solution being in the form of quadratures Expressions of flow velocity on both sides of the moving surface are obtained for a variety of moving surfaces The solution enables determination of the aerodynamic coefficients of such bodies B J

A78-51697 # **Interaction of turbulent boundary layers in a right-angle corner (Vzaimodeistvie turbulentnykh pogranichnykh sloev v priamom dvugrannom ugle)** V I Kornilov and A M Kharitonov *PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki*, May-June 1978, p 69 76 8 refs In Russian

Experiments were performed in a low-turbulence wind tunnel to study boundary layer characteristics in a right-angle corner model The extent of the turbulent boundary layer interaction region was determined for different Reynolds numbers, and particular attention was given to the effects of the longitudinal static pressure gradient on boundary layer characteristics B J

A78-51711 # **Mathematical analysis of impact erosion** T Q McCawley, J S Mills, and J Peddieson, Jr (Tennessee Technological University, Cookeville, Tenn) In Environmental degradation of engineering materials, Proceedings of the Conference, Blacksburg, Va , October 10-12, 1977 Blacksburg, Va , Virginia Polytechnic Institute and State University, 1978, p 161-169

The requirement of an all-weather capability of high-speed aircraft, space shuttles, rockets, and missiles has made it vital to protect critical sensitive parts of these systems against erosion damage produced by collision with particulate matter in the form of dust, metal particles, or raindrops In order to develop rational design procedures for erosion protection it is necessary to know the distribution of impact positions and impact speeds over the surface of the body The reported investigation is concerned with the derivation of a closed-form solution for a calculation of the required data The mathematical study takes into account the motion of small particles near the stagnation line of a sphere or a circular cylinder G R

A78-51744 # **Fatigue crack growth of titanium fan blades** W H Cullen and F R Stonesifer (U S Navy, Naval Research Laboratory, Washington, D C) In Environmental degradation of engineering materials, Proceedings of the Conference, Blacksburg, Va, October 10-12, 1977 Blacksburg, Va, Virginia Polytechnic Institute and State University, 1978, p 771-781 11 refs

The actual occurrence and continued possibility of gas-turbine engine fan-blade failures has led to a study of fatigue-crack growth rates in production-quality forged titanium-alloy fan blades An experimental procedure has been developed for determining the stress intensity factor for transverse through-thickness cracks in turbine blades The nonuniform thickness and foil shape of the blades necessitate calculation of the stress intensity factor from the change in specimen compliance with respect to crack length Using this technique, crack growth rates were measured at ambient temperature in both air and 3 5% salt solution These two conditions should represent the environmental extremes to which these turbines are subjected The results indicate that fatigue-crack growth rates in salt water at 0 5 Hz are five to twenty times faster than the rates in air at 5 0 Hz for equivalent stress intensities These data prove comparable to literature data on forms of the same chemistry The implications of these results for gas turbine design and operation are discussed (Author)

A78-51749 # **Optimization of quasi-stationary long distance flights in the case of different directions for conducting the flight according to a model which has been idealized to a large extent (Optimierung quasistationarer Streckenfluge bei unterschiedlichen Flugfuhrungsvorschriften nach einem weitgehend idealisierten Modell)** B Faber Darmstadt, Technische Hochschule, Fachbereich Maschinenbau, Dr-Ing Dissertation, 1977 180 p 48 refs In German Research supported by the Deutsche Forschungsgemeinschaft

The optimization of quasi-stationary sections of the flight under various flight conditions with respect to flight duration, range, flight dependent costs, and cost per payload unit is considered, taking into account constant values for flight speed, altitude, lift coefficient, thrust adjustment, or dynamic pressure The decrease in weight as a result of fuel consumption is an important factor Performance differences for different flight conditions, in the case of comparable initial conditions, are examined The considered problem is partly a simple, but degenerate variational problem, and partly an ordinary extreme value problem G R

A78-51752 # **Technical-economic analysis of the direct operating costs of air transport companies (Technisch-Wirtschaftliche Analyse der direkten Betriebskosten von Luftverkehrsgesellschaften)** G Mentzel Darmstadt, Technische Hochschule, Fachbereich Maschinenbau, Dr Ing Dissertation, 1977 364 p 149 refs In German

The reported investigation is concerned with the characteristics of the direct operating costs of commercial aircraft and the factors affecting these costs The concepts used in the investigation are based on a description of the actual conditions, their representation in a model, the mathematical formulation of the model, and an application of the obtained results to the actual situation The currently existing conditions are analyzed, taking into account the experience of the airlines General relations are derived with the aid of mathematical statistical procedures, and an application-oriented planning and evaluation instrument is developed Attention is given to aspects of maintenance, questions of depreciation, operating performance, operating cost, and details of methodology G R

A78-51816 * **Feasibility of an orbital simulator of stratospheric photochemistry** G L Matloff and M I Hoffert (New York University, Staten Island, N Y) *Acta Astronautica*, vol 5, July-Aug 1978, p 619-621 6 refs Grant No NsG 1298

It is proposed that a stratospheric photochemistry simulator could be created in sun-synchronous orbit, so that diffusion and photochemistry could be decoupled and uncertainties in photo chemical reaction rates could be substantially reduced The proposed test chamber is described, and it is suggested that the technology of superpressure balloons seems to be the best short-term solution to the construction of the proposed facility Both unreinforced polyester films and gelatin films are considered as candidate chamber coatings It is noted that the experiments can be performed early in the space-manufacturing era and that at least three dedicated Shuttle launches will be required to establish the proposed facility F G M

A78-51817 **The shape of airliners to come** M Hewish *New Scientist*, vol 79, Sept 7, 1978, p 681-683

The advantages of designing a new commerical aircraft from scratch and the advantages of modifying designs used in earlier aircraft are compared with reference to a series of smaller aircraft known as JET (Joint European Transport) While JET will have many items in common with Airbus aircraft, JET is described as a completely new aircraft Characteristics of JET and of its new turbine (based on the RB 211) are reported M L

A78-51822 **International jurisdiction related to the Warsaw Convention during the years from 1974 to 1976 II (Die internationale Rechtsprechung zum Warschauer Abkommen in den Jahren 1974 bis 1976 II)** D Schoner *Zeitschrift fur Luft- und Weltraumrecht*, vol 27, Sept 1978, p 151-170 656 refs In German

The concept of embarkation and disembarkation as used in Article 17 of the Warsaw Convention is considered No definition is provided in the Convention regarding the exact meaning of the terms used in this connection in the original French text which speaks of 'toutes operations d'embarquement et de débarquement' Juridicial decisions in different countries involving an interpretation of these terms are discussed, taking into account an attack on passengers by terrorists at the airport of Athens in August 1973 G R

A78-51823 **The legal basis for security measures in air traffic (Rechtsgrundlagen fur Sicherungsmassnahmen im Luftverkehr)** E Grabberr *Zeitschrift fur Luft- und Weltraumrecht*, vol 27, Sept 1978, p 171-178 11 refs In German

Security measures for the air traffic, as distinguished from the operational safety measures customarily practiced, were introduced into air traffic operations in 1970 These security measures include control procedures for passengers, baggage, and freight, in addition to the identification of baggage and special object protection measures. It appears that these security measures will be retained as a permanent feature of the air traffic An investigation is in this connection conducted concerning the need to provide a legal basis for these measures in the territory of the Federal Republic of Germany, taking into account existing constitutional rights of a person and current laws and regulations related to the considered measures. G R

A78-51838 * **Fire resistivity and toxicity studies of candidate aircraft passenger seat materials** L L Fewell (NASA, Ames Research Center, Moffett Field, Calif), E L Trabold, and H H Spieth (Douglas Aircraft Co, Long Beach, Calif) *Journal of Fire and Flammability*, vol 9, July 1978, p 377-402 8 refs

This paper describes fire resistivity studies of a wide range of candidate nonmetallic materials for the construction of improved fire resistant aircraft passenger seats These materials were evaluated on the basis of FAA airworthiness burn and smoke generation tests, colorfastness, and animal toxicity tests Physical, mechanical, and aesthetic properties were also included in the evaluations Candidate seat materials that have significantly improved thermal response to various thermal loads corresponding to reasonable fire threats, as they relate to in-fight fire situations, are identified (Author)

A78-51839 **Opportunities for cost-affordable titanium aerospace structures** N G Tupper, J K Elbaum, and H M Burte (USAF, Materials Laboratory, Wright-Patterson AFB, Ohio) *Journal of Metals*, vol 30, Sept 1978, p 7-13 20 refs

The development of cost-effective titanium structures for aircraft is outlined The design process is considered with reference to stress, fatigue, crack growth, and temperature parameters

Titanium and aluminum structures are compared on the bases of properties and manufacturing costs The implementation of titanium aerospace structures is described in terms of cost reduction, isothermal forging, powder metallurgy, welding, and metal removal
S C S

A78-51889 # **Accuracy of ship-position determination by means of NNSS Transit (Dokladnosc okreslenia pozycji statku za pomoca NNSS 'Transit')** K Wielebski and J Wereszczynski (Lodz, Politechnika, Lodz, Poland) *(Sympozjum na temat Problemow Nawigacji Kosmicznej, Lodz, Poland, Dec 19, 1977) Postepy Astronautyki,* vol 11, no 2, 1978, p 43-61 13 refs In Polish

The paper examines the accuracy of Transit, the Navy Navigation Satellite System in determining the accuracy of ship positions The position of the ship relative to the satellite, ship velocity, and the altitude of the antenna above the reference ellipsoid are taken into account Formulas for determining the accuracy of position determination are presented
B J

A78-51890 # **The use of Doppler-shift position lines in satellite navigation systems (Izodoppa w nawigacji przy uzyciu sztucznych satelitow)** J Wereszczynski (Lodz, Politechnika, Lodz, Poland) *(Sympozjum na temat Problemow Nawigacji Kosmicznej, Lodz, Poland, Dec 19, 1977) Postepy Astronautyki,* vol 11, no 2, 1978, p 63-78 7 refs In Polish

The utilization of the Doppler shift of satellite signals for purposes of navigation is considered The use of Doppler-shift position lines for accurate determinations of ship positions is investigated Particular attention is given to the Transit system B J

A78-51896 Applications for airborne digital communications N P Janus (Mitre Corp , Bedford, Mass), J J McConnell (U S Army, Washington, D C), P H Phillips (Electrospace Systems, Inc , Richardson, Tex), and L S Nored *Signal,* vol 33, Sept 1978, p 23-29

Techniques and capabilities for implementing high-speed digital communications aboard military aircraft are reviewed The review is limited to line-of-sight, air-to-air, and air-to-ground communications requirements, with attention given to threat, countermeasures, system capability, antenna, radio, modem, and frequency band evaluation Certain recommendations are made for a typical system
B J

A78-51933 Values of diffusion coefficients deduced from the closing times of helicopter-produced clearings in fog V G Plank (USAF, Geophysics Laboratory, Bedford, Mass), D M Johnson (Combustion Engineering Co , Windsor, Conn), and A A Spatola *Journal of Applied Meteorology,* vol 17, Aug 1978, p 1190-1200 16 refs

The geometric and thermodynamic properties and observed closing times of certain clearings created in fog layers by helicopter downwash during hover experiments are examined Modifications of Elliott's (1970) treatment are outlined which were required to estimate the diffusion coefficients for the particular situations studied The values of the coefficients are found to range from 70,000 to 190,000 sq cm/s, which are appreciably larger than any reported previously for fog of similar type It is concluded that the absolute values of the coefficients probably cannot be given too much credence since they are heavily dependent on assumptions concerning the geometry of the clearings as well as on the definition of closing time However, it is noted that the relative values and trends seem to correlate sensibly with a turbulence index, such as the Richardson number
F G M

A78-51945 # **Stochastic properties of conflict frequency at multiple connected air route intersections** D K Schmidt (Purdue University, West Lafayette, Ind) *Journal of Aircraft,* vol 15, Oct 1978, p 682-685 5 refs

Previous results regarding the stochastic properties of the frequency of conflict situations at a single intersection of two air routes have been extended to the case of multiple connected intersections Such a situation occurs when more-than one aircraft stream intersects with another aircraft stream Examples include multiple discrete velocity groups of vehicles on routes, intersections in the horizontal plane involving more than two routes, and routes transitioning through altitude strata or flight levels It is determined that the conflict frequency at multiple intersections connected with a common vehicle stream are correlated, and the expression for the covariance is derived With these results, not only the mean, but the variance of conflict frequency for an ATC sector may be predicted from traffic-flow and route-geometry information, both of which are important parameters for sector capacity analyses (Author)

A78-51946 # **Detecting abnormal turbine engine deterioration using electrostatic methods** R P Couch (USAF, Aeronautical Systems Div , Wright Patterson AFB, Ohio) *Journal of Aircraft,* vol 15, Oct 1978, p 692-695 8 refs

A method of detecting abnormal turbine engine deterioration has been developed and tested The method observes pulse electrostatic signals in the exhaust which have been determined to originate from component rubbing, chaffing, erosion, and burning (i e , various forms of deterioration) The normal (healthy engine) deterioration rate is first studied as a function of engine cycling and power This deterioration rate is then normalized with an engine power and an engine cycling parameter Tenfold increases in the normalized deterioration rate are then used as an indication of impending component failure Experience shows that about two out of three turbine engine gas-path failures can be predicted four or more hours ahead of time by this method The false alarm rate is estimated to be about 5% (Author)

A78-51947 # **Comparison of linear and nonlinear dampers for landing gears** C Venkatesan *Journal of Aircraft,* vol 15, Oct 1978, p 696-698 6 refs

For given aircraft weight and descent velocity, the parameters preload and linear or nonlinear damping, governing the performance of the landing gear, are optimized so as to obtain the minimum peak ground load with a constraint on the maximum stroke It is assumed that the descent velocity is uniform, that the forward velocity of the aircraft is zero, and that the force-deflection characteristic of the tire is linear The system behavior is studied at three different velocities of descent, viz 3, 8 86, and 11 ft/sec Attention is given to a comparison of the results obtained with those of Hall (1967) for both the linear and the nonlinear dampers It is shown that if the landing gears are optimized for a given descent velocity and then used at lower or higher descent velocities, the nonlinear orifice damper in the shock absorber exhibits a better performance, since the peak ground loads obtained are lower than those produced by a linear damper
S D

A78-51948 # **Computation of two-dimensional potential flow using elementary vortex distributions** P Raj and R B Gray (Georgia Institute of Technology, Atlanta, Ga) *Journal of Aircraft,* vol 15, Oct 1978, p 698-700 16 refs

The two-dimensional potential flow problem is formulated using surface-vorticity distribution coupled with the conventional zero-normal-flow boundary condition More specifically, velocity and pressure distributions are computed on the surface of a circular cylinder and NACA basic thickness form airfoils A second-order equation defines the profile curve of the cylinder, and the bounding surface of the airfoil is analytically represented by a higher-order expression The surface-vorticity method coupled with zero-normal-velocity boundary condition gives a Fredholm integral equation of the first kind An elementary vortex distribution technique which utilizes a linear distribution on each element is employed to approximate the integral equation by a set of linear algebraic equations The resulting coefficient matrix has diagonal entries larger than other entries, which is a crucial factor in numerical solution Nonlifting and lifting flows are computed for NACA symmetrical airfoils with very high accuracy
S D

A78-51949 # **Minimum on-axis noise for a propeller or helicopter rotor** M R Fink (United Technologies Research Center, East Hartford, Conn) *Journal of Aircraft,* vol 15, Oct 1978, p 700-702 6 refs

A method for predicting ultimate limits on noise for propellers or helicopter rotors is presented and evaluated by comparisons with

available data It is found that predicted on-axis broadband noise caused by flow of the blade turbulent boundary layer past the trailing edge generally matches the portion of a hovering helicopter rotor's spectrum called high-frequency broadband noise Noise radiation from nonlifting blades with their shed wakes blown downstream is overestimated near peak amplitude by this method B J

A78-51950 # **Compressibility effects on parachute transient pressures** P C Klimas (Sandia Laboratories, Albuquerque, N Mex) *Journal of Aircraft,* vol 15, Oct 1978, p 702-704

The present work attempts to expand the available information in the area of parachute transient pressures and to determine the dependence of transient aerodynamics on freestream Mach number This is done on the basis of an experimental investigation of parachutes of three different geometric porosities (0, 12, and 25%) for a freestream Mach number range of 0 3-1 2 and a constant value freestream dynamic pressure (225 psf) Maximum values of transient differential pressure coefficients are given for various radial positions It is found that this coefficient is a reasonably strong and monotonically decreasing function of freestream Mach number B J

A78-51968 **Waves and wave resistance for air-cushion vehicles with time-dependent cushion pressures** H J Haussling and R T Van Eseltine (U S Naval Material Command, David W Taylor Naval Ship Research and Development Center, Bethesda, Md) *Journal of Ship Research,* vol 22, Sept 1978, p 170-177 13 refs Navy supported research

Wave patterns and wave resistance are computed for air-cushion vehicles with time-dependent cushion pressures moving at uniform speed over deep and shallow water The effect of beam-to-length ratio, Froude number, and water depth on the resistance is investigated The resistance is found to exhibit a distinctive behavior at a critical frequency This behavior corresponds to a singularity in the resistance at the critical frequency The importance of this behavior is found to diminish with decreasing beam-to-length ratio and increasing Froude number (Author)

A78-51971 **Infrared passbands for clear-air-turbulence detection** P M Kuhn, L P Stearns (NOAA, Atmospheric Physics and Chemistry Laboratory, Boulder, Colo), I G Nolt, and J V Radostitz (Oregon, University, Eugene, Ore) *Optics Letters,* vol 3, Oct 1978, p 130-132 5 refs

Clear air turbulence (CAT) ahead of an aircraft can be detected in real time by an infrared radiometer The alert time and reliability depend on the passband of the infrared filter used and the altitude of the aircraft Preliminary results and analyses show that a nominal passband of 26 to 35 microns appears optimal to alert CAT from 1 5 to 6 0 min ahead of the encounter The alert time increases with higher altitude as the atmospheric absorption, determining the horizontal weighting, is reduced (Author)

A78-51977 # **Solar power satellite construction and maintenance - The first large-scale use of man-in-space** K H Miller and E Davis (Boeing Aerospace Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Conference on Large Space Platforms Future Needs and Capabilities, Los Angeles, Calif , Sept 27-29, 1978, Paper 78-1637* 10 p

The 10 GWe photovoltaic solar power satellite concept developed by NASA and Boeing Aerospace Company is described Current construction and maintenance approaches are discussed This concept requires several hundred people working in space They will be located at a low-earth-orbit construction base, a geosynchronous earth-orbit final assembly base, or on the satellites performing maintenance The text includes discussions of crew jobs, work schedules, rotation, transportation, productivity, and other human factors considerations (Author)

A78-52042 # **Application of hypersonic favorable aerodynamic interference concepts to supersonic aircraft** R M Kulfan (Boeing Commercial Airplane Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif , Aug 21-23, 1978, Paper 78-1458* 28 p 41 refs

A study was made to identify hypersonic favorable aerodynamic interference concepts for application to supersonic aircraft. Preliminary aerodynamic analysis defined key design parameters, and scoped potential aerodynamic efficiency improvements The study included supersonic biplanes, ring wings, parasol wings, wave rider concepts, and flat-top wing/body arrangements Results indicate the parasol wing concept offers the greatest potential aerodynamic benefits for the study conditions However, the best aerodynamic concept is very dependent on the design Mach number, and on the airplane component size relationships It is shown that existing aerodynamic design/analysis methods can be used for parasol wing aerodynamics studies (Author)

A78-52043 **On the nonstationary boundary layer with self-induced pressure at transonic external stream velocities** O S Ryzhov (Akademiia Nauk SSSR, Vychislitel'nyi Tsentr, Moscow, USSR) *(Akademiia Nauk SSSR, Doklady,* vol 236, Oct 11, 1977, p 1091-1094) *Soviet Physics - Doklady,* vol 22, Oct 1977, p 537-539 10 refs Translation

Unsteady transonic boundary layer flow with a self induced pressure gradient is studied using a mathematical model which divides the velocity field into three regions (1) an outer region of potential flow where viscosity and thermal conductivity can be neglected, (2) a midregion of vortices where dissipative factors can be neglected, and (3) a near wall region with viscous stresses The nature of the unsteady flow is determined by a freestream K parameter (derived in the paper) related to Mach number and temperature ratio and by initial flow conditions B J

A78-52175 **The force on a small sphere in slow viscous flow** D A Drew (Rensselaer Polytechnic Institute, Troy, N Y) *Journal of Fluid Mechanics,* vol 88, Sept 27, 1978, p 393-400 8 refs Navy-supported research

The force on a small sphere translating relative to a slow viscous flow is found to order of the 1/2 power of Re for two different fluid flows far from the sphere, namely pure rotation and pure shear For pure rotation, the correction of this order to the Stokes drag consists of an increase in the drag For pure shear, the force of this order contains a component perpendicular to the Stokes drag force (Author)

A78-52244 **Boeing launches the 767** J P Geddes *Interavia,* vol 33, Sept 1978, p 779 782

The 767 aircraft is described The aircraft will carry 197 passengers, has a gross takeoff weight of 127,000 kg, is powered by two JT9D-7R engines each rated at 20,100 kp, has a wing area about one third larger than the Airbus 300, and requires 2317 m take-off field length for maximum gross weight First flight is presently scheduled for August 1981 The integration of 767s into a fleet of 727s is considered The aircraft design is considered 'conventional', the most noticeable change being the adoption of a conventionally positioned horizontal stabilizer in place of the 'T' tail Topics examined include interior layout cargo space production work sharing, marketing predictions, and the effect of commonality on costs M L

A78-52245 **The L 1011 500 long range TriStar** J P Geddes *Interavia,* vol 33, Sept 1978, p 863-866

The L 1011 500 called the Dash 500 is described, its prospects are considered, and modifications made in the basic L 1011-1 design are examined The wide bodied Dash 500 can carry 250 passengers and 19 LD3 containers, the empty operating weight is 108,925 kg Design innovations, the flight management system, and the Dash 500/digital automatic flight control system are discussed The aircraft is intended to serve both as a replacement of 707s and DC 8s and as a substitute for 747s for city pairs with light traffic M L

A78-52360 # **Atmospheric attenuation statistics at 15 and 35 GHz for very low elevation angles** E E Altshuler, M A Gallop, Jr , and L E Telford (USAF, Rome Air Development Center, Bedford, Mass) *Radio Science,* vol 13, Sept Oct 1978, p 839 852 16 refs

The paper presents 440 sets of slant path attenuation data at 15 and 35 GHz frequencies The attenuations were measured with an 8 8-m paraboloidical antenna using the sun as a source Data were also obtained on surface temperature, pressure, and absolute humidity The data made systematic analyses of the relations between attenuation, elevation angle, and atmospheric conditions possible It is found that (1) the mean attenuations at both 15 and 35 GHz decrease smoothly with increasing elevation angle and at a 0-deg range from 5 44 to 8 80 dB and 15 47 to 24 12 dB, respectively, for clear to cloudy conditions, and (2) at an angle of 5 degrees, the mean attenuations at 15 and 35 GHz have a range of 69 to 1 08 dB and 2 45 to 9 02 dB, respectively S C S

A78-52401 # ***Optimization and differential games (Optimizatsiia i differentsial'nye igry)*** L S Pontriagin *Akademiia Nauk SSSR, Vestnik,* no 7, 1978, p 10-17 In Russian

Some applied problems in differential game theory are considered Particular attention is given to optimal and time-optimal control in the pursuit tracking of one aircraft by another B J

A78-52447 **Innovation in international air transportation regulation - The US-Netherland's agreement of 10 March 1978** H A Wassenbergh (KLM Royal Dutch Airlines, Schiphol Airport, Netherlands) *Air Law,* vol 3, no 3, 1978, p 138 162 26 refs

The 'Protocol relating to the U S -Netherlands Air Transport Agreement of 1957' is discussed, with attention given to route authority, charter rights, fair competition, tariffs and prices, tariff participation, capacity, and enforcement The full text of the Protocol is presented along with the full text of the Memorandum of Consultations B J

A78-52448 **The changing environment of international air commerce** A E Kahn (Civil Aeronautics Board, Washington, D C) *Air Law,* vol 3, no 3, 1978, p 163-174

The harmful effects of government protection in U S air transportation are pointed out It is emphasized that the loosening of regulation of the domestic aviation industry should be extended to the international market as well Ways in which the American experience of competition could apply to the international market are discussed B J

A78-52450 **Design concepts for future air freighters** H W Withington (Boeing Commercial Airplane Co , Seattle, Wash) *Exxon Air World,* vol 30, no 3, 1978, p 70-73

Use patterns of air freighters in the future are considered, and design concepts for fuselage, payload/range capabilities, wing configuration, and commonality of components are examined A typical dedicated air freighter that could be introduced in the 1980's would use the horizontal double-lobe cross section concept and would be able to carry up to 60 8-foot by 10-foot containers in four cargo lanes Characteristics of the tailless aircraft concept and of the tandem wing and flying wing configurations are discussed, and the distributed load freighter concept is described M L

A78-52498 # **A visual simulation procedure for the processing of television images with reduced frame rates in the case of representations of outside views from remotely piloted vehicles (Ein Sichtsimulationsverfahren zur Aufbereitung von Fernsehbildern mit reduzierten Bildraten bei Aussensichtdarstellungen aus ferngelenkten Fahrzeugen)** K D Schulz-Helbach Meckenheim, Forschungsinstitut fur Anthropotechnik (Forschungsinstitut fur Anthropotechnik, Bericht, No 35), 1977 42 p 17 refs In German S5 25

The transmission of image information from a remotely piloted vehicle to the ground station is of importance for a successful mission Particular attention must therefore be given to approaches which will prevent a disturbance or interruption of this communication link A description is presented of a number of such approaches, taking into account human factor considerations Approaches which can be used with respect to picture transmission in the case of a disturbed information channel are discussed, taking into account a reduction of the amount of information transmitted per picture and an increase in image transmission time The properties of image sensors for reduced frame rates are examined Attention is also given to details of image processing, which in case of an employment of the considered approaches is necessary to add missing information regarding the motion of the remotely piloted vehicle G R

A78-52578 ***Eddy current torques, air torques, and the spin decay of cylindrical rocket bodies in orbit*** V Williams and A J Meadows (Leicester, University, Leicester, England) *Planetary and Space Science,* vol 26, Aug 1978, p 721-726 11 refs Research supported by the Science Research Council

This paper considers the torques causing spin decay in cylindrical rocket bodies in orbit Eddy current torques, due to the earth's magnetic field, are estimated by Smith's (1962) model - a hollow cylindrical conducting shell, tumbling about a transverse axis Air torques are estimated by numerical integration of aerodynamic moments over the rocket surface It is shown that for Cosmos rockets, 7 4 m long and 2 4 m in diameter, eddy current torques outweigh air torques by several orders of magnitude at altitudes near 500 km, and that they are dominant at altitudes down to 160 km Visual observations of several such rockets illustrate a variation of spin decay time with altitude which supports this conclusion The same observations suggest that a few Cosmos rockets may be special cases, different from the rest in construction (Author)

A78-52592 # **Analysis of advanced variable camber concepts for combat aircraft** R F Siewert (U S Naval Air Systems Command, Washington, D C) and R E Whitehead (U S Navy, Office of Naval Research, Washington, D C) *Naval Research Reviews,* vol 31, July 1978, p 1-16 12 refs

The paper reviews current applications of variable camber and discusses advanced variable camber concepts, segmented variable camber, and the self-optimizing wing concept Some conclusions concerning the use of variable camber concepts to enhance the 'off-design' performance of fighter aircraft are presented In particular, the use of such concepts to improve the transonic maneuvering characteristics of fighter aircraft is discussed B J

A78-52616 **Duct effects on the heave stability of plenum air cushions** M J Hinchey and P A Sullivan (Toronto, University, Toronto, Canada) *Journal of Sound and Vibration,* vol 60, Sept 8, 1978, p 87-99 19 refs Research supported by Transport Canada, National Research Council of Canada Grant No A-3378

Linear heave stability boundaries for a fan-duct-plenum air cushion suspension system were obtained by using a quasi-static pressure-flow relationship for the fan, a finite element discretization for one-dimensional unsteady duct flow, and a lumped capacitance model for the plenum These studies indicate that even relatively short ducts can have a major effect, at practical flow rates, on the stability of cushion systems (e g , tracked levitated vehicles) typically used for amphibious and overland operations Reasons for considering the linear approach adequate for practical stability calculations are described The duct effect is thought to be associated primarily with the inertance of the air in the duct M L

A78-52626 * # **The development and evaluation of advanced technology laminar-flow-control subsonic transport aircraft.** R F Sturgeon (Lockheed Georgia Co , Marietta, Ga) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-96* 9 p 11 refs Contract No NAS1-13694

A study was conducted to evaluate the technical and economic feasibility of applying laminar flow control (LFC) to the wings and empennage of long-range subsonic transport aircraft for initial operation in 1985 For a design mission range of 5500 n mi, advanced technology LFC and turbulent-flow aircraft were devel

oped for a 200 passenger payload, and compared on the basis of production costs, direct operating costs, and fuel efficiency Parametric analyses were conducted to establish optimum geometry, advanced system concepts were evaluated, and configuration variations maximizing the effectiveness of LFC were developed The final comparisons include consideration of maintenance costs and procedures, manufacturing costs and procedures, and operational considerations peculiar to LFC aircraft (Author)

A78-52628 * # An improved higher order panel method for linearized supersonic flow F E Ehlers, M A Epton, F T Johnson, A E Magnus, and P E Rubbert (Boeing Commercial Airplane Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78 15* 7 p 8 refs Contract No NAS2 7729

An improved higher order panel method for linearized supersonic flow is described Each panel, defined by four points on the surface, is divided into eight subpanels in such a way that all subpanel and panel edges are contiguous By prescribing a quadratic distribution of the doublet on each subpanel, the doublet strength is made strictly continuous on the paneled surface A linear source distribution is also used Numerical results are smoother and in better agreement with experiment than the previous method with less strict continuity A brief discussion of superinclined panels used to eliminate interior interference in nacelles is included (Author)

A78-52629 # Influence of surface roughness on skin friction and heat transfer for compressible turbulent boundary layers A G Keel, Jr (U S Navy, Naval Surface Weapons Center, Silver Spring, Md) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 15th, Los Angeles, Calif , Jan 24-26, 1977, Paper 77 178* 52 p 29 refs

A systematic experimental investigation of the effects of uniformly distributed sand grain roughness on compressible turbulent boundary layers with heat transfer has recently been completed An internally cooled five-degree conical model was used Direct measurements of the local skin friction, heat transfer, and boundary-layer Pitot profile were made Tests were conducted at free stream Mach numbers of 2 5 and 5 0 and at model wall-to adiabatic wall temperature ratios of 0 3 and 1 0 Length Reynolds numbers from 1 to 25 million were considered, yielding measured momentum thickness Reynolds numbers from 2 to 20 thousand Results were obtained with a smooth model wall, with a 23 mil surface roughness, and with a 43 mil roughness, providing roughness Reynolds numbers from 100 to 1000 (Author)

A78 52630 * # Advanced panel-type influence coefficient methods applied to unsteady three dimensional potential flows A R Dusto, M A Epton, and F T Johnson (Boeing Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-229* 9 p 7 refs Contract No NAS2 7729

A panel method for solving unsteady, subsonic wind body-tail flow problems is formulated and partially verified The method is applicable to general aircraft configurations consisting of arbitrary arrangements of wings, bodies, tails, and nacelles The wake may be located arbitrarily and the unsteady, transverse component of vorticity in the wake may be assigned any covection velocity The wake in the unsteady flow problem, therefore, can be given the location and convection velocity of the wake produced by a steady flow which is the mean flow of the unsteady flow problem The panel method has been used as a basis for expanding the unsteady kernel function in a power series to obtain panel influence coefficients which can be integrated in closed form G R

A78-52647 The response of a Hooke's-joint gyroscope to linear vibration J S Burdess, C H J Fox, and L Maunder (Newcastle upon-Tyne, University, Newcastle-upon-Tyne, England) *Journal of Mechanical Engineering Science*, vol 20, Aug 1978, p 189-195

The response of an unbalanced Hooke's-joint gyroscope to linear vibration is considered Six major resonant frequencies are identified It is shown that, if the gyroscope is subjected to linear vibration either along the spin axis at the spin frequency, or perpendicular to the spin axis at twice the spin frequency, measurement errors may be generated as a result of mass unbalance These errors are shown to depend not only upon the degree of unbalance but also upon the amplitude and phase characteristics of the vibration Compensation by the application of suitable control torques is shown to be possible (Author)

A78-52648 A surface vorticity theory for propeller ducts and turbofan engine cowls in non-axisymmetric incompressible flow V P Hill (Newcastle upon Tyne, University, Newcastle-upon Tyne, England) *Journal of Mechanical Engineering Science*, vol 20, Aug 1978, p 201-219 12 refs Research supported by the Science Research Council

Starting from the basic Fredholm integral equations, a surface vorticity theory is developed for the prediction of annular airfoil performance in three dimensional flow A mathematical model is proposed for the general case of the axisymmetric body in nonaxisymmetric flow, using a Fourier series to represent circumferential variations in bound vorticity strength Using the pure incidence case as an example, it is indicated how an economical solution of the flow may be arrived at by use of a digital computer The theoretical pressure distributions obtained are compared with the results of wind tunnel tests on an annular airfoil model (Author)

A78-52686 High temperature elastomers in gas turbine engine fuel sealing K P Palmer and M W Aston (Lucas Aerospace, Ltd , Engine Management Div , Solihull, Warwicks , England) In International Conference on Fluid Sealing, 8th, Durham, England, September 11 13, 1978, Proceedings Volume 1
Cranfield, Beds , England, British Hydromechanics Research Association Fluid Engineering, 1978, p F1-1 to F1 18 7 refs

The compression stress relaxation properties of fluorocarbon and fluorosilicone 'O' rings were correlated to their sealing performance and related to other properties which are commonly used for assessing this performance Whilst the correlation with sealing performance was found to be very good, poor correlation was obtained with volume swell, compression set, low temperature brittle point and the Gehman T10 value in the cases examined These properties could give a very misleading indication of the likely sealing performance of the elastomer It is concluded that compression stress relaxation is the property which most closely conforms to the configuration in which most elastomeric seals are used and is the best property for indicating their likely sealing performance, particularly as it can be measured over the full range of environmental conditions that might be applied to the seal (Author)

A78-52763 # Experimental investigation of laminar-to-turbulent-flow transition under the effect of acoustic oscillations (Eksperimental'noe issledovanie perekhoda laminarnogo techeniia v turbulentnoe pod vozdeistviem akusticheskikh kolebanii) A N Shel'piakov and G P Isupov (Izhevskii Mekhanicheskii Institut, Votkinsk, USSR) *Inzhenerno-Fizicheskii Zhurnal,* vol 35, Sept 1978, p 410-414 In Russian

Experimental results are presented regarding the effects of acoustic oscillations at frequencies up to 100 kHz on a free laminar jet Experiments performed in a capillary setup show that the free laminar jet is turbulized by acoustic oscillations at certain frequencies The effects of certain geometrical and aerodynamic parameters on the transition flow in the presence of acoustic oscillations are also discussed B J

A78-52926 # Influence of the compression process in air intakes on the specific impulse characteristics of a hypersonic ramjet engine (Vliianie protsessa szhatiia v vozdukhozabornike na udel'nye tiagovye kharakteristiki GPVRD) V V Zatoloka, V I Zvegintsev, and V V Shumskii (Akademiia Nauk SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR) *Akademiia Nauk SSSR,*

Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk, June 1978, p 3 12 7 refs In Russian

The dependence of the specific thrust of a hypersonic ramjet engine with supersonic combustion on the compression of the air-stream in an air scoop is analyzed for a Mach number range of 8 to 15, assuming hydrogen as the fuel It is shown that the influence of the compression process is defined by two parameters the compression ratio (which indicates the increase in pressure which the airstream must overcome) and the relative throat area of the air intake (which is one of the basic requirements placed on the configuration of the surfaces which form the air intake) The thrust characteristics are plotted against a wide range of values of compression parameter V P

A78-52932 # **Density of motions in the flutter of infinite plates (Plotnost' dvizhenii pri flattere beskonechnykh plastin)** V M Kornev (Akademiia Nauk SSSR, Institut Gidrodinamiki, Novosibirsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk,* June 1978, p 101-105 8 refs In Russian

In the present paper, the behavior of tensioned plates resting on an elastic base in a gas flow is analyzed for given external inputs It is assumed that the arbitrarily clamped plate is infinite in the direction of the flow Proper motions, in the form of traveling waves, are analyzed along the longitudinal coordinate Along the transverse coordinate, the solution consists of the principal part and the dynamic edge effect The boundary conditions are shown to have a weak effect on the principal part of the solution The frequencies and lengths of the traveling waves and the critical flow parameters are calculated An analysis of the density of proper motions of the plate in the gas flow reveals the existence of a point of condensation of proper motions about the minimal critical flow parameter V P

A78-52951 **Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings and Supplement** Washington, D C , Air Traffic Control Association, 1978 Proceedings, 328 p , Supplement, 75 p $15

Papers are presented on the Navstar Global Positioning System and the Sanders AN/FYK 14 project Consideration is given to air traffic surveillance systems, computer-driven displays, the Central Flow Control System, and a moving target detector radar system The development of a wake vortex advisory system is discussed along with a system theory for metering and spacing Financial considera tions regarding airline operations are outlined and an overview of potential air traffic control developments is presented The Iranian National Airspace System is described and plans for the automation of air traffic control in the Federal Republic of Germany are proposed Prospects for the international standardization of air traffic control services are reviewed and advancements in air traffic control displays and computer controller interaction are noted S C S

A78-52952 # **The Navstar Global Positioning System /GPS/** E G DeAvies (USAF, Office of the Secretary of Defense, Washington, D C) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 1 6

The paper discusses the Navstar Global Positioning System which is being developed to support weapon delivery systems and other military missions The Timation I satellite and the Navigation Technology Satellite 2 are described with reference to their associated hardware, assembly, and instrumentation The application of Navstar for precision approaches is considered S C S

A78-52954 # **Sanders AN/FYK-14 - Bridging the gap between mission control and air traffic control** W C Goodrich (USAF, Space and Missile Test Center, Vandenberg AFB, Calif), A Hastbacka, M Janosky, and J Cawley (Sanders Associates, Inc , Nashua, N H) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 19 32

The AN/FYK-14 area surveillance and control system is dis cussed with reference to the SAMTEC (U S Air Force Space and Missile Test Center) problem The major AN/FYK-14 subsystems are reviewed including the central processor, tracking processor, display processors, and display consoles SAMTEC radar sites are identified in terms of location, primary and secondary radar, and common digitizer A typical AN/FYK-14 data display is presented and the quick action functions and alphanumeric keyboard functions are described S C S

A78-52955 # **The helicopter operators' viewpoint** G A Gilbert In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 33-41

Helicopter operational considerations are reviewed noting the helicopter operational development program and design criteria for all weather heliports Helicopter operations are categorized on the basis of weather considerations, air traffic control, off-shore opera tions, and remote area operations The air traffic control interface is reviewed and on-board navigation equipment is described Terminal instrument procedures are outlined and the basic aspects of a helicopter operational development are listed S C S

A78-52956 # **Safety and communication requirements in air traffic control today** E C Krupinski (Air Line Pilots Association, Washington, D C) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 46-50

Air traffic control is discussed from the point of view of safety and communications requirements proposed by the Air Line Pilots Association Recent near midair collisions, system errors, and pilot deviations are noted Recommendations are made with regard to the acknowledgement of clearances and/or instructions The pilot's role in air traffic control is reviewed and the development of a total situation cockpit display is considered S C S

A78-52957 # **Airport traffic surveillance** A D McComas (Bendix Corp , Communications Div , Baltimore, Md) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 54 65

A technique is presented for the continuous beacon surveillance throughout the terminal area from enroute transition to the ramp Consideration is given to the Geoscan interrogation process, a trilateration brassboard station, and a comparative analysis of position location systems S C S

A78 52958 # **The ARTS III Umbrella - Concepts and applications** L G DuBois and J A Gersch (Sperry Rand Corp , Defense Systems Div , St Paul, Minn) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 75 87

The paper discusses a terminal air traffic control automation concept for collecting and disseminating aircraft positional data within radar coverage regions containing two or more air traffic control facilities The concept has been implemented in Tampa/ Sarasota and New York TRACON The Tampa/Sarasota system is outlined with reference to the radar remoting system, the remote tower displays, the operational impact, and the implementation procedure The New York TRACON system is considered in terms of software and hardware specifications, the remote radar sites, tower sites, the TRACON site, controller impact, and implementation S C S

A78-52959 # **A more fully Automated En Route ATC system** A W Bowers and R A Rucker (Mitre Corp , Metrek Div , McLean, Va) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 88 103 U S Department of Transportation Contract No FA70WA-2448

Attention is given to the Automated En Route ATC (AERA) program being developed for the automation of en route air traffic control clearance and advisory services The design goals are identified as the accommodation of user flight preferences, reduction in system errors, improvement of system performance monitoring and supervision, increased controller productivity, and increased pilot participation in clearance planning The experimental approach consists of refining the closed-loop algorithm and developing controller as manager concepts The basic functions of the AERA system are reviewed, including the initial processing point, the inbound handoff point, progress monitoring, clearance delivery, final metering and spacing control point, and outbound handoff point S C S

A78-52960 # **The Central Flow Control /CFC/ system** C A Frum In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977 Proceedings Washington, D C , Air Traffic Control Association, 1978, p 108-116

The paper discusses the main features of the Central Flow Control (CFC) system Attention is given to the communications network, the software system, and the hardware specifications The information-flow characteristics of the system are noted with reference to the input/output devices, arrival and delay prediction, quota flow prediction, and fuel advisory prediction S C S

A78-52961 # **Management of software development for advance ATC systems** K R Dilks In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 117 121

The development of software for advance air traffic control systems is outlined noting the present-day management procedures and their associated shortcomings A management methodology is proposed with reference to the relationships between designer and operator and the division of documents into subdocuments S C S

A78-52963 # **Moving target detector /MTD/ radar system** R S Bassford (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 129 143

The paper outlines the development of the moving target detector radar system which operates as a multilevel radar digitizer and clutter eliminator The system utilizes an integrated radar/processor concept and has coherent processing Performance is discussed with reference to sensitivity flight testing, tangential target detection over clutter, subclutter visibility, subweather visibility, and target resolution S C S

A78-52964 # **Development of a breadboard system for recording ATC displays** E A Mack (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 144 154

Techniques for the recording, storage, and display of air traffic control information are considered The radar display subsystem is described noting the display generator, display control vector generators (DCVGs), and the radar keyboard multiplexer The development of a plan view display (PVD) is outlined with reference to a television display system, the digital input to the PVD, and the DCVG input Recording procedures are reported including the recorded interface buffer and the playback/refresh alternating memory S C S

A78-52965 # **Development and evaluation of a wake vortex advisory system** H Daiutolo (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 155 170

A prototype wake vortex advisory system, presently being tested at Chicago O'Hare International Airport, is examined The system utilizes a predictive algorithm described by an elliptical boundary drawn about the cross wind and head or tail wind System testing procedures are outlined noting simulated and on site evaluations of procedural implications, capacity gains delay decreases, reliability, and maintenance Preliminary results are presented S C S

A78-52966 # **Aviation futures to the year 2000** L E Jackson (FAA, Office of Aviation Policy, Washington, D C) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 171-181

Aviation in the year 2000 is discussed in terms of changes in the population, the gross national product, and resource availability Future air carrier trends are considered noting activity demand, the development of new aircraft, and trip-length statistics Trends in fuel availability are outlined with reference to the development of solar energy, coal gasification, geothermal energy, and the production of oil from shale Attention is given to air cargo and aviation safety regulations as well as air traffic control systems S C S

A78-52967 * # **Aircraft developments that hold promise for increased compatability with an advanced ATC system** K E Hodge (NASA, Washington, D C) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 182 208

In terms of an advanced air traffic control environment, consideration is given to a wake vortex advisory system and V/STOL aircraft The terminal configured vehicle program is described Procedures for all weather operations are reviewed and the search and rescue satellite system is described Predictions are made concerning an advanced national aviation system, digital communications, integrated control technology, and cockpit avionics Human factors in both general and civil aviation are discussed S C S

A78 52968 # **A system concept of metering and spacing** B G Sokkappa (Mitre Corp , Metrek Div , McLean, Va) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 209 220

The paper discusses FAA research concerning the design of an en route metering function for operation with a digital interface with the terminal metering and spacing function Attention is given to landing-sequence calculation, delay absorption, speed control, and holding and vectoring Consideration is given to advisory generation with reference to time and metering fix, metering display, descent advisory, speed advrsory, and hold advisory Display systems are described including controller displays and metering position displays S C S

A78-52969 # **The Navy's approach /Air traffic control/** H M Nordenberg (U S Naval Electronic Systems Command, Surveillance and Navigation Systems Div , Washington, D C) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 242-251

An informal discussion is presented of the possible contribution of the U S Navy to future air traffic control systems The Navy approach is discussed in relation to (1) the forces afloat, (2) the naval air stations, and (3) the fleet area control and surveillance facilities Photographs of some Navy ATC facilities are presented

along with a chart of warning and restricted areas for the United States with major air routes B J

A78-52970 # **Overview of potential ATC developments** D J Sheftel (FAA Systems Research and Development Service, Atlantic City, N J) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 252-257

The paper presents a broad overview of developments in air traffic control Projects related to improved aircraft safety are noted including the beacon collision avoidance system, the minimum safe altitude warning concept, and studies of wind shear Improvements in controller productivity have been suggested in terms of the electronic tabular display subsystem, the discrete address beacon system, and the automation of flight service stations Increases in capacity are discussed with reference to the wake vortex avoidance system, the microwave landing system, and airport surface traffic control Energy conservation is considered and developments in the area of fuel conservation are proposed including flow control Future air traffic control procedures are identified such as automated en route traffic control, automated terminal service, advanced computer systems, and the incorporation of satellite technology S C S

A78-52971 # **Modernization program for the Iranian National Airspace System** G Izadpanah (Civil Aviation Organization, Teheran, Iran) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 264 271

A system program developed by the FAA for upgrading the air traffic control system for Iran is considered The present Iranian National Airspace System is outlined noting air traffic control operations, communications, navigation and landing systems, airspace surveillance, and civil military air traffic control interfaces and coordination The FAA improvement plan is outlined noting the specific steps of the first and second 6-year periods Program management and procurement are reviewed S C S

A78-52972 # **Concept and future plans for automation of air traffic control in the Federal Republic of Germany** K Platz (Bundesanstalt fur Flugsicherung, Frankfurt am Main, West Germany) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 272-285

A78-52973 # **Preparing today, to meet the ATC challenges of tomorrow** Y T Mao (Civil Aeronautics Administration, Taipei International Airport, Nationalist China) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 286-291

The paper discusses some aspects of the future development of civil aircraft operations in Taiwan The developments relate to short-term and long-term airport planning, air traffic control systems and facilities, automation, personnel and training, and international standardization P T H

A78-52974 # **System measurement improves computer responses to the controller** W D Kandler (Logicon, Inc , Redondo Beach, Calif) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 303 315

The paper describes work on a program aimed at determining the cause of delays in message processing by computer systems used in air traffic control The tested system was the En Route system, consisting of an input terminal, the computer, and one or more output devices such as a plan view display (PVD), computer readout device (CRD), and flight strip printer (FSP) The unique feature in the approach to measuring the En Route system's performance was the use of the Tesdata MS 68 hardware monitor Without affecting system performance, it was possible to measure the master CE storage address register, IOCE channel activities, primary disk seek address, keypushes, and other objects Response times under various loading levels were measured The data show what hardware utillization levels can be tolerated in order to still achieve proper system performance P T H

A78-52975 # **Advancements in ATC information displays and controller-computer interaction** R A Amato and W A Manison (Mitre Corp , Metrek Div , McLean, Va) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Proceedings Washington, D C , Air Traffic Control Association, 1978, p 316 323

Air traffic control is discussed noting the current procedures for handling flight data and controller computer interaction The development of the electronic tabular display subsystem is described in terms of reductions in the manual handling of flight information, simplifications in message entry, failure mode operations, and reductions in controller workload The terminal information processing subsystem is reviewed S C S

A78-52976 # **The direct access radar channel - A distributed minicomputer system** K R Schwerdt (Raytheon Co , ATC Systems Directorate, Wayland, Mass) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10 13, 1977, Supplement Washington, D C , Air Traffic Control Association, 1978, p 11-22

The paper describes the direct access radar channel (DARC) system with attention to reliability, maintenance, and cost-effectiveness The selection of the minicomputer network architecture is outlined noting data base and flow, system diagnostics, and fault analysis The primary architectural features are described including the radar multiplexer, display processors, system control unit, and control processors DARC performance is evaluated in terms of input and output data loads and throughput times Typical display data capability is described and minicomputer characteristics are identified S C S

A78-52977 # **Area navigation - Fast-time/real-time simulations in a high-altitude center environment** F M Willett, Jr (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Supplement Washington, D C , Air Traffic Control Association, 1978, p 23-40

The paper discusses fast-time and real time simulation tests in a high altitude en route air route traffic control center environment Results for jet VOR (very high frequency omnidirectional radio range) route structures are noted The simulation procedures are outlined with reference to one- and five sector test conditions and the computer program designed to increase the number of test samples Values are presented for the correlation of fast- and real time measures S C S

A78-52978 # **ATC in the year 2000** J M Del Balzo (FAA, National Aviation Facilities Experimental Center, Atlantic City, N J) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev , October 10-13, 1977, Supplement Washington, D C , Air Traffic Control Association, 1978, p 41 63

Trends for air traffic control in the year 2000 are reviewed Consideration is given to (1) data entry and display (color display, voice data entry, computer data processing), (2) cockpit display of traffic information, (3) terminal-area guidance for en route air traffic control and precision approach and landing, (4) mass weather dissemination methods, (5) alternate energy sources (solar voltaics, wind, fuel cells), (6) data-link applications, (7) satellite communications and navigation, and (8) automated air traffic control techniques S C S

A78-52979 # **What's new in controller displays - Electronic flight strips and a color plan view display** W D Hett (Raytheon Co., ATC Systems Directorate, Wayland, Mass.) In Air Traffic Control Association, Annual Meeting, 22nd, Las Vegas, Nev., October 10-13, 1977, Supplement Washington, D.C., Air Traffic Control Association, 1978, p. 64-73

The paper discusses electronic flight strips noting design goals such as capacity, data entry, packaging, and applications. The demonstration system is described, the flight-strip format is shown, and a sample display photograph is presented. A four-color plan view display is discussed noting possible applications including the differentiation of data classes (maps, weather, controlled and uncontrolled flights) and warning systems (conflict alert, radio failure, severe weather). S.C.S.

A78-53050 **Concorde emissions at Dulles International Airport - Results of measurements** H. Segal (FAA, Washington, D.C.) *Air Pollution Control Association, Journal*, vol. 28, Oct. 1978, p. 1039-1042. 7 refs.

Data on dispersion of Concorde emissions are presented, indicating much lower initial concentrations of emissions from Concorde and other aircraft than had previously been estimated. The cause of these reduced concentrations appears to be related to the turbulence of the hot jet exhaust gases and the rise of the emission plume, which up to now had not been realistically determined in mathematical models. Measurement data on the dispersion of Concorde emissions are used to develop a dispersion model in order to determine pollution concentrations over the entire ground path of the aircraft. It is shown that a commercial aircraft is an insignificant source of CO pollution at Dulles International Airport. S.D.

A78-53063 * **Reaction diffusion in the NiCrAl and CoCrAl systems** S. R. Levine (NASA, Lewis Research Center, Coatings Section, Cleveland, Ohio) *Metallurgical Transactions A - Physical Metallurgy and Materials Science*, vol. 9A, Sept. 1978, p. 1237-1250. 18 refs.

The paper assesses the effect of overlay coating and substrate composition on the kinetics of coating depletion by interdiffusion. This is accomplished by examining the constitution, kinetics and activation energies for a series of diffusion couples primarily of the NiCrAl/Ni-10Cr or CoCrAl/Ni-10Cr type annealed at temperatures in the range 1000-1205 C for times up to 500 hr. A general procedure is developed for analyzing diffusion in multicomponent multiphase systems. It is shown that by introducing the concept of beta-source strength, which can be determined from appropriate phase diagrams, the Wagner solution for consumption of a second phase in a semiinfinite couple is successfully applied to the analysis of MCrAl couples. Thus, correlation of beta-recession rate constants with couple composition, total and diffusional activation energies, and interdiffusion coefficients are determined. S.D.

A78-53087 # **Oscillating airfoils I - Wedges of arbitrary thickness in supersonic and hypersonic flow** R. M. Barron (Windsor, University, Windsor, Ontario, Canada) *AIAA Journal*, vol. 16, Oct. 1978, p. 1076-1083. 11 refs.

Equations are obtained, by a perturbation method, for straight and curved airfoils with attached shocks in supersonic and hypersonic flows and undergoing small harmonic oscillations. The mode shape of the oscillation is arbitrary and hence may be used to describe rigid body motions as well as elastic deformations of the body surface. The wedge problem is solved for small frequency and an exact expression for the pressure distribution is obtained as a function of the mode of oscillation. The analysis presented can be easily modified to treat the case of arbitrary two-dimensional body shapes by developing an unsteady Newtonian flow theory. These results are reported in a subsequent paper. (Author)

A78-53095 # **Inviscid flow through wide-angle diffuser with actuator disk.** A. L. Loeffler, Jr. (Grumman Aerospace Corp., Bethpage, N.Y.) and D. Vanderbilt *AIAA Journal*, vol. 16, Oct. 1978, p. 1111, 1112. 8 refs.

A theoretical analysis is conducted of the inviscid flow past a diffuser turbine combination, using the method of singularities. The analysis makes use of a modification and extension of a method employed by Kuchemann and Weber (1953). The new approach, which does not constrain the vortices to lie on a cylinder, is expected to be more accurate than calculations performed by Kuchemann and Weber, Bagley et al. (1958), Young (1971), and Mann (1974). An appropriate distribution of ring vortices has been combined with a uniform flow along the axis to yield the desired flow. The boundary condition of zero normal velocity at the diffuser surface and at the wake bounding surface is used to determine the distribution of vorticity among the discrete vortices. G.R.

A78-53119 # **Optimal control of aircraft powerplant (Optimal'noe upravlenie silovoi ustanovkoi samoleta)** O. K. Iugov, O. D. Selivanov, and L. N. Druzhinin. Moscow, Izdatel'stvo Mashinostroenie, 1978. 204 p. 23 refs. In Russian.

Basic principles and methods of optimizing and coordinating the operation of the elements of the powerplant in steady operation under design and off-design flight conditions are set forth. The effects of different control laws for the air intake, engine, and nozzle on coordination of powerplant elements under different flight conditions are analyzed. Optimization of powerplant control laws for optimal flight range is carried out. The effect of random control errors on operating efficiency of the powerplant is elucidated, and statistical methods for taking these errors into account in computer studies of powerplant control systems are developed. P.T.H.

A78-53174 **Helicopter manufacturing technology III - Future manufacturing technologies** R. L. Spangenberg (U.S. Army, Tank Automotive Research and Development Command, Warren, Mich.) *ManTech Journal*, vol. 2, no. 3, 1977, p. 40-48.

The development of new manufacturing technologies by the Army Aviation Research and Development Command (AVRADCOM) is discussed with reference to several aspects of helicopter manufacture. Cost drivers and potential actions for reducing costs are surveyed. Problem areas and approaches to solutions are considered for the airframe system, rotor system, drive system, and turbine engine, technologies (e.g., joining, composites) requiring more research are indicated. M.L.

A78-53175 **Maintenance of gas turbine accessory equipment** P. J. Bingham, P. H. Huhtanen, and H. G. Starnes (General Electric Co., Fairfield, Conn.) *Power Engineering*, vol. 82, Sept. 1978, p. 74-77.

The maintenance of several components associated with gas turbines is examined. It is suggested that all minor items of 'running' maintenance should be completed during scheduled operational shutdown periods, while large items and systems should be maintained during a preplanned unit 'upkeep' outage. The lubricating, cooling water, CO_2, atomizing air, and starting systems as well as the load and accessory gear, batteries, and charger are discussed, and the preplanning of a maintenance program is considered. M.L.

A78-53238 **Key beam weapons tests slated** C. A. Robinson, Jr. *Aviation Week and Space Technology*, vol. 109, Oct. 9, 1978, p. 42, 43, 45 (5 ff.)

The paper discusses charged particle beam weapons proposed for deployment onboard U.S. Navy vessels for point defense against cruise missiles and describes propagation tests scheduled for late 1981 or early 1982 which will study the feasibility of the concept. The tests will use a new 50-MeV advanced-technology accelerator at the Lawrence Livermore Laboratory in California and will follow closely the current testing which uses a 5-MeV accelerator. The effective ranges for various operating modes could be a few hundred meters for a single pulse, 4.5 km for a wide interval pulse, and over 10 km for a continuous pulse propagation mode. The beam could detonate explosives and disrupt electronics. Fire control and miss distance measurement are considered, and the advantages of a charged beam system in comparison with alternate defense systems are examined. M.L.

A78-53239 **New production methods gain** E H Kolcum *Aviation Week and Space Technology,* vol 109, Oct 16, 1978, p 16-21

It is pointed out that the U S aerospace industry is moving into a new era of manufacturing innovation to meet the challenges of higher performance standards and soaring prices of alloys and other raw materials The payoff potential for the industry is substantial in virtually all manufacturing disciplines This potential is highest in engine manufacturing New processes used are related to the use of powder metallurgy in a new isostatic forming process, a superalloy manufacturing process that will enable turbine blades to operate at 100 F, higher temperatures than the strongest cast turbine blade made today, advances in powder metallurgy and near net shape technology, and a new nickel-base powder alloy Attention is given to forgings cost, tensile strength, Gatorizing units, and powder metallurgy disks G R

A78-53249 **Double row radial hydraulic piston pumps for aircraft hydraulic systems** K P Palmer (Lucas Aerospace, Ltd , Engine Management Div , Solihull, Warwicks , England) In International Fluid Power Symposium, 5th, University of Durham, Durham, England, September 13-15, 1978, Proceedings Volume 1 Symposium sponsored by the British Hydromechanics Research Association Fluid Engineering Cranfield, Beds , England, British Hydromechanics Research Association Fluid Engineering, 1978, p B1-1 to B1-12

This paper describes the development of high speed radial hydraulic piston pumps for aircraft hydraulic systems Pumps of this type have been designed to operate at appreciably higher speeds for their size than conventional hydraulic pumps The scaling of pump size to speed is discussed and the operating speeds of different types of pump are compared The reductions in total aircraft system mass obtainable by running pumps at high speed are outlined since these can be much greater than the direct saving in pump mass It is concluded that the double row radial pump which is in a relatively early stage of development compared with axial piston pumps, will operate reliably at speeds well in excess of the maximum achievable on equivalent sizes of conventional pump (Author)

A78-53253 **Methodology questions involved in systems engineering for devising an optimum radio-engineering system for trajectory measurements** B A Striukov *(Radiotekhnika,* vol 32, Dec 1977, p 11-16) *Telecommunications and Radio Engineering, Part 2 - Radio Engineering,* vol 32, Dec 1977, p 37 41 10 refs Translation

The paper examines the optimal design of a radio-electronic system for measuring the trajectory of flight vehicles, the system involves the reception of radio signals from the flight vehicle by a ground-based antenna array and transmission of these data to a computer system for processing The overall optimization problem is examined in the framework of the methodology of systems technology and involves the sequential ordering of individual optimization problems with a view to overall optimal design Various optimality criteria are analyzed B J

A78-53257 **The optimum shape of the aperture of an antenna array** Iu F Uchaev *(Radiotekhnika,* vol 32, Dec 1977, p 50-54) *Telecommunications and Radio Engineering, Part 2 - Radio Engineering,* vol 32, Dec 1977, p 68-71 Translation

Cost-quality criteria are used to develop an optimization procedure for the aperture shape of a radionavigation-system antenna-array The optimal shape for such an array is determined to be a surface of revolution with a curvilinear generatrix, determined in accordance with the obtained value of A max(beta) - the required relationship between the effective surface of the array and the angle of elevation Since this optimal shape is difficult to realize, it is suggested that quasi-optimal shapes (an aperture composed of simpler apertures in the form of conical or cylindrical surfaces with a common axis of symmetry and placed one on top of the other) be used instead B J

A78-53309 # **Some problems of heat transfer in a boundary layer on continuously moving axisymmetric surfaces (Nekotorye voprosy teploobmena v pogranichnom sloe na osesimmetrichnykh nepreryvno dvizhushchikhsia poverkhnostiakh)** A M Antonova, M M Belova, V R Borovskii, and N D Omel'chuk In Nonlinear differential equations in applied problems Kiev, Izdanie Instituta Matematiki AN USSR, 1977, p 132-137 In Russian

A78-53324 # **Investigation of the weldability of heat-resistant titanium alloys (Izuchenie svarivaemosti zharoprochnykh titanovykh splavov)** V P Kuraeva and Zh D Tkhorevskaia (Vsesoiuznyi Nauchno Issledovatel'skii Institut Aviatsionnykh Materialov, Moscow, USSR) In All-Soviet Conference on Electron-Beam Welding, 5th, Kiev, Ukrainian SSR, December 17-19, 1975, Proceedings (Vsesoiuznaia Konferentsiia po Elektronno Luchevoi Svarke, 5th, Kiev, Ukrainian SSR, December 17-19, 1975, Materialy) Kiev, Izdatel'stvo Naukova Dumka, 1977, p 61 66 In Russian

Results are presented for an experimental study of the electron-beam weldability of VT25 and VT18Y titanium alloys containing limited amounts of aluminum and silicon The quality of the weld seam is evaluated by X-ray metallography and measurement of the mechanical properties of welded joints Optimal heat-treatment conditions are determined which provide the best combination of properties, achievable by standard high-temperature annealing of each alloy S D

A78-53371 # **Influence of compositions of NG 22-46 additive with phosphorus containing compounds on the antioxidative stability of T-7 fuel (Vliianie kompozitsii prisadki NG 22-46 s fosforsoderzhashchimi soedineniiami na antiokislitel'nuiu stabil'nost' topliva T 7)** O P Lykov, I F Krylov, T P Vishniakova, N V Tumar, and O V Sergeeva (Moskovskii Institut Narodnogo Khoziaistva, Moscow, USSR) *Khimiia i Tekhnologiia Topliv i Masel,* no 9, 1978, p 13 16 9 refs In Russian

A78-53426 # **Antenna fairings for flight vehicles /2nd revised and enlarged edition/ (Obtekateli antenn letatel'nykh apparatov /2nd revised and enlarged edition/)** B A Prigoda and V S Kokun'ko Moscow, Izdatel'stvo Mashinostroenie, 1978 120 p 41 refs In Russian

Principles of analysis and design of aircraft and spacecraft radomes are set forth The study covers the transmission of electromagnetic energy through various dielectric materials and methods of calculating the effect of the radome on the antenna radiation pattern Methods of compensating for the distortions of the radiation pattern caused by the radome are studied The basic design notions for special purpose radomes such as those operating under space conditions, radomes for antennas with circularly polarized field, and radomes for IR and laser systems, are mentioned Data on materials and testing of radomes are given P T H

A78-53428 # **VTOL aircraft dynamics (Dinamika samoleta s vertikal'nym vzletom i posadkoi)** V T Taranenko Moscow, Izdatel'stvo Mashinostroenie, 1978 248 p 64 refs In Russian

The book deals with the aerodynamics and flight mechanics of an aircraft during vertical takeoff and vertical landing and with the reliability, stability, and safety aspects of these modes A method of calculating the takeoff and landing characteristics of a VTOL aircraft is outlined, along with a computer-aided engineering method for solving optimal control problems for given boundary conditions and constrained phase coordinates and control functions V P

A78-53431 # **Investigation of the heat regime of gas turbine engine bearings (Issledovanie teplovogo rezhima podshipnikov GTD)** V M Demidovich Moscow, Izdatel'stvo Mashinostroenie, 1978 172 p 87 refs In Russian

A new method is described for evaluating the heat regime of rolling-contact bearings used in gas turbine engines, with special emphasis on the experimental theoretical substantiation of the

established mathematical model of bearing calculations The derivation of a universal criterial equation which constitutes the basis of the proposed method is outlined, along with current test rigs for examining gas turbine engine bearings A generalized engineering methodology is presented for calculating the heat regime of ball and roller bearings of varying sizes in the presence and absence of external heating Illustrative examples highlighting the effectiveness of the described methodology are provided The appendix contains necessary reference data for evaluation of the heat regime of bearings S D

A78-53432 # **Fabrication and assembly of cable strands for aircraft engines (Izgotovlenie i montazh elektrozhgutov aviadvigatelei)** N I Tsibizov Moscow, Izdatel'stvo Mashinostroenie, 1978 132 p 7 refs In Russian

The work reviews methods of production of cable strands for electric drives in aircraft engines Recommendations are presented on the development of fabrication procedures for the cable strands and on the mechanization of the basic operations of fabrication, assembly, quality control, and performance testing B J

A78-53434 # **Spacecraft flight control systems (Sistemy upravleniia poletom kosmicheskikh apparatov)** G G Bebenin, B S Skrebushevskii, and G A Sokolov Moscow, Izdatel'stvo Mashinostroenie, 1978 272 p 55 refs In Russian

The general problem of estimating the parameters of motion of a spacecraft and controlling the flight of a vehicle in space is formulated, and basic methods of solution are set forth Problems investigated are linearization of nonlinear models of spacecraft motion, deterministic and stochastic models of motion, numerical prediction methods, orbit element prediction with nonsphericity of the earth taken into account, determining the conditions of mutual visibility of planetary satellites and conditions of visibility of an artificial satellite from an observation point, rendezvous of spacecraft along a long-range navigation segment, attitude control and stabilization systems, control of systems of satellites, statistical modeling of spacecraft control processes, and principles of distributing the control functions between ground and onboard control systems P T H

A78-53504 # **Nonlinear vibrations of an asymmetric flight vehicle (Nelineinye kolebaniia asimmetrichnogo letatel'nogo apparata)** A P Moroz and B N Penia *Kosmicheskie Issledovaniia na Ukraine,* no 11, 1977, p 3 7 5 refs In Russian

The problem of the vibrations of a rotating asymmetric flight vehicle with nonlinear dependence of aerodynamic characteristics on angle of attack and slip is considered It is also assumed that the parameters of motion of the center of mass are variable Differential equations are obtained for the first approximation for the amplitude and phase of the spatial angle of attack of an asymmetric flight vehicle The effect of nonlinearity of the vehicle aerodynamic characteristics on the amplitude of the spatial angle of attack in the region of parametric resonance is studied P T H

A78-53506 # **An algorithm for complex study of the aerodynamic characteristics of spacecraft (Ob odnom algoritme dlia kompleksnogo issledovaniia aerodinamicheskikh kharakteristik kosmicheskikh apparatov)** V P Bass *Kosmicheskie Issledovaniia na Ukraine,* no 11, 1977, p 11-17 13 refs In Russian

A variant of the Monte Carlo method is developed for application to the calculation of the aerodynamic characteristics of spacecraft having complicated shapes traveling through a rarefied gas at finite Mach number Methods of reducing the statistical computational errors are considered P T H

A78-53508 # **Mutual effect of thermochemical destruction of the surface and viscous interaction for hypersonic flow past a sharp cone (O vzaimnom vliianii termokhimicheskogo razrusheniia poverkhnosti i viazkogo vzaimodeistviia pri giperzvukovom obtekanii ostrogo konusa)** A V Limanskii and V I Timoshenko *Kosmicheskie Issledovaniia na Ukraine,* no 11, 1977, p 23 26 15 refs In Russian

Numerical results on the hypersonic gas flow in viscous interaction regime past sharp circular cones with thermally destructible teflon surface are presented Characteristics of the mutual influence between the thermochemical destruction of the surface and the viscous interaction are revealed P T H

A78-53511 # **Theoretical study of the thermal regime of noncooled combustion chambers of flight vehicle engines (Teoreticheskoe issledovanie teplovogo rezhima neokhlazhdaemykh kamer sgoraniia dvigatelei letatel'nykh apparatov)** V V Orlov, N D Kovalenko, and V G Pereverzev *Kosmicheskie Issledovaniia na Ukraine,* no 11, 1977, p 34-37 In Russian

A computational procedure is set forth for calculating the thermal regime of noncooled combustion chambers in the shape of shells of revolution with significantly varying diameter and thickness The analysis takes into account nonuniformity of the heat removal from the combustion products, longitudinal and transverse heat flow in the structure, and temperature dependence of the thermophysical characteristics of the material The substantial influence of longitudinal heat flow on the thermal regime is revealed P T H

A78-53556 # **Calculation of viscous radiant gas flows (Raschet techenii viazkogo izluchaiushchego gaza)** Iu P Golovachev and F D Popov In Numerical methods in plasma physics Moscow, Izdatel'stvo Nauka, 1977, p 249-252 In Russian

The paper deals with flows and heat transfer in shock layers that form on the surface of blunted bodies entering planetary atmospheres Hypersonic flows past spherically blunted cones are analyzed A solution is obtained by a modification of the Lax-Wendroff method, using an implicit finite difference scheme of second-order accuracy with respect to the space variables V P

A78-53614 # **Spacelab hardware update** K Berge (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) *American Astronautical Society and Deutsche Gesellschaft fur Luft- und Raumfahrt, Goddard Memorial Symposium, 16th, Washington, D C , Mar 8-10, 1978, AAS Paper 78-005* 45 p

The development of Spacelab, Europe's first manned space venture, is reviewed Systems and hardware are examined from the viewpoint of conversion from paper designs and component development to full-system hardware integration and test Topics include design reviews, interfaces with the orbiter, electrical system integration, ground support equipment, Spacelab engineering model, Spacelab system verification, crew system reviews, and overall technical status Topics related to the hardware include the module, pallet structure, igloo structure, command and data management, electrical power distribution subsystem, computer software, system activation and monitoring, electrical and mechanical ground support equipment, environment control/life support system, crew habitability hardware, and transportation of equipment M L

A78-53664 **Ballooning stability boundaries for the large-aspect-ratio tokamak** D Lortz and J Nuhrenberg (Max Planck-Institut fur Plasmaphysik GmbH, Garching, West Germany) *Physics Letters,* vol 68A, Sept 18, 1978, p 49, 50 5 refs EURATOM-sponsored research

The ballooning mode criterion is reevaluated for a model problem representing a large-aspect-ratio tokamak with circular flux surfaces It is found that an instability exists if both the shear and pressure gradient tend to zero (Author)

A78-53674 * **Fire detector response in aircraft applications** S J Wiersma and R G McKee (SRI International, Menlo Park, Calif) *Aviation Engineering and Maintenance,* vol 2, Aug -Sept 1978, p 12, 13, 18 Contract No NAS2-8583

Photoelectric, ionization, and gas sensors were used to detect the signatures from the radiant heat or flame of various aircraft materials It was found that both ionization and photoelectric detectors are about equally capable of detecting products of pyrolysis and combustion of synthetic polymers, especially those

containing fire retardant additives Ionization detectors alone appeared to be sensitive to combustion products of simple cellulosic materials A gas sensor detector appeared to be insensitive to pyrolysis or combustion products of many of the materials P T H

A78-53675 AIDS - Aircraft-integrated-data-system I Hughes (United Technologies Corp , Hamilton Standard Div , Windsor Locks, Conn) *Aviation Engineering and Maintenance,* vol 2, Aug -Sept 1978, p 24, 26, 27

The aircraft integrated data system (AIDS) provides onboard monitoring of engines, aircraft subsystems, and aircraft performance and makes these data readily available for subsequent analysis and diagnostics The system is comprised of data acquisition units for a magnetic tape recorder with quick-access tape cassette, and a data management unit for preprocessing the data or performing onboard diagnostics and analysis The cost of the AIDS is offset by the savings resulting from better maintenance planning, reduced engine removals, and lower test cell and repair shop costs For new aircraft, it is likely the Digital Information Transfer System ARINC 429 will be used A single digital bus carries all the information from a subsystem P T H

A78-53716 The multirole cruise missile B Walsh *Military Electronics/Countermeasures,* vol 4, Sept 1978, p 42 44, 46, 48

The new generation of cruise missiles represents a powerful and versatile addition to the U S Military's strategic and tactical force structure By the late 1950s, the Air Force had activated the first intercontinental cruise missile, Snark The newest cruise missiles currently in development evolved from earlier development programs The new cruise missiles have taken maximum advantage of new technology to overcome earlier limitations They are difficult to detect on radar, have low infrared observables, can fly at extremely low altitudes and slip in under enemy air defenses, and they are phenomenally accurate They are compatible with existing platforms' launch equipment, such as submarine torpedo tubes and bomber rotary rack launchers In recent months, there has been considerable speculation about cruise missile survivability if they were used against heavily defended targets The implications of the new developments are discussed G R

A78-53751 Nickel brazing honeycomb for aircraft gas turbine engines W P McNeill (Trans World Airlines, Inc , Kansas City, Mo) *Welding Journal,* vol 57, Oct 1978, p 32-35

The paper describes the process of replacing worn gas turbine engine seals with honeycomb ribbon applied by a combination of spot welding and brazing with powdered filler material The powdered filler material is applied by means of a small dump chute with an opening of 0 25 mm The inner diameter of the seal surface is rotated as the powdered filler is applied, and clear adhesive is sprayed onto the filler to hold it in place The brazing is done in a vacuum furnace where temperature is raised quickly to 2100 F and held for 5 min Standard grinding procedures are used P T H

A78-53764 The attachment of a ventilated plane jet to an inclined plane wall G F Marsters (Queen's University, Kingston, Ontario, Canada) *Aeronautical Quarterly,* vol 29, May 1978, p 60-74 National Research Council of Canada Grant No A 4310

The behavior of a plane jet issuing in the neighborhood of a plane wall has been studied experimentally for possible applications in jet augmented flaps for STOL aircraft development The essential features are the gap between the wall and the jet nozzle permitting entrainment of secondary flow, and the inclination of the plane wall with respect to the nozzle axis Measurements of velocity profiles, wall static pressure distributions and turbulence intensities reveal the presence of extensive regions of low pressure over the wall, strong pressure gradients and self preservation of the mean velocities The size of the gap and the wall angle and length influence the reattachment location noting limits of gap, angle and length for which reattachment occurs The sub-ambient static pressure regions give rise to forces on the wall due to the entrainment feature (Author)

A78-53765 Experiments on the laminar flow in a rectangular streamwise corner H A El-Gamal (Alexandria, University, Alexandria, Egypt) and W H Barclay (University College, London England) *Aeronautical Quarterly,* vol 29, May 1978, p 75-97 10 refs

Results of measurements in the flow along a rectangular corner are presented in the form of velocity profiles The profiles form two sets one for flow in a slightly favorable streamwise pressure gradient and one for flow when the pressure gradient is 'practically zero' The appearance of the profiles is quite different from that of previous experimental work noting that the primary cause of this is the different type of corner leading edges used in each case The flow appears to be only marginally stable and even very slightly changed entry conditions caused by alterations in the leading edge geometry may have a marked effect on the profiles further downstream The new results are consistent with the notion of corner layer similarity but there remains a significant difference between the experimental results and the theoretical solutions (Author)

A78-53767 Two different theoretical approaches to the base pressure problem in two-dimensional supersonic flow M Tanner (Aerodynamische Versuchsanstalt, Gottingen, West Germany) *Aeronautical Quarterly,* vol 29, May 1978, p 114-130 23 refs

A new theory for the prediction of the base pressure in two-dimensional and axisymmetric supersonic turbulent base flow has been developed by Tanner (1976, 1977) The basic physical concepts of the new theory are quite different from those of the theories based on the flow model reported by Chapman et al (1958) and Korst (1956) The essential physical characteristics of both theories are compared and some characteristic theoretical results are presented together with experimental data It appears that the experimental values agree better with the new theory than with the theory considered by Korst In the theory reported by Tanner difficulties regarding a satisfactory reattachment criterion are avoided by using a different approach to the base pressure problem G R

A78-53781 # Influence of rarefaction and compression waves on base pressure (O vliianii voln razrezheniia i szhatiia na donnoe davlenie) A N Antonov *Prikladnaia Mekhanika,* vol 14, Sept 1978, p 89 94 11 refs In Russian

Analytical methods are proposed for calculating flows through suddenly expanding channels and supersonic gas flows behind a recess Calculations show that rarefaction and compression waves in the near wake may produce appreciable changes of the base pressure, the rarefaction waves decreasing the base pressure and compression waves producing the opposite effect The results are in agreement with the experiment V P

A78-53783 # Application of the method of integral equations to the calculation of subsonic gas flows through turbine blade cascades (Primenenie metoda integral'nykh uravnenii dlia rascheta obtekaniia rechetok turbomashin dozvukovym potokom gaza) G I Chmyr' (Zaporozhskii Mashinostroitel'nyi Institut, Zaporozhe, Ukrainian SSR) *Prikladnaia Mekhanika,* vol 14, Sept 1978, p 110 117 8 refs In Russian

A78-53805 # Numerical calculation of magnetic levitation systems (O chislennom raschete ustroistv magnitnogo podvesa) V M Vorob'ev (Zavod Arsenal, USSR), S S Romanovich, and L V Fedchun (Akademiia Nauk Ukrainskoi SSR, Institut Kibernetiki, Kiev, Ukrainian SSR) *Elektromekhanika,* July 1978, p 718-723 In Russian

The paper presents integral equations whose solution can be used to calculate the electromagnetic field, and force and moment characteristics of a magnetic levitation system An algorithm for the numerical calculation of the system is presented, and numerical results on the magnetic lift force and the transverse stiffness of the suspension are presented B J

A78-53864 **New materials in the Si-C-Al-O-N and related systems** I B Cutler, P D Miller, W Rafaniello (Utah, University, Salt Lake City, Utah), H K Park, D P Thompson, and K H Jack (Newcastle-upon Tyne, University, Newcastle-upon-Tyne, England) *Nature*, vol 275, Oct 5, 1978, p 434, 435 10 refs

The discovery of a continuous series of solid solution, with the 2H wurtzite type structure, between silicon carbide and aluminum nitride is reported SiC-AlN solid solutions were obtained by heating intimate mixtures in molecular nitrogen at 1400 1500 C of SiO2, Al2O3, and C obtained by a sol-gel process Some X-ray photographs of 2H solid solutions of 3AlN SiC, AlN SiC, and AlN 3SiC compared with some of pure AlN show shift of X ray reflections indicating that c increases and a decreases as AlN is replaced by SiC The mean expansion coefficients are probably too high for use in gas turbines, but the electrical and semiconducting properties should be of interest P T H

A78-53903 # **Suboptimal adaptive filtering of radio signals (Suboptimal'naia adaptivnaia fil'tratsiia signalov neskol'kikh radiotekhnicheskikh izmeritelei)** A V Semenychev *Radiotekhnika*, vol 33, July 1978, p 44-49 In Russian

The paper examines the effect of errors in determining unknown elements in the noise correlation matrix on the potential accuracy of linear Kalman filters as applied to radio signal processing Methods for obtaining simple recursive adaptive filters with near-optimal potential accuracy are examined The implementation of such filters in onboard computers is discussed B J

A78-53911 # **Satellites for position determination** A Sewards, A E Winter, and R Mamen (Department of Communications, 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, Sept -Oct 1978, p 266-273 Research sponsored by the Department of National Defence

The potential uses of satellites for position determination are considerable, and current experiments are expected to demonstrate techniques which offer unprecedented accuracy to an essentially unlimited number of users Position determination, depending on the satellite system, may be performed aboard the user vehicle or remotely for such purposes as emergency beacon location Three satellite systems are described in some detail Sarsat, Aerosat and GPS/Navstar The first, the Search and Rescue Satellite System, entails the determination at a ground station of the position of a remote vehicle Aerosat will utilize two geostationary satellites over the Atlantic to provide voice and data links to transatlantic aircraft and to determine and monitor aircraft positions The Global Positioning System (GPS) is being developed for high precision position and velocity determination by users anywhere around the globe Canadian involvement in these programs is discussed (Author)

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STAR ENTRIES

N78-32037*# FWG Associates Inc Tullahoma Tenn
INVESTIGATIONS OF SIMULATED AIRCRAFT FLIGHT THROUGH THUNDERSTORM OUTFLOWS
Walter Frost and Bill Crosby Sep 1978 123 p refs
(Contract NAS8 32217)
(NASA CR 3097 M 263) Avail NTIS HC A06/MF A01 CSCL 01B

The effects of wind shear on aircraft flying through thunderstorm gust fronts were investigated A computer program was developed to solve the two dimensional, nonlinear equations of aircraft motion including wind shear The procedure described and documented accounts for spatial and temporal variations of the aircraft within the flow regime Analysis of flight paths and control inputs necessary to maintain specified trajectories for aircraft having characteristics of DC-8 B-747 augmentor wing STOL, and DHC-6 aircraft was recorded From the analysis an attempt was made to find criteria for reduction of the hazards associated with landing through thunderstorm gust fronts B B

N78-32038 Iowa State Univ of Science and Technology Ames
BLADE SURFACE BOUNDARY LAYER AND WAKE COMPUTATIONAL MODELS FOR ESTIMATION OF AXIAL-FLOW COMPRESSOR AND FAN BLADE-ROW TURNING ANGLES AND LOSSES Ph D Thesis
Elmer Carl Hansen 1978 148 p
Avail Univ Microfilms Order No 78-13230

A method is developed for computation of the flow field around an arbitrary blade cascade on an axially symmetric blade-to-blade surface which takes into account the blade surface boundary layers separation of the boundary layers and mixing in the wake The method predicts the overall fluid turning and total pressure loss in the context of an inviscid-viscous interaction scheme Dissert Abstr

N78-32040 Virginia Polytechnic Inst and State Univ Blacksburg
THREE DIMENSIONAL FULLY VISCOUS SHOCK-LAYER FLOWS OVER SPHERE-CONES AT HIGH ALTITUDES AND ANGLES OF ATTACK Ph D. Thesis
Alvin Lee Murray 1978 224 p
Avail Univ Microfilms Order No 7814040

The viscous shock-layer equations were extended to complete 3 D flowfields and applied to sphere cones at high altitudes and large angles of attack A computer code was developed for the solution of these equations and calculations were done on a large matrix of test cases Comparisons with Stanton number wall pressure and aerodynamic coefficient data show the predictions of the three-dimensional shock-layer code were in good to excellent agreement with experiments Comparisons with solutions of the parabolized Navier-Stokes equations show the shock-layer calculations were in excellent agreement up to the cross-flow separation point The Mach numbers for these test cases ranged from 10 to 25 and the Reynolds number ranged from 5 28 x 1 000 to 2 0 x 1,000 000 ft The effects of slip were significant at the low Reynolds numbers but the small mass transfer rates that were tested had little effect Dissert Abstr

N78-32041 Purdue Univ Lafayette Ind
THE FLOW FIELD CALCULATION IN SUPERSONIC MIXED-COMPRESSION AIRCRAFT INLETS AT ANGLE OF ATTACK USING THE THREE-DIMENSIONAL METHOD OF CHARACTERISTICS WITH DISCRETE SHOCK WAVE FITTING Ph D Thesis
Joseph Vadyak 1977 258 p
Avail Univ Microfilms Order No 78-13132

The calculation of the flow field in supersonic mixed-compression aircraft inlets angle of attack is accomplished using the method of characteristics for steady three-dimensional flow in conjunction with a discrete shock wave fitting procedure The influence of molecular transport may be included in the computation by treating the viscous and thermal diffusion terms in the governing partial differential equations as correction terms in the method of characteristics scheme The culmination of the research is the development of a production type computer program which is capable of calculating the flow field in a variety of axisymmetric mixed-compression aircraft inlets Dissert Abstr

N78-32042 California Univ , Berkeley
ASYMMETRIC SUPERCRITICAL FLOW PAST A DOUBLE WEDGE WITH EMBEDDED SHOCKS Ph D Thesis
Keun Sick Chang 1977 78 p
Avail Univ Microfilms Order No 7812516

Supercritical transonic flow past a double wedge at small angle of attack was analyzed in the hodograph plane The flow is treated as steady two-dimensional and inviscid, and is assumed to be isentropic and irrotational Along the wedge surface the stagnation points are assumed to be attached at the forward and rear vertices and sonic speed is, a priori, attained at the upper and lower shoulders of the double wedge The flow was mapped onto a hodograph plane containing two folds of a Riemann surface which are subsequently separated by a cut inserted along a branch line In each of the two Riemann folds a numerical technique based on Telenin's method and a double sweep method was used to solve the two boundary value problems, one for the stream function and the other for the velocity potential Dissert Abstr

N78-32043*# National Aeronautics and Space Administration Washington D C
THE TECHNOLOGY ASSESSMENT OF LTA AIRCRAFT SYSTEMS
Sep 1976 362 p refs Transl into ENGLISH of LTA Kokuki System on Technology Assessment Rept on Res Commissioned in 1977 by the Technol Evaluation Comm , Agency of Ind Sci and Technol Japan Ind Technol Assoc , Mar 1978 p 1-269, chapters 1-4 Trans by Kanner (Leo) Associates Redwood City Calif Original doc prep by Japan Ind Technol Assoc
(Contract NASw-3199)
(NASA-TM-75535) Avail NTIS HC A16/MF A01 CSCL 01A

The advantages of conventional small and large airships over heavier than air aircraft are reviewed and the need for developing hybrid aircraft for passenger and heavy charge transport is assessed Performance requirements and estimated operating costs are discussed for rota-ships to be used for short distance transportation near large cities as well as for airlifting civil engineering machinery and supplies for the construction of power stations dams tunnels and roads in remote areas or on isolated islands A R H

N78-32044*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
HIGH ANGLE OF INCIDENCE IMPLICATIONS UPON AIR INTAKE DESIGN AND LOCATION FOR SUPERSONIC CRUISE AIRCRAFT AND HIGHLY MANEUVERABLE TRANSONIC AIRCRAFT
Leroy S Presley Sep 1978 13 p refs
(NASA-TM 78530 A 7634) Avail NTIS HC A02/MF A01 CSCL 01A

Computational results which show the effects of angle of attack on supersonic mixed compression inlet performance at four different locations about a hypothetical forebody were obtained These results demonstrate the power of the computational method to predict optimum inlet location, orientation, and centerbody control schedule for design and off design performance The effects of inlet location and a forward canard on the angle of-attack performance of a normal shock inlet at transonic speeds were studied The data show that proper integration of inlet location and a forward canard can enhance the angle-of-attack performance of a normal shock inlet Two lower lip treatments for improving the angle-of-attack performance of rectangular inlets at transonic speeds are discussed Author

N78-32046*# National Aeronautics and Space Administration Langley Research Center Hampton, Va

COMPARISON OF WING-SPAN AVERAGING EFFECTS ON LIFT, ROLLING MOMENT, AND BENDING MOMENT FOR TWO SPAN LOAD DISTRIBUTIONS AND FOR TWO TURBULENCE REPRESENTATIONS

Jacob H Lichtenstein Sep 1978 49 p refs

(NASA-TM-78699 L-12014) Avail NTIS HC A03/MF A01 CSCL 01A

An analytical method of computing the averaging effect of wing-span size on the loading of a wing induced by random turbulence was adapted for use on a digital electronic computer The turbulence input was assumed to have a Dryden power spectral density The computations were made for lift, rolling moment, and bending moment for two span load distributions, rectangular and elliptic Data are presented to show the wing-span averaging effect for wing-span ratios encompassing current airplane sizes The rectangular wing-span loading showed a slightly greater averaging effect than did the elliptic loading In the frequency range most bothersome to airplane passengers the wing-span averaging effect can reduce the normal lift load, and thus the acceleration, by about 7 percent for a typical medium-sized transport Some calculations were made to evaluate the effect of using a Von Karman turbulence representation These results showed that using the Von Karman representation generally resulted in a span averaging effect about 3 percent larger

Author

N78-32047*# Vought Corp , Hampton, Va Hampton Technical Center

BOEING-747 AIRCRAFT WITH EXTERNAL CARGO POD

C B Quartero G F Washburn and J E Price Jul 1978 25 p refs

(Contract NAS1-13500)

(NASA-CR-158932) Avail NTIS HC A02/MF A01 CSCL 01A

An analysis was conducted to investigate the feasibility of mounting a detachable pod to the underside of the fuselage of a Boeing Model 747 aircraft to carry outsized cargo in case of military emergency The analysis showed that the 747 configured with the pod and carrying only a bridge launcher as payload attained a range of 8 70 Mm (4 700 n mi) at Mach 68 This range was based on a maximum take-off gross weight of 3 447 MN (775 000 1bf) which included 212 kN (47 700 lbf) pod weight and 543 kN (122 000 lbf) payload (bridge launcher)

B B

N78-32048*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

WIND TUNNEL TESTS ON A TAIL-LESS SWEPT WING SPAN-DISTRIBUTED CARGO AIRCRAFT CONFIGURATION

Dhanvada M Rao (Old Dominion Univ Research Foundation) and Jarrett K Huffman Sep 1978 140 p refs

(NASA-TM-78767) Avail NTIS HC A07/MF A01 CSCL 01A

The configuration consisted of a 30 deg -swept untapered, untwisted wing utilizing a low-moment cambered airfoil of 20 percent streamwise thickness designed for low wave drag at M = 0 6 C sub L = 0 4 The tests covered a range of Mach numbers 0 3 to 0 725 and chord Reynolds number 1 100,000 to 2,040 000, angles of attack up to model buffet and sideslip angles + or - 4 deg Configuration build up, wing pod filleting, airfoil modification and trailing edge control deflection effects were briefly investigated Three wing tip vertical tail designs were also tested Wing body filleting and a simple airfoil modification both produced increments to maximum lift/drag ratio Addition of pods eliminated pitch instability of the basic wing While the magnitude of these benefits probably was Reynolds number sensitive, they underline the potential for improving the aerodynamics of the present configuration The cruise parameter (product of Mach number and lift/drag ratio) attained a maximum close to the airfoil design point The configuration was found to be positively stable with normal control effectiveness about all three axes in the Mach number and C sub L range of interest

Author

N78-32049*# National Aeronautics and Space Administration Langley Research Center Hampton Va

AERODYNAMIC CHARACTERISTICS OF A 1/4 SCALE POWERED HELICOPTER MODEL WITH A V-TYPE EMPENNAGE

Carl E Freeman, Arthur E Phelps, III and Raymond E Mineck Aug 1978 65 p refs

(NASA-TM-74033) Avail NTIS HC A04/MF A01 CSCL 01A

An investigation was made in the Langley V/STOL tunnel to determine rotor induced effects on a 1/4-scale helicopter model with a conventional empennage and also a V-type empennage with dihedral angles of 45 deg 50 deg, 55 deg, and 60 deg Static longitudinal and lateral directional stability data are presented for rotor advance ratios of 0 057 0 102, and 0 192 in level flight and climb attitudes The data are presented without analysis or discussion

Author

N78-32050*# National Aeronautics and Space Administration Langley Research Center Hampton Va

AERODYNAMIC CHARACTERISTICS OF A FIXED ARROW-WING SUPERSONIC CRUISE AIRCRAFT AT MACH NUMBERS OF 2 30, 2 70, AND 2.95

Odell A Morris Dennis E Fuller and Carolyn B Watson Aug 1978 199 p

(NASA-TM-78706 L-12249) Avail NTIS HC A09/MF A01 CSCL 01A

Tests were conducted in the Langley Unitary Plan wind tunnel at Mach numbers of 2 30 2 70 and 2 95 to determine the performance static stability, and control characteristics of a model of a fixed-wing supersonic cruise aircraft with a design Mach Number of 2 70 (SCAT 15-F-9898) The configuration had a 74 deg swept warped wing with a reflexed trailing edge and four engine nacelles mounted below the reflexed portion of the wing A number of variations in the basic configuration were investigated, they included the effect of wing leading edge radius the effect of various model components and the effect of model control deflections

Author

N78-32051*# National Aeronautics and Space Administration Langley Research Center Hampton Va

DEVELOPMENT OF A NONLINEAR SWITCHING FUNCTION AND ITS APPLICATION TO STATIC LIFT CHARACTERISTICS OF STRAIGHT WINGS

Donald E Hewes Sep 1978 44 p refs

(NASA-TM-78737 L-12270) Avail NTIS HC A03/MF A01 CSCL 01A

A mathematical modeling technique was developed for the lift characteristics of straight wings throughout a very wide angle of attack range The technique employs a mathematical switching function that facilitates the representation of the nonlinear aerodynamic characteristics in the partially and fully stalled regions and permits matching empirical data within + or - 4 percent of maximum values Although specifically developed for use in modeling the lift characteristics, the technique appears to have other applications in both aerodynamic and nonaerodynamic fields

B B

N78-32052*# National Aeronautics and Space Administration Washington D C

DESIGN OF A TRANSONICALLY PROFILED WING

B Kiekebusch Aug 1978 62 p refs Transl into ENGLISH of conf paper from Messerschmitt-Boelkow-Blohm G m b H Hamburg, Paper-77-026 77 p Presented at the 10th Jahrestagung Deutsche Ges fuer Luft- und Raumfahrt Berlin, 13-15 Sep 1977 Original language document was announced as A78-24417 Transl by SCITRAN, Santa Barbara, Calif

(Contract NASw-3198)

(NASA-TM-75440, Paper-77-026) Avail NTIS HC A04/MF A01 CSCL 01A

The application of well known design concepts with the combined use of thick transonic profiles to aircraft wing design was investigated Optimization in terms of weight and operational costs was emphasized It is shown that the usual design criteria and concepts are too restricted and do not sufficiently represent the physical processes over the wing Suggestions are made for

improving this situation and a design example given Compared with a wing design according to previously used criteria, the new design is found to be superior in the most important functions It is concluded that an isobar concept adjusted to the planform in conjunction with an 'organically designed wing will lead to the weight optimum solutions of wing profiles J M S

N78-32064*# National Aeronautics and Space Administration, Washington, D C
PROFILE DESIGN FOR AN ADVANCED-TECHNOLOGY AIRFOIL FOR GENERAL AVIATION AIRCRAFT
D Welte Aug 1978 24 p refs Transl into ENGLISH of "Profilentwurf fuer einen Tragflugel neuer Technologie fuer Flugzeuge der allgemeinen Luftfahrt , Paper-77-027 Deutsche Gesellschaft fuer Luft- und Raumfahrt, Berlin, 13-15 Sep 1977 25 p Original language document was announced as A78-24418 Transl by Kanner (Leo) Associates Redwood City Calif (Contract NASw-3199)
(NASA-TM-75323, Paper-77-027) Avail NTIS HC A02/MF A01 CSCL 01A

A profile from the NASA General Aviation Whitcomb series and NACA profiles are used as a starting point in designing an advanced airfoil for general aviation aircraft Potential theory pressure distribution calculations, together with boundary layer calculations permit a decrease in the null moment and an optimization of the lift characteristics of the wing Trailing edge flap design is also improved Wind tunnel tests are used to compare the conventional profiles, the NASA profile, and the improved design Author

N78-32065*# National Aeronautics and Space Administration Flight Research Center Edwards Calif
YF-12 EXPERIMENTS SYMPOSIUM, VOLUME 1
Aug 1978 286 p refs Symp held at Edwards Calif 13-15 Sep 1978 Prepared by James and Associates, Lancaster, Calif
(NASA-CP-2054, H-1059) Avail NTIS HC A13/MF A01 CSCL 01A

Papers presented by personnel from the Dryden Flight Research Center, the Lewis Research Center, and the Ames Research Center are presented Topics cover propulsion system performance, inlet time varying distortion, structures aircraft controls propulsion controls and aerodynamics The reports were based on analytical studies, laboratory experiments wind tunnel tests and extensive flight research with two YF-12 airplanes

N78-32056*# National Aeronautics and Space Administration Flight Research Center, Edwards Calif
OVERVIEW OF THE NASA YF-12 PROGRAM
Berwin M Kock *In its* YF-12 Experiments Symp Vol 1 Aug 1978 p 3-25 refs

Avail NTIS HC A13/MF A01 CSCL 01C

The history of NASA s interest in supersonic research and the agency's contribution to the development of the YF 12 aircraft is reviewed as well as the program designed to use that aircraft as a test bed for supersonic cruise research Topics cover elements of the program, project organization, and major accomplishments A R H

N78-32057*# National Aeronautics and Space Administration Flight Research Center Edwards, Calif
RECENT LOAD CALIBRATIONS EXPERIENCE WITH THE YF-12 AIRPLANE
Jerald M Jenkins and Albert E Kuhl *In its* YF-12 Experiments Symp , Vol 1 Aug 1978 p 47-72 refs

Avail NTIS HC A13/MF A01 CSCL 01A

The use of calibrated strain gages to measure wing loads on the YF-12A airplane is discussed as well as structural configurations relative to the thermal environment and resulting thermal stresses A thermal calibration of the YF-12A is described to illustrate how contaminating thermal effects can be removed from loads equations The relationship between ground load calibrations and flight measurements is examined for possible errors and an analytical approach to accommodate such errors is presented A R H

N78-32058*# National Aeronautics and Space Administration Flight Research Center, Edwards Calif
FLIGHT-MEASURED AERODYNAMIC LOADS ON A 0 92 ASPECT RATIO LIFTING SURFACE
Robert R Meyer, Jr and V Michael DeAngelis *In its* YF-12 Experiments Symp Vol 1 Aug 1978 p 73-91 refs

Avail NTIS HC A13/MF A01 CSCL 01A

Ventral fin loads, expressed as normal force coefficients bending moment coefficients, and torque coefficients, were measured during flight tests of a YF-12A airplane Because of the proximity of the ventral fin to the ailerons the aerodynamic loads presented were the result of both sideslip loads and aileron crossflow loads Aerodynamic data obtained from strain gage loads instrumentation and some flight pressure measurements are presented for several Mach numbers ranging from 0 70 to 2 00 Selected wind tunnel data and results of linear theoretical aerodynamic calculations are presented for comparison Author

N78-32059*# National Aeronautics and Space Administration Flight Research Center Edwards Calif
FLIGHT EXPERIENCE WITH ALTITUDE HOLD AND MACH HOLD AUTOPILOTS ON THE YF-12 AIRCRAFT AT MACH 3
Glenn B Gilyard and John W Smith *In its* YF-12 Experiments Symp , Vol 1 Aug 1978 p 97-119 refs

Avail NTIS HC A13/MF A01 CSCL 01A

The altitude hold mode of the YF-12A airplane was modified to include a high-pass-filtered pitch rate feedback along with optimized inner loop altitude rate proportional and integral gains An autothrottle control system was also developed to control either Mach number or KEAS at the high-speed flight conditions Flight tests indicate that with the modified system, significant improvements are obtained in both altitude and speed control and the combination of altitude and autothrottle hold modes provides the most stable aircraft platform thus far demonstrated at Mach 3 conditions A R H

N78-32061*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif
THE YF-12 GUST VELOCITY MEASURING SYSTEM
J Ehernberger *In its* YF-12 Experiments Symp , Vol 1 Aug 1978 p 135-154 refs

Avail NTIS HC A13/MF A01 CSCL 01D

A true gust velocity measuring system designed to alleviate complications resulting from airframe flexibility and from the high-speed_ high-temperature environment of supersonic cruise aircraft was evaluated on a YF-12 airplane The system uses fixed vanes on which airflow direction changes produce differential pressure variations that are measured Airframe motions, obtained by postflight integration of recorded angular rate and linear acceleration data, are removed from the flow angle data An example of turbulence data obtained at high-altitude, supersonic flight conditions is presented and compared with previous high-altitude turbulence measurements obtained with subsonic aircraft and with turbulence criteria contained in both military and civil design specifications for supersonic cruise vehicles Results of these comparisons indicate that the YF-12 turbulence sample is representative of turbulence present in the supersonic cruise environment A R H

N78-32062*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
WIND TUNNEL EVALUATION OF YF-12 INLET RESPONSE TO INTERNAL AIRFLOW DISTURBANCES WITH AND WITHOUT CONTROL
Gary L Cole, George H Neiner, and Miles O Dustin *In* NASA Dryden Flight Res Center YF-12 Experiments Symp , Vol 1 Aug 1978 p 157-192 refs

Avail NTIS HC A13/MF A01 CSCL 01A

The response of terminal-shock position and static pressures in the subsonic duct of a YF-12 aircraft flight-hardware inlet to perturbations in simulated engine corrected airflow were obtained with and without inlet control Frequency response data, obtained with inlet controls inactive, indicated the general nature of the inherent inlet dynamics, assisted in the design of controls, and provided a baseline reference for responses with active controls All the control laws were implemented by means of a digital computer that could be programmed to behave like the flight inlet s existing analog control The experimental controls were designed using an analytical optimization technique The capabilities of the controls were limited primarily by the actuation hardware The experimental controls provided somewhat better attenuation of terminal shock excursions than did the YF-13 inlet control Controls using both the forward and aft bypass systems also provided somewhat better attenuation than those using just the forward bypass The main advantage of using both bypasses is in the greater control flexibility that is achieved A R H

N78-32063*# National Aeronautics and Space Administration, Flight Research Center, Edwards, Calif

FLIGHT-MEASURED PRESSURE CHARACTERISTICS OF AFT-FACING STEPS IN THICK BOUNDARY LAYER FLOW FOR TRANSONIC AND SUPERSONIC MACH NUMBERS

Sheryll Goecke Powers *In its* YF-12 Experiments Symp , Vol 1 Aug 1978 p 201-226 refs

Avail NTIS HC A13/MF A01 CSCL 01A

Aft-facing step base pressure flight data were obtained for three step heights for nominal transonic Mach numbers of 0 80 0 90 and 0 95 and for supersonic Mach numbers of 2 2 2 5 and 2 8 with a Reynolds number, based on the fuselage length ahead of the step, of about 10 to the 8th power Surface static pressures were measured ahead of the step, behind the step, and on the step face (base), and a boundary layer rake was used to obtain boundary layer reference conditions A comparison of the data from the present and previous experiments shows the same trend of increasing base pressure ratio (decreasing drag) with increasing values of momentum thickness to step height ratios However, the absolute level of these data does not always agree at the supersonic Mach numbers For momentum thickness to height ratios near 1 0, the differences in the base pressure ratios appear to be primarily a function of Reynolds number based on the momentum thickness Thus, for Mach numbers above 2, the data analyzed show that the base pressure ratio decreases (drag increases) as Reynolds number based on momentum thickness increases for a given momentum thickness and step height A R H

N78-32064*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif

BOUNDARY LAYER, SKIN FRICTION, AND BOATTAIL PRESSURE MEASUREMENTS FROM THE YF-12 AIRPLANE AT MACH NUMBERS UP TO 3

David F Fisher *In its* YF-12 Experiments Symp Vol 1 Aug 1978 p 227-258 refs

Avail NTIS HC A13/MF A01 CSCL 01A

In-flight measurements of boundary layer and skin friction data were made on YF-12 airplanes for Mach numbers between 2 0 and 3 0 Boattail pressures were also obtained for Mach numbers between 0 7 and 3 0 with Reynolds numbers up to four hundred million Boundary layer data measured along the lower fuselage centerline indicate local displacement and momentum thicknesses can be much larger than predicted Skin friction coefficients measured at two of five lower fuselage stations were significantly less than predicted by flat plate theory The presence of large differences between measured boattail pressure drag and values calculated by a potential flow solution indicates the presence of vortex effects on the upper boattail surface At both subsonic and supersonic speeds pressure drag on the longer of two boattail configurations was equal to or less than the pressure drag on the shorter configuration At subsonic and transonic speeds, the difference in the drag coefficient was on the order of 0 0008 to 0 0010 In the supersonic cruise range the difference in the drag coefficient was on the order of 0 002 Boattail drag coefficients are based on wing reference area A R H

N78-32065*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif

IN-FLIGHT COMPRESSIBLE TURBULENT BOUNDARY LAYER MEASUREMENTS ON A HOLLOW CYLINDER AT A MACH NUMBER OF 3.0

Robert D Quinn and Leslie Gong *In its* YF-12 Experiments Symp , Vol 1 Aug 1978 p 259-286 refs

Avail NTIS HC A13/MF A01 CSCL 01A

Skin temperatures, shearing forces surface static pressures, and boundary layer pitot pressures and total temperatures were measured on a hollow cylinder 3 04 meters long and 0 437 meter in diameter mounted beneath the fuselage of the YF-12A airplane The data were obtained at a nominal free stream Mach number of 3 0 and at wall-to-recovery temperature ratios of 0 66 to 0 91 The free stream Reynolds number had a minimal value of 4 2 million per meter Heat transfer coefficients and skin friction coefficients were derived from skin temperature time histories and shear force measurements, respectively Boundary layer velocity profiles were derived from pitot pressure measurements, and a Reynolds analogy factor of 1 11 was obtained from the measured heat transfer and skin friction data The skin friction coefficients predicted by the theory of van Driest were in excellent agreement with the measurements Theoretical heat transfer coefficients, in the form of Stanton numbers calculated by using a modified Reynolds analogy between skin friction and heat transfer, were compared with measured values The measured velocity profiles were compared to Coles incompressible law-of-the-wall profile A R H

N78-32066*# Hamilton Standard Windsor Locks, Conn

AERODYNAMIC DESIGN AND PERFORMANCE TESTING OF AN ADVANCED 30 DEG SWEPT, EIGHT BLADED PROPELLER AT MACH NUMBERS FROM 0.2 TO 0.85

Final Report

D M Black, R W Menthe and H S Wainauski Sep 1978 119 p refs

(Contract NAS3-20219)

(NASA-CR-3047) Avail NTIS HC A06/MF A01 CSCL 01A

The increased emphasis on fuel conservation in the world has stimulated a series of studies of both conventional and unconventional propulsion systems for commercial aircraft Preliminary results from these studies indicate that a fuel saving of from 15 to 28 percent may be realized by the use of an advanced high speed turboprop The turboprop must be capable of high efficiency at Mach 0 8 above 10 68 km (35,000 ft) altitude if it is to compete with turbofan powered commercial aircraft An advanced turboprop concept was wind tunnel tested The model included such concepts as an aerodynamically integrated propeller/nacelle, blade sweep and power (disk) loadings approximately three times higher than conventional propeller designs The aerodynamic design for the model is discussed Test results are presented which indicate propeller net efficiencies near 80 percent were obtained at high disk loadings at Mach 0 8 B B

N78-32067*# National Aeronautics and Space Administration Langley Research Center Hampton, Va

WIND-TUNNEL INVESTIGATION AT SUPERSONIC SPEEDS OF A CANARD-CONTROLLED MISSILE WITH FIXED AND FREE-ROLLING TAIL FINS

A B Blair, Jr Sep 1978 79 p refs

(NASA-TP-1316, L-12297) Avail NTIS HC A05/MF A01 CSCL 01A

A wind tunnel investigation was made at free stream Mach numbers from 1 70 to 2 86 to determine the effects of fixed and free rolling tail fin afterbodies on the static longitudinal and lateral aerodynamic characteristics of a cruciform canard controlled missile model The effect of small canard roll and yaw control deflections was also examined The results indicate that the fixed and free rolling tail configurations have about the same lift curve slope and longitudinal stability level at low angles of attack For the free rolling tail configuration the canards provide conventional roll control with no roll control reversal at low angles of attack The free rolling tail configuration reduced induced roll due to model roll angle and canard yaw control B B

N78-32068# ARO, Inc Arnold Air Force Station Tenn
INFLUENCES OF SWAY BRACES AND MOUNTING GAPS ON THE STATIC AERODYNAMIC LOADING OF EXTERNAL STORES Final Report, 1 Oct. 1976 - 30 Sep. 1977
R E Dix AEDC Feb 1978 135 p refs
(AD-A054963, AEDC-TR-77-117) Avail NTIS HC A07/MF A01 CSCL 01/3

As the scale factor applied in the design of wind tunnel models is reduced, many details of the configuration being simulated are customarily omitted A series of experiments was conducted in the Aerodynamic Wind Tunnel (4T) of the Propulsion Wind Tunnel Facility at the Arnold Engineering Development Center to evaluate the effect on captive store loading of model details such as sway braces and mounting gaps existing between store and aircraft components Six components of aerodynamic loads acting on both pylon and rack-mounted stores in the captive position were measured, a limited number of store separation trajectories was predicted using the captive trajectory system, and a brief comparison of wind tunnel and in-flight measurements of captive loads was made It was determined that the effects of mounting gaps or flow ventilation passages were generally small but that sway braces can significantly influence both captive loads and separation trajectories It was also observed that better agreement between wind tunnel and in-flight measurements of captive store loading resulted when mounting gaps and sway braces were simulated on the wind-tunnel models Author (GRA)

N78-32069# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate
V/STOL AERODYNAMIC TECHNOLOGY ASSESSMENT Interim Report
C Henderson and M Walters 15 May 1978 91 p refs
(WF41400000)
(AD-A054797, NADC-77272-60) Avail NTIS HC A05/MF A01 CSCL 20/4

The objective of this investigation is to determine the status of V/STOL aerodynamics technology, evaluating the capabilities and limitations of various techniques and the validity of methods through correlations of predictions with wind tunnel and/or flight test results This interim report presents the results of the first phase of this effort a survey and assessment of published methods and test results and a survey of industry applied methods and technology problem areas Author (GRA)

N78-32070# Aerospace Systems, Inc Burlington Mass
ROTOR WAKE EFFECTS ON HUB/PYLON FLOW VOLUME 1 THEORETICAL FORMULATION Final Report, Jun. 1975 - Sep 1977
Paul Soohoo Richard B Noll, Luigi Morino and Norman D Hamm May 1978 120 p refs
(Contract DAAJ02-75-C-0041)
(AD-A055921, ASI-TR 76-38-Vol-1 USARTL-TR-78-1A Vol-1) Avail NTIS HC A06/MF A01 CSCL 20/4

An investigation has been conducted to demonstrate the use of the Green's function method to study rotor wake effects on helicopter hub/pylon flow This report consists of two volumes which document the theoretical formulation and the use of the digital computer program SHAPES (Subsonic Helicopter Aerodynamics Program with Effects of Separaton) Volume 1 presents the theoretical formulation and corresponding numerical procedure for the study of incompressible potential aerodynamics with separated flow While the formulation is valid for fully unsteady aerodynamics this report is mainly concerned with rotor aerodynamics A potential flow aerodynamic program, SHAPES, with suitable rotor wake representation was developed to predict the separation characteristics of arbitrary three-dimensional helicopter configurations In particular the effect of the rotor blade wake blade shank wake and hub wake in the separation of the flow over a lifting helicopter in forward flight is analyzed The present method has potential application in the design of helicopters because it provides an analytical capability which can be used to develop low-drag profile as well as to explore problem areas Extensive numerical results obtained from Program SHAPES demonstrated the flexibility and accuracy of the method These results are in excellent agreement with existing data Author (GRA)

N78-32071# Aerospace Systems, Inc , Burlington, Mass
ROTOR WAKE EFFECTS ON HUB/PYLON FLOW VOLUME 2 PROGRAM SHAPES USER'S MANUAL Final Report, Jun. 1975 - Sep 1977
Paul Soohoo, Richard B Noll Luigi Morino and Norman D Hamm May 1978 192 p refs
(Contract DAAJ02-75-C-0041)
(AD-A055767 ASI-TR-76-38-Vol-2 USARTL-TR-78-1B-Vol-2) Avail NTIS HC A09/MF A01 CSCL 20/4

An investigation has been conducted to demonstrate the use of the Green s function method to study rotor wake effects on helicopter hub/pylon flow This report consists of two volumes which document the theoretical formulation and the use of the digital computer program SHAPES (Subsonic Helicopter Aerodynamics Program with Effects of Separation) Volume 2 The User s Manual, describes the structure and use of Program SHAPES SHAPES is written in FORTRAN 4 for operation on the CDC 6600 digital computer system at the Applied Technology Laboratory U S Army Research and Technology Laboratories Fort Eustis, VA The User s Manual (Volume (2) contains detailed information for preparing an input data deck and interpreting the computed data a discussion of various subroutines flow charts, common storage and definition of FORTRAN variables sample cases to illustrate the program output, and a FORTRAN listing of the program GRA

N78-32072# Air Force Flight Dynamics Lab , Wright-Patterson AFB, Ohio
M=3 TURBULENT BOUNDARY LAYER MEASUREMENTS AT VERY HIGH REYNOLDS NUMBERS Interim Report, Jan 1975 - Sep 1976
Anthony W Fiore Oct 1977 230 p refs
(AD-A055952, AFFDL-TR-77-80) Avail NTIS HC A11/MF A01 CSCL 20/4

Experimental turbulent boundary layer measurements were made Data was generated at supersonic speeds and very high Reynolds numbers to determine the effect of both unit and length Reynolds numbers on boundary layer profiles, thickness parameters and skin friction measurements GRA

N78-32073# National Technical Information Service, Springfield, Va
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1978

Guy E Habercom Jr May 1978 82 p Supersedes NTIS/PS-77/0375
(NTIS/PS-78/0410/7, NTIS/PS-77/0375) Avail NTIS HC $28 00/MF $28 00 CSCL 01C

Design and applications of balloons, dirigibles, and airships are investigated in these reports gathered in a worldwide literature survey Passenger or cargo transport timbering tethering, and fabric selection are among the aspects investigated GRA

N78-32074# Advisory Group for Aerospace Research and Development Paris (France)
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON PREDICTION OF AERODYNAMIC LOADING
Rimantas Liaugminas (Dept of AF, Wright-Patterson AFB, Ohio) Sep 1978 18 p refs Symp held at Moffett Field, Calif 27-29 Sep 1976
(AGARD-AR-125 ISBN-92-835-1296-0) Avail NTIS HC A02/MF A01

The fluid dynamic aspects of predicting aerodynamic loads that represent difficult design and operating problems are examined with emphasis on theoretical and semi-empirical methods for determining the level and distribution of the expected loading and on assessing and evaluating the accuracy of the predicted values through comparison with available experimental data from windtunnels and flight tests Advances in the state-of-art of aerodynamic load prediction are summarized and problem areas for further research effort are indicated Topics cover test techniques stores high angle of attack, high lift and drag, viscous/inviscid interactions in transonic flow maneuvering aircraft, unsteady loads on arbitrary bodies in supersonic flow, flow with separation dynamic stall, buffeting and special problem areas A R H

N78-32075*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Jul - 30 Sep. 1977
Jul 1978 62 p refs Prepared in cooperation with Battelle Columbus Labs, Mountain View, Calif
(NASA-TM-78511 A-7559, QR-6) Avail NTIS HC A04/MF A01 CSCL 01C

An analytical study of reports relating to cockpit altitude alert systems was performed A recent change in the Federal Air Regulation permits the system to be modified so that the alerting signal approaching altitude has only a visual component the auditory signal would continue to be heard if a deviation from an assigned altitude occurred Failure to observe altitude alert signals and failure to reset the system were the commonest cause of altitude deviations related to this system Cockpit crew distraction was the most frequent reason for these failures It was noted by numerous reporters that the presence of altitude alert system made them less aware of altitude this lack of altitude awareness is discussed Failures of crew coordination were also noted It is suggested that although modification of the altitude alert system may be highly desirable in short-haul aircraft it may not be desirable for long-haul aircraft in which cockpit workloads are much lower for long periods of time In these cockpits the aural alert approaching altitudes is perceived as useful and helpful If the systems are to be modified, it appears that additional emphasis on altitude awareness during recurrent training will be necessary it is also possible that flight crew operating procedures during climb and descent may need examination with respect to monitoring responsibilities A selection of alert bulletins and responses to them is presented B B

N78-32076*# National Aeronautics and Space Administration Langley Research Center Hampton Va
A PRELIMINARY STUDY OF THE BENEFITS OF FLYING BY GROUND SPEED DURING FINAL APPROACH
Earl C Hastings Jr Aug 1978 23 p refs
(NASA-TM-78777) Avail NTIS HC A02/MF A01 CSCL 01C

A study was conducted to evaluate the benefits of an approach technique which utilized constant ground speed on approach It was determined that the technique reduced the capacity losses in headwinds experienced with the currently used constant airspeed technique The benefits of technique were found to increase as headwinds increased and as the wake avoidance separation intervals were reduced An additional benefit noted for the constant ground speed technique was a reduction in stopping distance variance due to the approach wind environment B B

N78-32077# Army Research and Technology Labs Fort Eustis Va
CH-47 CRASH TEST (T-40) STRUCTURAL, CARGO RESTRAINT, AND AIR CREW INFLATABLE RESTRAINT EXPERIMENTS
L Burrows R Lane and J McElhenney Apr 1978 111 p refs
(AD-A055804 USARTL-TR-78-22) Avail NTIS HC A06/MF A01 CSCL 01/3

A full-scale crash test of a CH-47A troop/cargo helicopter was conducted at the NASA-Langley Research Center Impact Dynamics Research Facility This joint Army/NASA/Navy test program was performed as part of the Army's continuing research and development program to enhance the crashworthiness of helicopters This report describes the structural crashworthiness, the load attenuating cargo restraint and the aircrew inflatable crew restraint experiments that were conducted and presents the resulting data The test aircraft crashed with a 9 degree nose-down attitude this impact was representative of the 95th percentile potentially survivable accident crash pulse Results of the test can be compared with those of a CH-47C crash test (T-39) conducted in 1975 which impacted at a 10 degree nose-up attitude with approximately the same resultant impact velocity vector Author (GRA)

N78-32078# Sandia Labs, Albuquerque N Mex
ANALYSIS OF THE ENGINE FRAGMENT THREAT AND THE CRUSH ENVIRONMENT FOR SMALL PACKAGES CARRIED ON US COMMERCIAL JET AIRCRAFT
W F Hartman J D McClure and W A VonRiesemann 1978 8 p refs Presented at the 5th Symp on the Packaging and Transportation of Radioactive Mater Las Vegas, Nev 7 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0244C CONF-780506-8) Avail NTIS HC A02/MF A01

The results of two separate analyses are reported The engine fragment analysis determined the probability of a small package being in the path of a fragment from a failure in a gas turbine engine The calculated values show that, depending on aircraft type the incidence rate varies by approximately an order of magnitude from a high of about once per 5 million flights to a low of nearly once every 40 million package flights for a flight of five hours' duration The analysis of the crush environment consisted of an examination of two principal crush modes, i e vertical and longitudinal crush The vertical crush mode was examined by formulating a structural model of the cargo deck beams of the aircraft The longitudinal crush mode was studied by using dynamic models of the aircraft cargo and the radioactive material package (RAM) ERA

N78-32079*# Litton Systems, Inc Woodland Hills Calif
STRAPDOWN SYSTEM REDUNDANCY MANAGEMENT FLIGHT DEMONSTRATION Final Report
Sep 1978 73 p refs
(Contract NAS1-15155)
(NASA-CR-145356) Avail NTIS HC A04/MF A01 CSCL 17G

The suitability of strapdown inertial systems in providing highly reliable short-term navigation for vertical take-off and landing (VTOL) aircraft operating in an intra-urban setting under all-weather conditions was assessed A preliminary design configuration of a skewed sensor inertial reference system employing a redundancy management concept to achieve fail-operational, fail-operational performance was developed
A R H

N78-32080*# Virginia Univ , Charlottesville School of Engineering and Applied Science
OPTIMIZATION OF MLS RECEIVERS FOR MULTIPATH ENVIRONMENTS Annual Report
G A McAlpine, J H Highfill, III, C P J Tzeng and Ghassem Koleyni Oct 1978 62 p refs
(Grant NsG-1128)
(NASA-CR-157736, UVA/528062/EE78/106) Avail NTIS HC A04/MF A01 CSCL 17G

Reduced order receiver (suboptimal receiver) analysis in multipath environments is presented The origin and objective of MLS is described briefly Signal modeling in MLS the optimum receiver is also included and a description of a computer oriented technique which was used in the simulation study of the suboptimal receiver is provided Results and conclusion obtained from the research for the suboptimal receiver are reported B B

N78-32084# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio
TERRAIN CONTOUR MATCHING (TERCOM) SENSITIVITY TO HEADING AND GROUND-SPEED ERRORS Final Report, Mar 1975 - Aug 1977
Mark W Cannon Jr May 1978 25 p refs
(AF Proj 7233)
(AD-A056127 AMRL-TR-77-84) Avail NTIS HC A02/MF A01 CSCL 17/7

A simulation of the TERCOM navigation system is presented and the effects of a number of error sources are studied Two error sources are course heading and ground-speed variation A third source is the fact that the radar altimeter samples the terrain at geographical coordinates lying between coordinates that specify the locations of terrain altitudes stored in the on-board computer The latter is shown to be an insignificant error with the 400 ft distance between sample points Course heading and ground-speed errors are shown to be critical problems when they occur simultaneously Maximum acceptable errors are approximately two degrees course heading at + or - 3% expected ground speed
Author (GRA)

N78-32085# National Technical Information Service, Springfield Va
AIR TRAFFIC CONGESTION AND CAPACITY A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Guy E Habercom Jr Jun 1978 164 p Supersedes NTIS/PS-77/0567 NTIS/PS-76/0495, NTIS/PS-75/376 (NTIS/PS-78/0598/9, NTIS/PS-77/0567 NTIS/PS-76/0495 NTIS/PS-75/376) Avail NTIS HC $28 00/MF $28 00 CSCL 01E

Present and predicted air traffic density and capacity were analyzed for both, enroute and in airport environments Terminal area scheduling, runway queuing, and airspace regulation are discussed (This updated bibliography contains 159 abstracts, 13 of which are new entries to the previous edition) GRA

N78-32086* National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SUPERSONIC TRANSPORT Patent
Paul Coe Jr , inventor (to NASA) Issued 6 Jun 1978 7 p Filed 27 Aug 1976 Supersedes N76-31219 (14 - 22 p 2826)
(NASA-Case-LAR-11932-1 US-Patent-4 093,156 US-Patent-Appl-SN-718244, US-Patent-Class-244-45A US-Patent-Class-244-46, US-Patent-Class-244-218) Avail US Patent Office CSCL 01C

An aircraft of supersonic transport configuration is described, featuring thrust vectoring in conjunction with wing apex segments used as canard surfaces during takeoff, landing and low-speed flight The angle of incidence of the wing apex segments, when the segments were functioning as canard surfaces was variable with respect to the aircraft angle of attack The wing apex segments furthermore formed a portion of the main wing panel swept leading edge when not functioning as canard surfaces The combination of thrust vectoring and deployable wing apex segments resulted in increased aircraft range and improved low speed longitudinal stability while providing acceptable takeoff length capabilities Official Gazette of the U S Patent Office

N78-32087*# Douglas Aircraft Co Inc , Long Beach, Calif
REFERENCE AIRCRAFT FOR ICAO WORKING GROUP E
Jul 1978 81 p refs
(Contract NAS1-14624)
(NASA-CR-158929) Avail NTIS HC A05/MF A01 CSCL 01C

The results of an advanced supersonic transport aircraft/ engine integration study to be used as a detail preliminary design case to assist in the assessment of noise standards applicable to future supersonic transports are summarized The design considered reflects the application of the advanced technologies which are projected to be available for program initiation in the 1980-1985 time period Suppression characteristics included were obtained in simulated forward flight in the Rolls-Royce spin rig using a small scale model The engine size selected produces a noise no greater than 108 EPNdB at any of the three Far Part 36 (Stage 2) defined measuring points and is sized slightly larger than the optimum cruise size to meet this noise constraint condition
J M S

N78-32088# Nielsen Engineering and Research Inc Mountain View Calif
MODIFICATIONS AND IMPROVEMENTS IN A STRUCTURAL OPTIMIZATION SCHEME BASED ON AN OPTIMALITY CRITERION Final Report, 1 Mar 1977 - 28 Feb 1978
S C McIntosh, Jr Jun 1978 81 p refs
(Contract F49620-77-C-0055)
(AD-A055941, AFOSR-78-1115TR) Avail NTIS HC A05/MF A01 CSCL 01/2

Three optimization algorithms based on optimality criteria are compared with an algorithm based on mathematical programming Two of the optimality-criterion algorithms are adapted from previous work and the third is new The example problem used is a simple 12-design-variable rectangular wing with three separate equality behavioral constraints a fixed deflection at the tip under a transverse load a fixed fundamental free-vibration frequency, and a fixed subsonic flutter speed Minimum-gage constraints were also imposed All of the algorithms gave virtually identical optimal designs The optimality-criterion algorithms were generally more efficient than the mathematical-programming algorithm although comparisons with more complicated problems are needed to establish clearly the degree of superiority The problems currently being considered are discussed and the research plan for the next year is briefly described
Author (GRA)

N78-32089# Technology Inc , Dayton, Ohio
ACQUISITION OF OPERATIONAL DATA DURING NOE MISSIONS Final Report, Sep. 1976 - Oct. 1977
Terry L Cox and F Joseph Giessler Apr 1978 95 p refs
(Contract DAAJ02-76-C-0065)
(AD-A055922, USARTL-TR-78-3) Avail NTIS HC A05/MF A01 CSCL 01/2

For the continued development and updating of the operational usage spectrum of Army helicopters a UH-1H helicopter assigned to nap-of-the-earth (NOE) training missions at Fort Rucker, Alabama was instrumented with an oscillograph and a photopanel recording system Two oscillographs collectively recorded

20 different flight parameters and a photopanel assembly monitored 9 other flight parameters 14 9 hours of valid data over the NOE course were recorded For the optimum representation and interpretation of the helicopter s performance the data were processed by the Flight Condition Recognition (FCR) method In this program the FCR technique was used to identify 29 flight conditions (including maneuvers and operational categories) These included turns and steady-state flight according to the occurrence and duration of a single flight parameter or combinations of them each in a specific range The data presentation includes the operational usage spectrum expressed as the percentage of time in the flight condition categories and various graphic depictions of typical NOE mission profiles GRA

N78-32090# Clarkson Coll of Technology Potsdam N Y
DYNAMIC RESPONSE OF AIRCRAFT TO UNLOADED AND LOADED PAVEMENT PROFILES Final Report, May - Sep 1977
William H Highter and Mark R Snyder Oct 1977 65 p refs (Contract F08635-77-C-0181)
(AD-A055703 CEEDO-TR-77-42) Avail NTIS HC A04/MF A01 CSCL 01/3

This study sought to determine whether or not there exists a significant difference in the simulated dynamic response of an F-4C aircraft traversing either an unloaded (undeflected) or loaded (deflected) pavement profile The Air Force computer code TAXI calculates the vertical accelerations at three points on an aircraft as the aircraft traverses a pavement profile An unloaded pavement profile was determined on a 2100 foot-long test section at Eglin Air Force Base, Fla by measuring elevations along the pavement at 2 foot intervals Pavement deflections caused by a load cart equipped with an aircraft tire were measured at the same points that defined the unloaded profile These deflections were then subtracted from the unloaded profile point for point to obtain the loaded profile traversed by an F-4C aircraft It appears that there is no significant difference in the response of TAXI to unloaded and loaded pavement profiles at speeds up to 133 3 feet/second At higher speeds some rejections of the mean do occur but these are felt to be insignificant It appears that the present Air Force practice of using unloaded pavement profiles for aircraft dynamic response simulation is acceptable and loaded pavement profiles need not be obtained for this purpose GRA

N78-32091# Air Force Inst of Tech , Wright-Patterson AFB Ohio School of Engineering
AN EXTENDED KALMAN FILTER FIRE CONTROL SYSTEM AGAINST AIR-TO-AIR MISSILES, VOLUME 2 M S. Thesis
Salvatore J Cusumano and Manuel DePonte Jr Dec 1977 353 p
(AD-A055637 AFIT/GE/EE/77-13-Vol-2) Avail NTIS HC A16/MF A01 CSCL 19/5

This Appendix contains the graphical results of the Monte Carlo analysis of this study The plots will be presented in sets All sets will include the dynamic state error plots GRA

N78-32092# Naval Ship Research and Development Center, Bethesda Md Aviation and Surface Effects Dept
AIRCRAFT CONFIGURATIONS FOR HIGH-SPEED SHIPS
Thomas H Boyd Dec 1977 88 p refs
(AD-A055540 DTNSRDC/ASED-397) Avail NTIS HC A05/MF A01 CSCL 01/3

An analytical study was conducted to establish high-speed ship compatible aircraft configurations and to determine their capabilities and limitations in Navy missions The study was restricted to subsonic aircraft configurations The interface problems and design constraints associated with the application of Navy aircraft to high-speed ships were identified Current aircraft in the Navy inventory and proposed advanced concepts were reviewed for applicability Three open-ocean scenarios using the high-speed potential of the surface effect ship were postulated, and associated airborne missions were identified and defined Findings confirm that the high-speed ship offers a number of benefits relative to small air capable ships Conventional takeoff and landing aircraft can operate from deck lengths less than 600 feet Short takeoff and landing aircraft can operate efficiently from deck lengths below 200 feet Vertical takeoff and landing aircraft acquire up to a 50 percent increase in load capability at deck length of 400 feet Author (GRA)

N78-32093# Army Test and Evaluation Command Aberdeen Proving Ground Md
PHYSICAL CHARACTERISTICS AVIATION MATERIEL Test Operations Procedures
Roy L Miller 27 Nov 1977 16 p Supersedes MTP-7-3-500 and the aviation portions of TOP-1-3-504 TOP-1-3-505 (AD-A055803, TOP-7-3-500 MTP-7-3-500 TOP-1-3-504 TOP-1-3-505) Avail NTIS HC A02/MF A01 CSCL 01/3

This document identifies testing methods and techniques necessary to determine the degree to which Army aviation materiel s physical characteristics are determined Author (GRA)

N78-32094*# Illinois Univ Urbana-Champaign Aviation Research Lab
AVIONICS PERFORMANCE ANALYSIS A HISTORICAL REVIEW AND A CURRENT ASSESSMENT OF FLIGHT INSTRUMENTATION AND CONTROL SYSTEMS IN CIVIL AVIATION Final Report
Jul 1978 53 p refs
(Contract NAS1-15145)
(NASA-CR-145378) Avail NTIS HC A04/MF A01 CSCL 01D

The role of flight instrumentation and control systems in the advancement of civil aviation to the safest form of commercial transportation is discussed Safety, cost reduction and increased capabilities provided by recent developments are emphasized Cost/performance considerations are considered in terms of determining the relative values of comparable systems or the absolute worth of a system J M S

N78-32095 Michigan Univ , Ann Arbor
COMBUSTION AND EMISSION CHARACTERISTICS OF A GAS TURBINE COMBUSTOR Ph.D Thesis
Prabhakar Bapusaheb Patil 1978 257 p
Avail Univ Microfilms Order No 78-13719

Physical and chemical processes such as spray formation, fuel and air mixing, droplet evaporation, and gas phase chemical reactions occur simultaneously in a gas turbine combustor By estimating the characteristic times associated with these processes it is shown that the flow can be divided into regions where only some of these processes are important The analysis presented is for two adjoining regions, (1) the heat up region where the incoming air and liquid fuel are heated, and (2) the evaporation/combustion region where the fuel evaporates and subsequently burns This simplified analysis shows that evaporation limits the rate of the combustion process The analysis provides an expression for estimating the flame speed and, with a simple numerical procedure, predicts the profiles of temperature and liquid fuel fraction It is shown that by including a simple chemical kinetic scheme, the profiles of CO and NO can also be predicted Dissert Abstr

N78-32096*# Pratt and Whitney Aircraft Group, East Hartford, Conn Commercial Products Div
COMPRESSOR SEAL RUB ENERGETICS STUDY Final Report, 8 Apr. 1977 - 8 Apr. 1978
W F Laverty May 1978 139 p refs
(Contract NAS 3-20613)
(NASA-CR-159424 PWA-5616) Avail NTIS HC A07/MF A01 CSCL 21E

The rub mechanics of compressor abradable blade tip seals at simulated engine conditions were investigated Twelve statistically planned, instrumented rub tests were conducted with titanium blades and Feltmetal fibermetal rubstrips The tests were conducted with single stationary blades rubbing against seal material bonded to rotating test disks The instantaneous rub torque, speed, incursion rate and blade temperatures were continuously measured and recorded Basic rub parameters (incursion rate, rub depth, abradable density, blade thickness and rub velocity) were varied to determine the effects on rub energy and heat split between the blade, rubstrip surface and rub debris

The test data was reduced, energies were determined and statistical analyses were completed to determine the primary and interactive effects Wear surface morphology, profile measurements and metallographic analysis were used to determine wear glazing, melting and material transfer The rub energies for these tests were most significantly affected by the incursion rate while rub velocity and blade thickness were of secondary importance The ratios of blade wear to seal wear were representative of those experienced in engine operation of these seal system materials Author

N78-32097*# General Electric Co , Cincinnati, Ohio
AIRCRAFT GAS TURBINE LOW-POWER EMISSIONS REDUCTION TECHNOLOGY PROGRAM Final Report
W J Dodds, C C Gleason, and D W Bahr Oct 1978 161 p refs
(Contract NAS3-20580)
(NASA-CR-135434, Doc-R78AEG408) Avail NTIS HC A08/MF A01 CSCL 21E

Advanced aircraft turbine engine combustor technology was used to reduce low-power emissions of carbon monoxide and unburned hydrocarbons to levels significantly lower than those which were achieved with current technology Three combustor design concepts, which were designated as the hot-wall liner concept, the recuperative-cooled liner concept, and the catalyst converter concept were evaluated in a series of CF6-50 engine size 40 degree-sector combustor rig tests Twenty-one configurations were tested at operating conditions spanning the design condition which was an inlet temperature and pressure of 422 K and 304 kPa a reference velocity of 23 m/s and a fuel-air-ration of 10 5 g/kg At the design condition typical of aircraft turbine engine ground idle operation, the best configurations of all three concepts met the stringent emission goals which were 10, 1, and 4 g/kg for CO, HC, and Nox, respectively G G

N78-32098*# Grumman Aerospace Corp , Bethpage, N Y
LARGE SCALE STATIC TESTS OF A TILT-NACELLE V/STOL PROPULSION/ATTITUDE CONTROL SYSTEM
Jul 1978 166 p refs Sponsored by NASA
(NASA-CR-152181, PDR-698-8) Avail NTIS HC A08/MF A01 CSCL 21E

The concept of a combined V/STOL propulsion and aircraft attitude control system was subjected to large scale engine tests The tilt nacelle/attitude control vane package consisted of the T55 powered Hamilton Standard Q-Fan demonstrator Vane forces, moments, thermal and acoustic characteristics as well as the effects on propulsion system performance were measured under conditions simulating hover in and out of ground effect G Y

N78-32099# Ford Motor Co , Dearborn, Mich
BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE. VOLUME 1 CERAMIC COMPONENT FABRICATION AND DEMONSTRATION Interim Report, 1 Jan. - 30 Sep. 1977
Arthur F McLean and Robert R Baker Mar 1978 69 p refs 2 Vol
(Contract DAAG46-71-C-0162, ARPA Order 1849)
(AD-A055252, AMMRC-TR-78-14-Vol-1, IR-12-Vol-1) Avail NTIS HC A04/MF A01 CSCL 21/5

The progress made on the DARPA Ceramic Turbine Testing Program is presented Duo-density rotor fabrication continued with over 600 rotor blade rings injection molded utilizing the automatic solid state control system Eleven duo-density ceramic turbine rotors were cold spin tested to qualify them for further hot running Development of the hot spin rigs continued A combustor flame-out problem and a durability problem with the rotor tip shroud/failure detector were resolved An important engine test of a duo-density silicon nitride rotor was accomplished Fabrication development on injection molding of stators and nose cones of 2 7g/cc density was continued on a limited basis Testing of stationary components continued in both qualification and durability rigs A complete set of silicon nitride stationary components consisting of a nose cone two stators two rotor tip shrouds and a second-stage stator centering ring completed the program objective of 175 hours at 1930 F plus 25 hours at 2500 F with over 40 lights In addition a silicon carbide stator successfully completed over 175 hours at 1930 F plus over 28 hours at 2500 F with 52 lights GRA

N78-32100# Ford Motor Co , Dearborn, Mich
BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE. VOLUME 2 CERAMIC TURBINE ROTOR TECHNOLOGY Interim Report, Jan. - Sep 1977
Arthur F McLean and Robert R Baker Mar 1978 91 p refs 2 Vol
(Contract DAAG46-71-C-0162, ARPA Order 1849)
(AD-A055276, AMMRC-TR-78-14-Vol-2, IR-12-Vol-2) Avail NTIS HC A05/MF A01 CSCL 21/5

Investigations of the materials used to fabricate duo-density ceramic turbine rotors were conducted on injection molded reaction bonded and hot pressed silicon nitride The injection molding process, utilized to fabricate rotor blade rings, was improved by optimizing the molding parameters with the automated control system and improving the molding mixture The installation of nozzles, to apply mold release, and air blast jets, to clean the die and evenly distribute the mold release, resulted in a noticeable improvement in the surface finish of the blade rings Duo-density turbine rotors were tested in the cold spin pit to evaluate the hot press to reaction sintered bond joints and the effect of I D voids, in the blade ring rim, on blade failure speeds Degradation of the room temperature strength of the reaction bonded silicon nitride rotor blades was identified as resulting from the press-bonding operation A procedure for determining whether statistically significant differences exist between two sets of data known as the Hypothesis Testing was outlined The test was applied to data from duo-density turbine rotors and showed that blade strength did deteriorate after the press-bonding operation Use of proof-testing as a means of enhancing the accuracy of life predictions was discussed GRA

N78-32101# Naval Postgraduate School, Monterey, Calif
A VALIDATION OF MATHEMATICAL MODELS FOR TURBOJET TEST CELLS Final Report
John Justin Walters and David W Netzer Jun 1978 61 p refs
(AD-A055991, NPS-67NT78061) Avail NTIS HC A04/MF A01 CSCL 21/5

Previously developed one-dimensional and two-dimensional computer models for predicting turbojet test cell performance were compared with data obtained from a subscale test cell for the purpose of model validation Comparisons were made for a variety of configurations and flow rates A modified one-dimensional model was found to reasonably predict the variation of augmentation ratio with engine flow rate, although predicted magnitudes were consistently too small The model incorporated excessive drag losses and an inaccurate jet spreading parameter for large engine-augmentor spacings The two-dimensional model accurately predicted experimental velocity profiles, but over-predicted pressure variations except for low engine exit Mach numbers Author (GRA)

N78-32102# Naval Postgraduate School Monterey, Calif
STRESS ANALYSIS OF CERAMIC GAS TURBINE BLADES BY THE FINITE ELEMENT METHOD, PART 2 M S Thesis
John H Preisel Jr Mar 1978 130 p refs
(AD-A055538, NPS-69-78-010-Pt-2) Avail NTIS HC A07/MF A01 CSCL 21/5

The complex geometry of many parts of a ceramic gas turbine engine and the need to known the stresses in these parts to a high degree of accuracy indicate that the finite element method should be employed One analysis code used a finite element program based on an isoparametric 12 node brick This allowed quadratic variation in one coordinate direction but only linear variation in the other two coordinate directions This introduced an artificial stiffness into the structure This study was made to determine the effects of using a totally quadratic isoparametric brick, vice one which is quadratic in only one direction A distributed load preprocessor was also developed and tested FORTRAN 4 was used throughout Author (GRA)

N78-32103# Mathtech Inc , Bethesda, Md
STUDY OF THE TURBINE ENGINE INDUSTRY Final Report
David W Grissmer and Kwan H Kim 31 Jan 1978 189 p refs
(Contract MDA903-76-C-0220)
(AD-A055895, Rept-7050-DG-KK-78-FR-1-DOD) Avail NTIS HC A09/MF A01 CSCL 21/5

This report provides a summary and analysis of original data from seven major US aircraft engine manufacturers over a time period 1960-75 Analysis of large and small engine production, surge capacity, costs productivity, and industry structure was made and compared with historical trends and the use of econometric models Emphasis was placed on the lead times shortages and roles of subcontractors component availability, and materials Author (GRA)

N78-32104# Advisory Group for Aerospace Research and Development Paris (France)
TECHNICAL EVALUATION REPORT ON THE 51ST(B) PEP SPECIALISTS' MEETING OF THE PROPULSION AND ENERGETICS PANEL ON SEAL TECHNOLOGY IN GAS TURBINE ENGINES
B Wrigley (Rolls-Royce Ltd , Derby England) Jul 1978 10 p refs Meeting held at London, 6-7 Apr 1978
(AGARD-AR-123 ISBN-92-835-1289-8) Avail NTIS HC A02/MF A01

The following topics are discussed in relation to aircraft and industrial gas turbines (1) material technology particularly as applied to main flow path blade tip seals, (2) user's view of seal technology, (3) measurements of seal behavior (4) laboratory experiments and (5) design aids B B

N78-32105# *Advisory Group for Aerospace Research and* Development, Paris (France)
TECHNICAL EVALUATION REPORT ON THE 51ST (A) SPECIALISTS' MEETING OF THE PROPULSION AND ENERGETICS PANEL ON ICING TESTING FOR AIRCRAFT ENGINES
D Tedstone Aug 1978 8 p Meeting held at London 3-4 Apr 1978
(AGARD-AR-124, ISBN-92-835-1295-2) Avail NTIS HC A02/MF A01

The Propulsion and Energetics 51st (A) Specialists' Meeting on Icing Testing for aircraft engines contains a survey of the thirteen papers presented The discussions which followed each paper as well as of the concluding Round Table Session, are included Conclusions are drawn and recommendations made regarding future work Author

N78-32106*# Systems Technology Inc , Mountain View, Calif
COMPUTED RESPONSES OF SEVERAL AIRCRAFT TO ATMOSPHERIC TURBULENCE AND DISCRETE WIND SHEARS Final Report
Wayne F Jewell, Robert L Stapleford, and Robert K Heffley Feb 1977 79 p refs
(Contract NAS2-8889)
(NASA-CR-152185 STI-TR-1063-2) Avail NTIS HC A05/MF A01 CSCL 01C

The computed RMS and peak responses due to atmospheric turbulence and discrete wind shears respectively are presented for several aircraft in different flight conditions The responses *are presented with and without the effects of a typical second* order washout filter A complete set of dimensional stability derivatives for each aircraft/flight condition combination evaluated is also presented Author

N78-32107# Air Force Inst of Tech , Wright-Patterson AFB Ohio
PITCH RATE FLIGHT CONTROL FOR THE F-16 AIRCRAFT TO IMPROVE AIR-TO-AIR COMBAT M S. Thesis
Michael A Marchand Dec 1977 180 p refs
(AD-A055417, AFIT/GGC/EE/77-7) Avail NTIS HC A09/MF A01 CSCL 01/3

Digital simulations were developed to implement a pitch rate control system for the F-16 aircraft engaged in aerial gunnery First, the EASY Modelling and Analysis Program by Boeing Computer Services was adapted to implement a longitudinal axis F-16 aircraft, flight control system, and pilot model Comparison of closed loop system responses indicated a proposed pitch rate flight control configuration would improve target tracking performance The Terminal Aerial Weapon Delivery Simulation (TAWNDS) program by McDonnell Douglas Corporation was adapted for the F-16 aircraft An non-linear six-degree-of-freedom aircraft model, multi-axis flight control system and multi-axis pilot model were developed to demonstrate target tracking capabilities Eight different air-to-air scenarios were developed to simulate evasive encounters with a F-4 target aircraft Time history target tracking errors indicated the improved tracking performance of the proposed pitch rate flight control configuration over the present normal acceleration configuration of the F-16 aircraft Author (GRA)

N78-32108 Virginia Univ Charlottesville
AERODYNAMIC STABILITY TESTING WITH MAGNETICALLY SUSPENDED MODELS Ph D Thesis
Desikan Bharathan 1977 130 p
Avail Univ Microfilms Order No 7812113

The practicality of measuring aerodynamic stability derivatives using models suspended in a water-cooled electromagnetic suspension facility is examined Two non-spinning models are tested in pitch and heave oscillation in a subsonic flow and both static and dynamic aerodynamic derivatives are determined from the measurements The two models are 7 caliber and 5 caliber cone cylinders Important factors in aerodynamic derivative measurements such as magnetic damping position sensing, and position-control stability are discussed and a comprehensive description of the apparatus is presented Dissert Abstr

N78-32109# Bell Helicopter Co Fort Worth Tex
AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC AIDAPS TEST CELL DATA COLLECTION AND TECHNICAL SUPPORT Final Report
J V Hickey Aug 1977 471 p
(Contract DAAJ01-71-A-0335)
(AD-A055385 USAAVRADCOM-TR-78-4) Avail NTIS HC A20/MF A01 CSCL 14/2

This report covers the work accomplished in direct support to the AIDAPS prototype development Work covered includes test cell data for the AIDAPS developer to use in determining diagnostic and prognostic logic collection of engineering data and technical support for AIDAPS integration into the UH-1 and AH-1 aircraft and providing technical representation at AIDAPS development sites AIDAPS was intended for use in Army aircraft and was intended to be used to reduce maintenance cost and improve flight safety by continuous in-flight monitoring of aircraft subsystems GRA

N78-32123# Indian Inst of Science Bangalore Dept of Aeronautical Engineering
ROCKET STRUCTURES
S Durvasula *In its* Space Sci , Technol and Appl An Overview Apr 1978 17 p refs

Avail NTIS HC A10/MF A01

An attempt is made to focus attention on the features of structural practice as relevant to rocket structures and to give *an overall view of the structural design aspects with particular* emphasis on a few typical important facets of the approach to structural analysis and design Estimation of loads and environmental conditions during ground operqtions and flight are considered Analysis of overall structure the type of construction to be adopted and the choice of materials and methods of fabrication are presented Other topics discussed are (1) dynamics and aeroelasticity, (2) vibration of overall vehicle, (3) aeroelastic divergence (4) vibration and flutter of rocket fins, (5) vibration of shell configurations (6) analytical techniques for solutions (7) experimental techniques tests and qualification aspects and (8) reliability considerations G Y

N78-32124# Indian Inst of Science Bangalore Dept of Aeronautical Engineering
HYPERSONIC FLOWS
N M Reddy *In its* Space Sci Technol and Appl An Overview Apr 1978 7 p refs

Avail NTIS HC A10/MF A01

Effects of hypersonic flow are dealt with in order to highlight important features Topics of discussion include (1) inviscid flow over bodies different flow regimes (free molecular flow, transition rarefied gas flow and continuum flow), (2) characteristic features of hypersonic flows, (3) flow over slender bodies (4) Newtonian Theory (5) aerodynamic heating (6) heating rates at hypersonic speeds (7) stagnation point heat transfer rate (8) hypersonic testing facilities and (9) principle of operation of a shock tube/shock tunnel G Y

N78-32168*# National Aeronautics and Space Administration Langley Research Center, Hampton Va
HYPERSONIC AIRBREATHING MISSILE Patent Application
James L Hunt Pierce L Lawing, and Don C Marcum, Jr, inventors (to NASA) Filed 18 Sep 1978 21 p
(NASA-Case-LAR-12264-1 US-Patent-Appl-SN-943087) Avail NTIS HC A02/MF A01 CSCL 16D

A hypersonic airbreathing missile using dual mode scramjet engines for propulsion is described The fuselage is constructed of a material with a high heat sink capacity and is covered with a thermal protective shield and lined with an internal insulating blanket The engine airframe integration uses the flat lower portion of the lower fuselage to precompress the air entering the scramjet engines The precompression of air entering the scramjet inlets increases as the angles of attack This feature results in a highly maneuverable missile which can accelerate as it banks into a turn NASA

N78-32169# Army Missile Research and Development Command Redstone Arsenal Ala Engineering Lab
A METHOD FOR VALIDATING MISSILE SYSTEM SIMULATION MODELS
Thomas P Tytula Jun 1978 122 p refs
(DA Proj 1T1-61101-A-91A)
(AD-A055689, DRDMI-E-78-11) Avail NTIS HC A06/MF A01 CSCL 12/1

A method for deciding whether a missile system simulation model is sufficiently accurate for a specific purpose is presented The procedure uses time series models of test data to generate empirical distributions which can be compared to distributions obtained from simulation models Time series models are also used to generate empirical distributions of the error between simulated and test data These error distributions can then be used in decision models to decide whether the simulation model is valid for a specific purpose Examples demonstrate the validity of the time series transformation and illustrate its application to missile system data Author (GRA)

N78-32173*# National Aeronautics and Space Administration Marshall Space Flight Center Huntsville Ala
AERODYNAMIC ROLL CHARACTERISTICS OF A 0.00548 SCALE 146-INCH SOLID ROCKET BOOSTER REENTRY CONFIGURATION (MSFC MODEL NUMBER 488) OVER A PORTION OF THE REENTRY FLIGHT REGIME IN THE NASA MSF 14-INCH TRISONIC WIND TUNNEL
Paul E Ramsey Jun 1977 139 p
(NASA-TM-78195) Avail NTIS HC A07/MF A01 CSCL 01A

An experimental investigation was conducted in the MSFC 14 inch TWT to study the roll characteristics of a 0 00548 scale model of the 146 inch shuttle solid rocket booster to obtain more accurate rolling moment data on the solid rocket booster A sensitive single component roll balance was utilized Data were obtained for a single nose mounted sting The angle of attack range consisted of angles from 150 deg to 190 deg, roll angles consisted of angles from 0 deg to 337 1/2 deg in increments of 22 1/2 deg and Mach numbers were 1 46, 1 96, 2 74 and 2 48 B B

N78-32177*# National Aeronautics and Space Administration Lyndon B Johnson Space Center Houston Tex
SPACE SHUTTLE SEPARATION MECHANISMS
William F Rogers Sep 1978 26 p ref
(NASA-TM-58210) Avail NTIS HC A03/MF A01 CSCL 22B

The development of space shuttle separation devices is reviewed to illustrate the mechanisms involved in separating the Orbiter from the Boeing 747 carrier aircraft and from the externally mounted propellant tank. Other aspects of the separation device development discussed include design evolution operational experience during the orbiter approach and landing tests, and the work required to produce an operational system Author

N78-32185*# Boeing Commercial Airplane Co Seattle Wash
ADVANCED COMPOSITES WING STUDY PROGRAM VOLUME 1 EXECUTIVE SUMMARY Final Report
Stanley T Harvey and Gary L Michaelson Sep 1978 18 p 2 Vol
(Contract NAS1-15003)
(NASA-CR 145382 1) Avail NTIS HC A02/MF A01 CSCL 11D

The effort necessary to achieve a state of production readiness for the design and manufacturing of advanced composite wing structure is outlined Technical assessment and program options are also reviewed for the wing study results J A M

N78-32186*# Boeing Commercial Airplane Co Seattle Wash
ADVANCED COMPOSITES WING STUDY PROGRAM, VOLUME 2 Final Report
Stanley T Harvey and Gary L Michaelson 1 Aug 1978 119 p 2 Vol
(Contract NAS1-15003)
(NASA-CR-145382-2) Avail NTIS HC A06/MF A01 CSCL 11D

The study on utilization of advanced composites in commercial aircraft wing structures was conducted as a part of the NASA Aircraft Energy Efficiency Program to establish by the mid-1980s the technology for the design of a subsonic commercial transport aircraft leading to a 40% fuel savings The study objective was to develop a plan to define the effort needed to support a production commitment for the extensive use of composite materials in wings of new generation aircraft that will enter service in the 1985 1990 time period Identification and analysis of what was needed to meet the above plan requirements resulted in a program plan consisting of three key development areas (1) technology development, (2) production capability development, and (3) integration and validation by designing building and testing major development hardware J A M

N78-32187*# Lockheed-California Co, Burbank
STUDY ON UTILIZATION OF ADVANCED COMPOSITES IN COMMERCIAL AIRCRAFT WING STRUCTURES VOLUME 1 EXECUTIVE SUMMARY Final Report
I Frank Sakata Robert B Ostrom, and Sal V Cardinale Aug 1978 23 p ref 2 Vol
(Contract NAS1 28611)
(NASA-CR-145381-1 LR-28611-Vol-1) Avail NTIS HC A02/MF A01 CSCL 11D

The effort required by commercial transport manufacturers to accomplish the transition from current construction materials and practices to extensive use of composites in aircraft wings was investigated The engineering and manufacturing disciplines which normally participate in the design development and production of an aircraft were employed to ensure that all of the factors that would enter a decision to commit to production of a composite wing structure were addressed A conceptual design of an advanced technology reduced energy aircraft provided the framework for identifying and investigating unique design aspects A plan development effort defined the essential technology needs and formulated approaches for effecting the required wing development The wing development program plans resource needs and recommendations are summarized J M S

N78-32188*# Lockheed California Co Burbank
STUDY ON UTILIZATION OF ADVANCED COMPOSITES IN COMMERCIAL AIRCRAFT WING STRUCTURES, VOLUME 2 Final Report

I Frank Sakata and Robert B Ostrom Aug 1978 242 p refs 2 Vol
(Contract NAS1-15005)
(NASA-CR-145381-2 LR 28610 Vol-2) Avail NTIS HC A11/MF A01 CSCL 11D

A plan is defined for a composite wing development effort which will assist commercial transport manufacturers in reaching a level of technology readiness where the utilization of composite wing structure is a cost competitive option for a new aircraft production plan The recommended development effort consists of two programs a joint government/industry material development program and a wing structure development program Both programs are described in detail J M S

N78-32199# National Bureau of Standards Washington D C Center for Fire Research
IGNITION OF A LIQUID FUEL UNDER HIGH INTENSITY RADIATION Interim Report, 1 May 1977 - 30 Apr 1978
Takashi Kashiwagi and Howard R Baum 1978 33 p refs
(AFOSR-ISSA-77-0016 AF Proj 2308)
(AD-A054974 AFOSR-78-1008TR) Avail NTIS HC A03/MF A01 CSCL 21/4

Laser technology has been rapidly advancing in the last two decades Power outputs of modern lasers increased significantly and these lasers can be used as tactical weapons A high power laser weapon can ignite aircraft fuel through fuel tank penetration and can cause fire or explosion of the aircraft The objective of this program is to obtain a fundamental understanding of physical and chemical mechanism of the ignition of liquid fuels under high intensity radiation The program consists of an experimental study to clarify the key mechanisms of ignition and a theoretical study to predict the qualitative effects of physical and chemical parameters on ignition of flammable liquids Since the radiative ignition of flammable liquids is hardly known the theoretical study has been deferred until the key ignition process is confirmed from the experimental study GRA

N78-32235# Pratt and Whitney Aircraft Group, West Palm Beach, Fla Government Products Div
TITANIUM ALLOY IGNITION AND COMBUSTION Final Report, 10 Sep. 1976 - 10 Dec 1977
V G Anderson and B A Manty 15 Jan 1978 39 p refs
(Contract N62269-76-C-0429)
(AD-A055443, PWA-FR-9511, NADC-76083-30) Avail NTIS HC A03/MF A01 CSCL 11/6

The objective of this program was to determine the relative ignition and combustibility characteristics of titanium alloys Nine titanium alloys and two coatings were subjected to a laser ignition source at each of two conditions of temperature, pressure and airstream velocity typical of gas turbine engine compressor environments Three of the alloys did not burn and no significant difference could be established in the burning characteristics of six of the alloys A chromium-molybdenum coating significantly reduced the magnitude of burn and an ion vapor deposited aluminum coating prevented ignition The higher temperature environment was shown to produce a more severe burn Comparison of one test run with results predicted by the analytical model currently under development showed good agreement
Author (GRA)

N78-32264*# National Aeronautics and Space Administration Washington D C
HIGH-TEMPERATURE CERAMICS FOR AUTOMOBILE GAS TURBINES
Peter Walzer Sep 1978 18 p ref Transl into ENGLISH of *Conf Paper-77-073 from DGLR* Presented at the Symp ueber Kleingasturbinen Stuttgart 11-12 Oct 1977 18 p Original language document was announced as A78-18708 Transl by SCITRAN, Santa Barbara Calif
(Contract NASw 3198)
(NASA-TM-75457 Paper-77-073) Avail NTIS HC A02/MF A01 CSCL 11B

The employment of the high operational temperatures makes it necessary to use for the construction of the turbines ceramic materials such as silicon nitride or silicon carbide Investigations concerning the development of turbine components made of such materials are conducted by a German automobile manufacturer and the ceramics industry The current status of these investigations is reviewed Flame tubes and guide-vane rings have successfully passed tests lasting 20 hours Prototype turbine wheels have withstood the effects of peripheral speeds of 450 m/s They also showed resistance to thermal shocks which were as high as 6-0 K/s Author

N78-32265*# National Aeronautics and Space Administration Washington D C
HIGH TEMPERATURE CERAMICS FOR AUTOMOBILE GAS TURBINES PART 2 DEVELOPMENT OF CERAMIC COMPONENTS
P Walzer M Koehler and P Rottenkolber Aug 1978 20 p refs Transl into ENGLISH from Motortech Z (West Ger), v 37 Dec 1976 p 525-529 Original language document was announced as A77-17591 Transl by Kanner (Leo) Associates Redwood City Calif Original doc prep by Volkswagenwerk AG
(NASA-TM 75302) Avail NTIS HC A02/MF A01 CSCL 11B

The development of ceramic components for automobile gas turbine engines is described with attention given to the steady and unsteady thermal conditions the ceramics will experience and their anti-corrosion and strain resistant properties The ceramics considered for use in the automobile turbines include hot-pressed Si3N4, reaction-sintered isostatically pressed Si3N4 hot-pressed SiC reaction-bonded SiC and glass ceramics Attention is given to the stress analysis of ceramic structures and the state of the art of ceramic structural technology is reviewed emphasizing the use of ceramics for combustion chambers and ceramic shrouded turbomachinery (a fully ceramic impeller) Author

N78-32270# Boeing Commercial Airplane Co Seattle Wash
ADHESIVE BONDED AEROSPACE STRUCTURES STANDARDIZED REPAIR HANDBOOK Final Report, 1 Oct 1973 - 30 Sep 1977
R E Horton and J E McCarty Dec 1977 347 p refs
(Contract F33615-73-C-5171)
(AD-A055684, AFML-TR-77-206 AFFDL-TR-77-139) Avail NTIS HC A15/MF A01 CSCL 01/3

This handbook is the culmination of a five-phase program to develop standardized repair procedures for adhesively bonded aircraft structures It recommends repair materials and processing methods It identifies repair procedures for both small and large size repairs It additionally includes information on equipment and tools and nondestructive inspection techniques
Author (GRA)

N78-32273# Pennwalt Corp, King of Prussia Pa Central Research and Development Dept
THE APPLICATION OF ULTRAVIOLET CURE RESINS FOR REPAIR OF COMPOSITES Final Report
H D Gillman and J L Eichelberger Nov 1977 15 p refs
(Contract N62269-77-M-7197)
(AD-A055731) Avail NTIS HC A02/MF A01 CSCL 11/9

This investigation has shown that it is possible to quickly easily and safely repair in the field damaged composites using UV curable resins Although the best repair in this study restored 76% of the strength of the undamaged laminate stronger repairs should be possible by optimizing the repair method The nature of this study did not allow for a complete evaluation of all the variables which would affect the strength of these repairs It is therefore reasonable to assume that stronger repairs would be possible by optimizing not only the resin system but also the method of cure (i e cure time, light intensity and wavelength) the surface preparation and the reinforcing material
Author (GRA)

N78-32321# Hughes Aircraft Co Fullerton Calif
PORTABLE EARTH STATION ANTENNA STUDY SYSTEM Final Report
1 Mar 1978 104 p Sponsored by Naval Res Lab
(AD-A054791 FR 78-14-287) Avail NTIS HC A06/MF A01 CSCL 17/2

The Mobile Antenna System requirements should be satisfied by solutions which offer the best antenna system approach and

provide the latest in the state-of-the-art technology with little or no risk The antenna system should be very reliable yet cost effective For the purpose of this study only a single main reflector with a single beam system is considered The recommended approach used to meet the requirements is the result of parametric tradeoffs of mechanical electrical logistic reliability and cost considerations The recommended antenna system is a ten foot diameter parabolic reflector mounted on an ax-el pedestal that is tied to an erectable tower The tower and the antenna assembly is mounted on a 26 foot flat bed that can be easily transported by C130 cargo plane The erection mechanism is hydraulic and requires no special tools Outriggers are provided for stabilizing the flat bed which becomes the pedestal for the tower The system is designed for an antenna height of 25 feet The feed is a center-fed cup dipole feed the cup measuring approximately 9 inches in diameter and about 4 inches deep The center support is a two-inch diameter lightweight pipe with a support cone at the attachment point of the reflector The transmit and receive transmission lines plus a polarizing 90 degree hybrid are placed inside this support strut The solid state transmitter filters and preamplifier are all located directly behind the vertex of the reflector Author (GRA)

N78-32327# Army Cold Regions Research and Engineering Lab Hanover N H
INTERACTION OF A SURFACE WAVE WITH A DIELECTRIC SLAB DISCONTINUITY
Steven A Arcone and Allan J Delaney Apr 1978 19 p refs (DA Proj 4A1-61102-AT-24)
(AD A055956 CRREL-78-8) Avail NTIS HC A02/MF A01 CSCL 20/14

The interaction of a 5 1 GHz transverse electric surface wave with a dielectric slab is experimentally investigated The wave is initially supported by a dielectric substrate resting upon a metallic ground-plane A slab, made of the same dielectric material as the substrate and variable in height, is then placed upon the waveguide The results for a small slab sitting on the substrate showed that the discontinuity was a very inefficient launcher of reflected surface waves Investigations of these reflections with a trough waveguide showed that, for values of slab height comparable to the exponential decay height of the surface wave the reflections remain very small However as the slab height is increased beyond the decay height, the reflected amplitude approaches the theoretical value for a plane wave reflected from the interface between air and the same dielectric The results are applicable to surface wave methods of microwave deicing of wings and helicopter rotors Author (GRA)

N78-32330# Arinc Research Corp Annapolis, Md
INVESTIGATION OF THE TECHNICAL AND OPERATIONAL FEASIBILITY OF USING A VHF DATA LINK FOR TRANSMISSION OF INTERMITTENT POSITIVE CONTROL (IPC), VOLUME 1 Final Report
S H Kowalski E R Carbone D A Swann and K F Peter Aug 1977 250 p
(Contract DOT FA76WA 3788)
(AD A055444 REPT 1326-21 01-1648-Vol 1) Avail NTIS HC A11/MF A01 CSCL 01/2

This report presents the results of an investigation of using a VHF Data Link to transmit collision avoidance commands to aircraft operating in the National Air Space Operational scenarios are developed and system capacity evaluations are performed to establish the operational feasibility of the concept Identification of potential concepts considered feasible generated the design and cost development of the avionics required in support of the prepared operation of IPC on a VHF Data Link Author (GRA)

N78-32371 Michigan Univ , Ann Arbor
HEAT TRANSFER AUGMENTATION IN FLOWS OVER AND NORMAL TO HIGH-POROSITY PERFORATED SURFACES Ph.D. Thesis
Ching-Pang Lee 1978 193 p
Avail Univ Microfilms Order No 7813691

Heat transfer and friction loss performances for flows over and normal to stacks of perforated plates were experimentally studied by means of a single blow transient test technique in a subsonic wind tunnel The hole diameter pitch plate spacing and flow velocity were varied Dissert Abstr

N78-32384*# National Aeronautics and Space Administration, Washington D C
DYNAMIC STALL AN EXAMPLE OF STRONG INTERACTION BETWEEN VISCOUS AND INVISCID FLOWS
Jean-Jacques Philippe Sep 1978 57 p refs Transl into ENGLISH of "Le Dechrochage Dynamique un Exemple d'Interaction Forte entre Ecoulements Visqeux et Non-visqueux , Rept ONERA-TP-1977-135 Onera, Paris, 1977 22 p Presented at the Symp on Unsteady Aerodyn Ottawa, 26-28 Sep 1977, sponsored by NATO and AGARD Original language document was announced as A78-24467 Transl by SCITRAN, Santa Barbara Calif
(Contract NASw-3198)
(NASA-TM-75447 ONERA-TP-1977-135) Avail NTIS HC A04/MF A01 CSCL 20D

A study was done of the phenomena concerning profiles in dynamic stall configuration, and more specially those related to pitch oscillations The most characteristic experimental results on flow separations with a vortex character, and their repercussions on local pressures and total forces were analyzed Some aspects of the methods for predicting flows with the presence (or not) of boundary layer separation are examined as well as the main simplified methods available to date for the calculation of total forces in such configurations L S

N78-32385*# National Aeronautics and Space Administration Langley Research Center Hampton Va
INVERSE BOUNDARY-LAYER THEORY AND COMPARISON WITH EXPERIMENT
James E Carter Sep 1978 55 p refs
(NASA-TP-1208, L-12190) Avail NTIS HC A04/MF A01 CSCL 20D

Inverse boundary layer computational procedures which permit nonsingular solutions at separation and reattachment are presented In the first technique which is for incompressible flow, the displacement thickness is prescribed, in the second technique for compressible flow a perturbation mass flow is the prescribed condition The pressure is deduced implicitly along with the solution in each of these techniques Laminar and turbulent computations which are typical of separated flow are presented and comparisons are made with experimental data In both inverse procedures finite difference techniques are used along with Newton iteration The resulting procedure is no more complicated than conventional boundary layer computations These separated boundary layer techniques appear to be well suited for complete viscous-inviscid interaction computations Author

N78-32391# General Electric Co Schenectady, N Y
UNSTEADY BLADE ROWS IN HIGH-SPEED FLOW Final Report, 1 Jan 1974 - 31 Dec 1977
M Kurosaka May 1978 167 p refs
(Contract F44620-74-C-0040)
(AD-A055620 SRD-78-063 AFOSR-78-1055TR) Avail NTIS HC A08/MF A01 CSCL 20/4

This report covers analytic investigations toward defining the instability boundaries of low incidence supersonic compressor flutter A closed form expression was developed for the unsteady pressure distribution for a flat plate cascade in supersonic flow which is valid for a frequency range of practical interest The work was extended to symmetric parabolic arc airfoils in cascade Finite thickness was shown to have a first order effect on the flow field Coupling the flow analysis with blade vibration modes indicates a bending instability in the frequency range of conventional design in general agreement with experimental data An expression for the frequency of the unsteady pressure along the stationary rotor casing due to a vibrating blade row was derived It indicates casing treatment tuned approximately to blade passing frequency and its harmonics should be effective in absorbing this unsteady flow energy GRA

N78-32392# Texas A&M Research Foundation, College Station
AEROELASTIC CHARACTERISTICS OF A CASCADE OF BLADES Final Report, 1 Apr 1974 - 31 Dec 1977

Balusu M Rao and Louis Kronenberger Jr Feb 1978 32 p refs
(Grant AF-AFOSR-2700-74 AF Proj 2307)
(AD-A055619, AFOSR-78-1027TR) Avail NTIS HC A03/MF A01 CSCL 20/4

A general aerodynamic theory and a numerical lifting surface technique based on velocity potential formulation for predicting aerodynamic derivatives of a cascade of blades in subsonic flow is described The unsteady airload prediction method is applied for predicting the flutter boundaries of a single degree-of-freedom in torsion of a cascade of blades Also, a general flutter program is developed for a two degree-of-freedom staggered cascade in subsonic flow By utilizing an iterative procedure which permits frequency variation The flutter frequency and the flutter speed of the reference airfoil are obtained as a function of cascade parameters The computer program uses very efficient techniques in computing unsteady loads the flutter frequency and the flutter speeds Author (GRA)

N78-32396* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
ANGLE DETECTOR Patent
Gilbert T Parra inventor (to NASA) Issued 13 Jun 1978 8 p Filed 10 Nov 1976 Supersedes N77-11364 (15 - 02, p 0194)
(NASA-Case-ARC-11036-1 US-Patent 4 094 073 US-Patent-Appl-SN-740457 US-Patent-Class-33-366) Avail US Patent Office CSCL 14B

An angle detector for determining a transducer's angular disposition to a capacitive pickup element is described The transducer comprises a pendulum mounted inductive element moving past the capacitive pickup element The capacitive pickup element divides the inductive element into two parts L sub 1 and L sub 2 which form the arms of one side of an a-c bridge Two networks R sub 1 and R sub 2 having a plurality of binary weighted resistors and an equal number of digitally controlled switches for removing resistors from the networks form the arms of the other side of the a-c bridge A binary counter controlled by a phase detector balances the bridge by adjusting the resistance of R sub 1 and R sub 2 The binary output of the counter is representative of the angle
Official Gazette of the U S Patent Office

N78-32424 Virginia Univ , Charlottesville
DYNAMIC ANALYSIS OF FLEXIBLE ROTOR-BEARING SYSTEMS USING A MODEL APPROACH Ph D Thesis
Kat Chung Choy 1977 379 p
Avail Univ Microfilms Order No 7812107

The generalized dynamic equations of motion were obtained by the direct stiffness method for multimass flexible rotor-bearing systems including the effects of unbalance, shaft bow, disk skew rotor acceleration gyroscopic moments and nonlinear bearing forces The use of undamped and damped system mode shapes in the transformation are discussed A set of undamped critical speed modes is used to transform the equations of motion into a set of coupled modal equations of motion A rapid procedure for computing stability steady state unbalance response, and transient response is presented Examples of the application of this modal approach are presented The dynamics of the system is further investigated with frequency spectrum analysis of the transient response through the use of numerical fast Fourier transformations Dissert Abstr

N78-32427*# National Aeronautics and Space Administration Washington D C
CHEVRON CUTTING EXPERIMENT WITH NEW RUNWAY MIXTURES
K Tyran, comp Sep 1978 31 p Transl into ENGLISH of 'Chevron Cutting Versuch mit neuen Laufflaechenmischungen Rept Publ-72-758 Swissair Zurich, 22 Dec 1977 20 p Transl by Kanner (Leo) Associates Redwood City Calif
(Contract NASw-3199)
(NASA-TM-75448, Publ-72-758) Avail NTIS HC A03/MF A01 CSCL 11J

Chevron cutting is shown to occur in different forms depending on the type of tire and the rubber on the running surface Hardest wear is shown by the main tires of the B-747 Four defects occurred in the form of two rip separation and two breakouts of the running surface Tires capped by Thompson are more affected than any of the other rubber-capping fabrics For Thompson tires Chevron Cutting is greatly reduced with a fiberglass-rubber mixture For Goodyear tires it is eliminated with spiral wrap rubbercapping resistance to damages through cuts seems to be more positive for Goodyear tires For Mader tires, the extent of Chevron Cutting is generally smaller than for Thompson cappings J M S

N78-32433*# Tennessee Univ Space Inst Tullahoma
TRANSIENT DYNAMICS OF A FLEXIBLE ROTOR WITH SQUEEZE FILM DAMPERS Final Report
D F Buono L D Schlitzer R G Hall III, and D H Hibner Sep 1978 85 p refs
(Contract NAS3-18523)
(NASA-CR-3050, PWA-5548-9) Avail NTIS HC A05/MF A01 CSCL 13I

A series of simulated blade loss tests are reported on a test rotor designed to operate above its second bending critical speed A series of analyses were performed which predicted the transient behavior of the test rig for each of the blade loss tests The scope of the program included the investigation of transient rotor dynamics of a flexible rotor system similar to modern flexible jet engine rotors both with and without squeeze film dampers The results substantiate the effectiveness of squeeze film dampers and document the ability of available analytical methods to predict their effectiveness and behavior G G

N78-32457 Ohio State Univ Columbus
FORCED VIBRATION OF THIN ELASTIC SHELLS WITH APPLICATION TO FRACTIONAL HORSEPOWER HERMETIC REFRIGERATION COMPRESSOR SHELLS Ph.D Thesis
Earl Bruce Brookbank, III 1978 212 p
Avail Univ Microfilms Order No 7812323

A method for determining the differential equations of motion for thin elastic shells with various types of external loading was developed This technique consisted of determining the generalized force from the virtual work done by the shell loading *The generalized force for many types of point line and distributed* loadings are derived and summarized The derivation of these equations of motion showed that the reaction force from springs attached masses or external dampers excite all shell vibration mode shapes and crosscouples the shell differential equations of motion for each mode shape These differential equations were applied to a fractional horsepower hermetic refrigeration compressor Dissert Abstr

N78-32458 Syracuse Univ N Y
SHEAR BUCKLING OF CORRUGATED PLATES WITH QUASI-SINUSOIDAL CORRUGATIONS Ph D Thesis
Mirza Iqbal Hussain 1977 114 p
Avail Univ Microfilms Order No 7811658

The usual approach to this problem was to idealize the corrugated plate as an orthotropic flat plate and apply the conventional techniques of flat plate buckling analysis However there were doubts as to the applicability of orthotropic plate theory to corrugated plates A somewhat more refined approach was used specifically in connection with simply supported corrugated plates of curvilinear cross section In this approach the corrugated plate was regarded as a shell and its buckling load was determined by the method of stationary total potential energy On the basis of this approach numerical buckling load data were obtained for simply supported curvilinearly corrugated plates covering a wide range of geometries The results were compared with the predictions of orthotropic plate theory and it was seen that the latter generally underestimates the buckling strength by a significant amount Dissert Abstr

N78-32462# Technion - Israel Inst of Tech Haifa Dept of Aeronautical Engineering
EFFECT OF AIRCRAFT LOADING PROGRAM MODIFICATIONS ON THE FATIGUE LIFE AND DAMAGE CUMULATION PART 1 EFFECT OF LOAD PEAKS IN CASE OF CENTRAL HOLE SHEET SPECIMENS
Alfred Buch Jul 1978 62 p refs
(TAE 334 Pt 1 ICAF 1040) Avail NTIS HC A04/MF A01

Flight simulation and program tests were performed with different 2024-T3 sheet specimens containing a central hole The effect of the peak-load frequency on the damage sum and flight number was investigated For sufficiently close spectra with similar log-linear airborne stress distribution but different GAG cycle distribution the relative Miner rule yielded satisfactory results In the case of truncation levels the investigated change of the frequency of stress cycles at the highest loading level had a weak effect on the damage sum while the effect of decrease of the frequency of the lowest stress amplitude was considerable in some cases It was found that in particular loading program cases rare load peaks may have not only a beneficial but also a detrimental effect on the number of simulated flights Truncation had a detrimental effect but the increase of the number of overload peaks above the number of cycles at the truncation level associated with the log-linear gust distribution had also a detrimental effect L S

N78-32486*# Hughes Helicopters Culver City Calif
DYNAMIC ANALYSIS USING SUPERELEMENTS FOR A LARGE HELICOPTER MODEL
Magan P Patel and Lalit C Shah (Multiple Access Inc) *In* NASA Marshall Space Flight Center Seventh NASTRAN User s Colloq Oct 1978 p 335-354

Avail NTIS HC A21/MF A01 CSCL 20K
Using superelements (substructures), modal and frequency response analysis was performed for a large model of the Advanced Attack Helicopter developed for the U S Army Whiffletree concept was employed so that the residual structure along with the various superelements could be represented as beam-like structures for economical and accurate dynamic analysis A very large DMAP alter to the rigid format was developed so that the modal analysis, the frequency response and the strain energy in each component could be computed in the same run J A M

N78-32504# Lockheed California Co Burbank
FLAW GROWTH IN COMPLEX STRUCTURE, VOLUME 3: SUMMARY, ASSESSMENTS, CONCLUSIONS Final Report, 12 May 1975 - 12 Sep 1977
T R Brussat S I Chiu and M Creager Dec 1977 67 p refs
(Contract F33615-75-C-3093)
(AD-A055483, LR-28272 Vol-3 AFFDL-TR-77-79 Vol-3) Avail NTIS HC A04/MF A01 CSCL 01/3
Fatigue crack growth testing and analysis was conducted to evaluate the effects of initial flaw location and multiplicity on fatigue crack growth life and element failure sequence in multiple element mechanically fastened metallic structure The test program including 68 precracked structural specimens consisting of 26 joints and 42 stringer reinforced panels is summarized The test results and corresponding analytical results are presented and compared With respect to the test results for precracked joints the following effects are discussed fastener torque faying surface friction friction under the fastener head single and multiple initial flaws fretting transverse bending flush-head and protruding-head fasteners and spectrum loading effects With respect to the results for precracked stringer reinforced panels the following are discussed longitudinal splice versus continuous skin initial flaw locations single or multiple initial flaws presence of continuing damage flaws crack growth in a tee or angle stringer transverse bending load shedding effects spectrum loading fracture surface marking stress level and crack path Guidelines and recommendations based on the results from this program are discussed Author (GRA)

N78-32539* National Aeronautics and Space Administration Langley Research Center, Hampton Va
INDEPENDENT POWER GENERATOR Patent
Richard N Young inventor (to NASA) Issued 30 May 1978 6 p Filed 30 Jul 1976 Supersedes N78-10096 (16 - 01 p 14)
(NASA-Case-LAR-11208-1 US-Patent-4 091,613 US-Patent-Appl-SN-710036 US Patent-Class-60-39 07 US-Patent-Class-60-39 14, US-Patent-Class-60-39 33 US-Patent-Class-98-1 5 US-Patent-Class-417-88) Avail US Patent Office CSCL 10B
A gas turbine powered aircraft auxiliary power system is described which is capable of efficiently supplying all aircraft auxiliary services both in flight and on the ground and is further capable of operating independently of the aircraft main engines The system employs multiple gas turbine compressor stages, thereby accomplishing cabin pressurization, ventilation and heating Official Gazette of the U S Patent Office

N78-32601# California Univ , Livermore Lawrence Livermore Lab
THE HIGH ALTITUDE POLLUTION PROGRAM Annual Report, 1977
F M Luther 30 Sep 1977 102 p refs
(Contract W-7405-eng-48)
(UCRL-50042-77) Avail NTIS HC A06/MF A01
The High Altitude Pollution Program (HAPP) was initiated by the Federal Aviation Administration to ensure that aircraft engine emissions in the stratosphere will not result in unacceptable effects on the biosphere Lawrence Livermore Laboratory (LLL) has participated in HAPP since July 1975 The primary research emphasis at LLL is on numerical modeling of the atmospheric response to stratospheric perturbations The modeling effort at LLL covers four major research areas photochemical kinetics coupled kinetics and transport radiative transfer, and meteorological analysis Progress since July 1, 1976 is reported ERA

N78-32604# National Technical Information Service, Springfield Va
AIR POLLUTION EMISSION FACTORS A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Diane M Cavagnaro Jun 1978 138 p Supersedes NTIS/PS-77/0489 NTIS/PS-76/0392, NTIS/PS-75/410
(NTIS/PS-78/0548/4 NTIS/PS-77/0489 NTIS/PS-76/0392 NTIS/PS-75/410) Avail NTIS HC $28 00/MF $28 00 CSCL 13B
Emission factors for various industry stationary, and mobile sources are presented in this annotated bibliography of research reports The calculation and use of these factors are included GRA

N78-32620# Illinois Univ at Urbana-Champaign, Urbana Inst for Environmental Studies
BASELINE DATA REQUIREMENTS FOR ASSESSING ENVIRONMENTAL IMPACT Final Report
Glenn E Stout, Kent McGregor, Joe L Spaeth, Keturah A Reinbold, and G Laurin Wheeler May 1978 141 p refs
(PB-281148/7, IIEQ-78/05) Avail NTIS HC A07/MF A01 CSCL 13B
A guide used by technical personnel to perform an integrated baseline evaluation of changes in the total environment--in plants soils, and animals (including man)--that is needed for a factual pinpoint assessment was developed The methodology outlined requires substantial resources both in manpower and funds GRA

N78-32642*# National Aeronautics and Space Administration, Washington D C
SOME PRINCIPLES FOR STUDYING REDUCED VISIBILITY CONDITIONS IN REGIONS AROUND AIRPORTS
N N Romanov, Z Ye Babenko and M N Yaroslavtseva Aug 1977 9 p Transl into ENGLISH from Vopr Sinopticheskoy i Aviats Meteorologii Tr Sredneaziatskiy Regionalnyy Nauchno-Issled Gidrometeorol Inst (Leningrad) no 5, 1973 p 117-121 Original language document was announced as A74-37224 Transl by Kanner (Leo) Associates Redwood City Calif
(Contract NASw-2790)
(NASA-TM-75152) Avail NTIS HC A02/MF A01 CSCL 04B
A set of guidelines based on the experiences of the meteorological team at Tashkent airport is presented These guidelines pertain to all the possible immediate and specific sources of relevant information in the vicinity of a given airport and to the combination of theoretical and experimental information which should be used in evaluating the data B B

N78-32673# Joint Publications Research Service Arlington Va

SOME PRESSING PROBLEMS OF SETTING PHYSIOLOGICAL-HYGIENIC STANDARDS FOR NOISE IN AEROSPACE MEDICINE

Yu V Krylov *In its* Space Biol and Aerospace Med No 4 (JPRS-71830) 7 Sep 1978 p 1 5 refs Transl into ENGLISH from Kosmich Biol Aviakosmich Med (Moscow) no 4, Jul /Aug 1978 p 3-6

Avail NTIS HC A07/MF A01

Aircraft noise exposure tests established satisfactory human endurance of acoustic intensities of up to 60 dbA for exposure times of up to 60 days Continuous exposure to acoustic energy levels of about 75 dbA produced fatigue and decreased efficiency Specific suggestions are provided for the design of protective antinoise gear in accordance with noise intensity and cumulative exposure time G G

N78-32754# Softech, Inc Waltham, Mass

OPERATIONAL SOFTWARE CONCEPT OSC EXECUTIVE EVALUATION/REFINEMENT Final Technical Report, Sep. - Dec. 1976

Michael G Willoughby and Carl K Hitchon Aug 1977 178 p (Contract F33615-76-C-1192)

(AD-A055902 AFAL-TR-77-87) Avail NTIS HC A09/MF A01 CSCL 09/2

This report describes executives built using the Operational Software Concept (OSC) These executives are designed to operate on a federated network of four DAIS processors connected by DAIS multiplex data busses In fact, the executives and applications, represented by stubs, have been implemented on a two processor system The applications supported by the executives are specified using Directed Flowgraphs (DFG) as described in AD-A010 415 This report is divided into three sections and an appendix The first section describes the process of building an executive based on a DFG The second section describes the parameters affecting system performance that are associated with the DFG supported by the executives The third section presents the baseline executive statistics tuning method descriptions and statistics for the final tuned executive The appendix provides program listings of intermediate tuning results of the final tuned executives GRA

N78-32815*# National Aeronautics and Space Administration Langley Research Center, Hampton Va

LABORATORY AND COMMUNITY STUDIES OF AIRCRAFT NOISE EFFECTS

David G Stephens and Clemans A Powell Sep 1978 16 p refs Presented at the Intern Congr on Noise as a Public Health Probl - Biol and Behavioral Effects Freiburg, West Ger 25-29 Sep 1978

(NASA-TM-78776) Avail NTIS HC A02/MF A01 CSCL 20A

The noise effects programs objective is to develop aircraft noise criteria and noise reduction methods for achieving greater community and passenger acceptance of air transportation systems *The approach consists of laboratory tests to subjectively* evaluate the properties of aircraft-generated noise that are responsible for causing annoyance and field surveys to study the broader problems of community and passenger acceptability The program is organized into two major thrusts community acceptance and passenger acceptance The community acceptance includes subjective response studies of single and multiple aircraft overflights as well as longer term community noise exposure Emphasis is on the development of units and indices which accurately quantify annoyance The passenger acceptance program includes studies to determine acceptably levels of interior noise and vibration for speech intelligibility and comfort of crew and passengers Selected results from several recent studies are *presented to indicate the nature scope and methods of the* research program L S

N78-32816*# National Aeronautics and Space Administration Langley Research Center, Hampton Va

HELICOPTER ACOUSTICS

Aug 1978 399 p refs Presented at the Intern Specialists Symp , Hampton Va , 22-24 May 1978 sponsored by the Am Helicopter Soc and AROD

(NASA-CP-2052-Pt-1, L-12339) Avail NTIS HC A17/MF A01 CSCL 20A

Exterior and interior noise problems are addressed both from the physics and engineering as well as the human factors point of view The role of technology in closing the gap between what the customers and regulating agencies would like to have and what is available is explored Noise regulation concepts, design, operations and testing for noise control, helicopter noise prediction and research tools and measurements are among the topics covered

N78-32817*# Federal Aviation Administration Washington, D C

HELICOPTER EXTERNAL NOISE REQUIREMENTS FAA PERSPECTIVE

Charles R Foster *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 1-16

Avail NTIS HC A17/MF A01 CSCL 20A

Enactment of helicopter noise certification standards for the control of noise impact contributing to community annoyance is considered in terms of the development of helicopters as an *environmentally compatible air transportation mode Increased* use of helicopters for commercial applications and public awareness of aircraft noise are cited as factors making development of helicopter noise standards necessary both for the protection of the environmental interest of the community and to ensure the orderly growth of the helicopter industry itself Noise sources, technology trends in helicopter design and design concepts to control helicopter noise are discussed along with the regulatory background and specific helicopter regulatory concepts J M S

N78-32818*# Helicopter Association of America, Washington, D C

HELICOPTER NOISE REGULATIONS AN INDUSTRY PERSPECTIVE

R A Wagner *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 17-32 refs

Avail NTIS HC A17/MF A01 CSCL 20A

A review of helicopter noise measurement programs and noise reduction/economic studies of FAA is given along with a critique of a study which addresses the economic impact of noise reduction on helicopter noise Modification of several helicopters to reduce noise and demonstrate the economic impact of the application of the current state-of-the-art technology is discussed Specific helicopters described include Boeing Vertol 347 Helicopter Hughes OH-6 Helicopter and Hughes 269C Helicopter Other topics covered include (1) noise trends and possible noise limits (2) accuracy of helicopter noise prediction techniques (3) limited change possibilities of derivatives, and (4) rotor impulsive noise The unique operational capabilities of helicopters and the implications relative to noise regulations and certification are discussed J M S

N78-32819*# Army Aviation Research and Development Command St Louis Mo
NOISE REQUIREMENTS FROM A MILITARY POINT OF VIEW
Charles C Crawford, Jr *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 33-44 refs

Avail NTIS HC A17/MF A01 CSCL 20A
External and internal aircraft noise requirements are discussed in terms of application to military helicopters The impact of the application of noise reduction technology to comply with FAA standards on cost and performance is emphasized J M S

N78-32820*# Hughes Helicopters Culver City, Calif
THE IMPACT OF URBAN OPERATIONS ON HELICOPTER NOISE REQUIREMENTS
Stanley R Spector *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 45-59 refs

Avail NTIS HC A17/MF A01 CSCL 20A
The interrelationship of urban helicopter operations, helicopter noise and the establishment of urban public-use heliports is discussed Public resistance to urban helicopter operations due to concern for safety and noise is shown to negatively impact the establishment of public-use heliports in urban centers It is indicated that increased government and industry effort to reduce helicopter noise is needed to ensure continued growth in the helicopter industry J M S

N78-32821*# Bolt Beranek and Newman, Inc , Cambridge Mass
PREDICTION AND REDUCTION OF ROTOR BROADBAND NOISE
Richard E Hayden and Krishna S Aravamudan *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 61-87 refs

Avail NTIS HC A17/MF A01 CSCL 20A
Prediction techniques which can be or have been applied to subsonic rotors, and methods for designing helicopter rotors for reduced broadband noise generation are summarized It is shown how detailed physical models of the noise source can be used to identify approaches to noise control J M S

N78-32822*# Westland Helicopters Ltd Hayes (England)
THEORETICAL MODELS OF HELICOPTER ROTOR NOISE
D L Hawkings *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 89-108 refs

Avail NTIS HC A17/MF A01 CSCL 20A
For low speed rotors it is shown that unsteady load models are only partially successful in predicting experimental levels A theoretical model is presented which leads to the concept of unsteady thickness noise This gives better agreement with test results For high speed rotors it is argued that present models are incomplete and that other mechanisms are at work Some possibilities are briefly discussed J M S

N78-32823*# United Technologies Research Center East Hartford Conn
NOISE DUE TO ROTOR-TURBULENCE INTERACTION
R K Amiet *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 109-126 refs

Avail NTIS HC A17/MF A01 CSCL 20A
A procedure for calculating the noise due to turbulent inflow to a propeller or helicopter rotor in hover is summarized The method is based on a calculation of noise produced by an airfoil moving in rectilinear motion through turbulence At high frequency the predicted spectrum is broadband while at low frequency the spectrum is peaked around multiples of blade passage frequency The results of a parametric study of the variation of the noise with rotor tip speed blade number chord turbulence scale and directivity angle are given A comparison of the theory with preliminary experimental measurements shows good agreement J M S

N78-32824*# Stanford Univ Calif
THEORY ON ACOUSTIC SOURCES
S E Wright *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 127-147 refs Sponsored by ONERA

Avail NTIS HC A17/MF A01 CSCL 20A
A theory is described for the radiation emission emission from acoustic multipole sources The sources can be stationary or moving at speeds including supersonic and experience stationary or moving disturbances The effect of finite source disturbutions and disturbances is investigated as well as the manner in which they interact Distinction is made between source distributions that responsed as a function of time and those that respond as a function of space J M S

N78-32825*# Naval Ship Research and Development Center, Bethesda, Md
POTENTIAL ACOUSTIC BENEFITS OF CIRCULATION CONTROL ROTORS
Robert M Williams and Ian C Cheeseman (Southampton Univ) *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 149-179 refs
Avail NTIS HC A17/MF A01 CSCL 20A
The fundamental aeroacoustic mechanisms responsible for noise generation on a rotating blade are theoretically examined Their contribution to the overall rotor sound pressure level is predicted Results from a theory for airfoil trailing edge noise are presented Modifications and extensions to other source theories are described where it is necessary to account for unique aspects of circulation control (CC) aerodynamics The circulation control rotor (CCR) as embodied on an X-wing vertical takeoff and landing (VTOL) aircraft, is used as an example for computational purposes, although many of the theoretical results presented are generally applicable to other CC applications (such as low speed rotors propellers compressors, and fixed wing aircraft) Using the analytical models it is shown that the utilization CC aerodynamics theoretically makes possible unprecedented advances in rotor noise reduction For the X-wing VTOL these reductions appear to be feasible without incurring significant attendant performance and weight penalties J M S

N78-32826*# National Aeronautics and Space Administration Langley Research Center, Hampton Va
HELICOPTER NOISE RESEARCH AT THE LANGLEY V/STOL TUNNEL
Danny R Hoad (AVRADCOM Res and Technol Labs) and George C Green *In its* Helicopter Acoustics Aug 1978 p 181-204 refs
Avail NTIS HC A17/MF A01 CSCL 20A
The noise generated from a 1/4-scale AH-1G helicopter configuration was investigated in the Langley V/STOL tunnel Microphones were installed in positions scaled to those for which flight test data were available Model and tunnel conditions were carefully set to properly scaled flight conditions Data presented indicate a high degree of similarity between model and flight test results It was found that the pressure time history waveforms are very much alike in shape and amplitude Blade slap when it occurred seemed to be generated in about the same location in the rotor disk as on the flight vehicle If model and tunnel conditions were properly matched, including inflow turbulence characteristics the intensity of the blade-slap impulse seemed to correlate well with flight J M S

N78-32827*# National Aeronautics and Space Administration Langley Research Center Hampton Va
EXPLORATORY WIND-TUNNEL INVESTIGATION OF THE EFFECT OF THE MAIN ROTOR WAKE ON TAIL ROTOR NOISE
Robert J Pegg and Phillip A Shidler *In its* Helicopter Acoustics Aug 1978 p 205-219 refs

Avail NTIS HC A17/MF A01 CSCL 20A

Approaches to minimizing the noise generated by the interaction of the tail rotor blades with the wake of the main rotor considered include repositioning of the tail rotor with respect to the main rotor changes in the rotational direction of the tail rotor and modification of the main rotor tip vortex A variable geometry model was built which had the capability of varying tail rotor position relative to the main rotor as well as direction of tail rotor rotation Acoustic data taken from the model in the Langley anechoic noise facility indicates interaction effects due to both main rotor shed vortex and the main rotor turbulence J M S

N78-32828*# Massachusetts Inst of Tech Cambridge
WIND TUNNEL INVESTIGATIONS OF MODEL ROTOR NOISE AT LOW TIP SPEEDS
K S Aravamudan A Lee and W L Harris *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 221-261 refs
(Contract DAAG29-76-C-0027)
Avail NTIS HC A17/MF A01 CSCL 20A

Experimental and related analytical results on model rotor rotational and broadband noise obtained in the anechoic wind tunnel and rotor facility are summarized Factors studied include various noise sources effects of helicopter performance parameters on noise generated by a model main rotor, appropriate scaling laws for the various types of main rotor noise and the effects of intensity and size scales of injected turbulence on the intensity and spectra of broadband noise J M S

N78-32829*# Textron Bell Helicopter, Ft Worth Tex
HELICOPTER EXTERNAL NOISE PREDICTION AND CORRELATION WITH FLIGHT TEST
Bharat P Gupta *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 263-275 ref

Avail NTIS HC A17/MF A01 CSCL 20A

Mathematical analysis procedures for predicting the main and tail rotor rotational and broadband noise are presented The aerodynamic and acoustical data from Operational Loads Survey (OLS) flight program are used for validating the analysis and noise prediction methodology For the long method of rotational noise prediction the spanwise chordwise and azimuthwise airloading is used In the short method, the airloads are assumed to be concentrated at a single spanwise station and for higher harmonics an airloading harmonic exponent of 2 0 is assumed For the same flight condition the predictions from long and short methods of rotational noise prediction are compared with the flight test results The short method correlates as well or better than the long method J M S

N78-32830*# National Aeronautics and Space Administration Langley Research Center Hampton Va
FULL-SCALE TESTING OF AN OGEE TIP ROTOR
Wayne R Mantay (AVRADCOM Res and Technol Labs) Richard L Campbell, and Phillip A Shidler *In its* Helicopter Acoustics Aug 1978 p 277-308 refs

Avail NTIS HC A17/MF A01 CSCL 20A

Full scale tests were utilized to investigate the effect of the ogee tip on helicopter rotor acoustics performance and loads Two facilities were used the Langley whirl tower and a UH-1H helicopter The text matrix for hover on the whirl tower involved thrust values from 0 to 44 480 N (10,000 lb) at several tip Mach numbers for both standard and Ogee rotors The full scale testing on the UH-1H encompassed the major portion of the flight envelope for that aircraft Both near field acoustic measurements and far field flyover data were obtained for both the ogee and standard rotors Data analysis of the whirl tower test shows that the ogee tip does significantly diffuse the tip vortex while providing some improvement in hover performance at low and moderate thrust coefficients Flight testing of both rotors indicates that the strong impulsive noise signature of the standard rotor can be reduced with the ogee rotor Analysis of the spectra indicates a reduction in energy in the 250 Hz and 1000 Hz range for the ogee rotor Forward flight performance was significantly improved with the ogee configuration for a large number of flight conditions Further rotor control loads were reduced through use of this advanced tip rotor J M S

N78-32831*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
HOVERING IMPULSIVE NOISE SOME MEASURED AND CALCULATED RESULTS
D A Boxwell (AVRADCOM Res and Technol Labs), Y H Yu (AVRADCOM Res and Technol Labs), and F H Schmitz (AVRADCOM Res and Technol Labs) *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 309-322 refs

Avail NTIS HC A17/MF A01 CSCL 20A

In-plane impulsive noise radiating from a hovering model rotor was measured in an anechoic environment The hover acoustic signature was compared with existing theoretical prediction models with previous forward flight experiments using the same model rotor These hover tests showed good experimental consistency with forward flight measurements both in pressure level, and waveform character, over the range of Mach numbers tested (0 8 to 1 0) Generally poor correlation, however was confirmed with current linear theory prediction efforts Failure to predict both the peak pressure levels and the shape was reported especially with increasing tip Mach number J M S

N78-32832*# Tokyo Univ (Japan)
IMPROVED METHODS FOR CALCULATING THE THICKNESS NOISE
Yoshiya Nakamura and Akira Azuma *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 323-337 refs

Avail NTIS HC A17/MF A01 CSCL 20A

Advanced methods to compute the rotor thickness noise which is predominant in the case of high speed rotor were developed These methods were deduced from a previous method by transforming the integral coordinate, commuting the order of integration and differential and/or performing chordwise integration analytically with some adequate assumption The necessary computational times and waveforms obtained by the previous and three advanced methods were compared It was then concluded that the advanced methods could save the computational time compared with the previous method with the same accuracy J M S

N78-32833*# Hamilton Standard, Windsor Locks, Conn
THE IMPORTANCE OF QUADRUPOLE SOURCES IN PREDICTION OF TRANSONIC TIP SPEED PROPELLER NOISE
Donald B Hanson and Martin R Fink (United Technol Res Center) *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 339-371 refs Presented at the Spring Meeting of the Inst of Acoustics Cambridge, England 7 Apr 1978 Submitted for publication

Avail NTIS HC A17/MF A01 CSCL 20A

A theoretical analysis is presented for the harmonic noise of high speed open rotors Far field acoustic radiation equations based on the Ffowcs-Williams/Hawkings theory are derived for a static rotor with thin blades and zero lift Near the plane of rotation the dominant sources are the volume displacement and the rho U(2) quadrupole where u is the disturbance velocity component in the direction blade motion These sources are compared in both the time domain and the frequency domain using two dimensional airfoil theories valid in the subsonic transonic and supersonic speed ranges For nonlifting parabolic arc blades the two sources are equally important at speeds between the section critical Mach number and a Mach number

of one However for moderately subsonic or fully supersonic flow over thin blade sections the quadrupole term is negligible It is concluded for thin blades that significant quadrupole noise radiation is strictly a transonic phenomenon and that it can be suppressed with blade sweep Noise calculations are presented for two rotors, one simulating a helicopter main rotor and the other a model propeller For the latter, agreement with test data was substantially improved by including the quadrupole source term J M S

N78-32834*# George Washington Univ Washington D C Joint Inst for Advancement of Flight Sciences

BOUNDS ON THICKNESS AND LOADING NOISE OF ROTATING BLADES AND THE FAVORABLE EFFECT OF BLADE SWEEP ON NOISE REDUCTION

F Farassat Paul A Nystrom, and Thomas J Brown (AVRADCOM Res and Technol Labs) *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 373-385 refs Sponsored in part by AROD

(Grant NsG-1474)

Avail NTIS HC A17/MF A01 CSCL 20A

The maxima of amplitudes of thickness and loading noise harmonics are established when the radial distribution of blade chord thickness ratio, and lift coefficient is specified It is first shown that only airfoils with thickness distribution and chordwise loading distributions which are symmetric with respect to midchord need be considered for finding the absolute maxima of thickness and loading noise The resulting chordwise thickness and load distributions for these maximum noise conditions require infinite slope at some points along the chord but otherwise are uniform It is shown that sweeping the blades reduces the thickness and loading noise, but there is no optimum sweep which generates the lowest noise J M S

N78-32835*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

A STUDY OF THE NOISE RADIATION FROM FOUR HELICOPTER ROTOR BLADES

Albert Lee (Beam Eng Inc) and Marianne Mosher *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 387-402 refs

Avail NTIS HC A17/MF A01 CSCL 20A

Acoustic measurements were taken of a modern helicopter rotor with four blade tip shapes in the NASA Ames 40-by-80-Foot Wind Tunnel The four tip shapes are rectangular swept trapezoidal, and swept tapered in platform Acoustic effects due to tip shape changes were studied based on the dBA level peak noise pressure and subjective rating The swept tapered blade was found to be the quietest above an advancing tip Mach number of about 0 9, and the swept blade was the quietest at low speed The measured high speed impulsive noise was compared with theoretical predictions based on thickness effects good agreement was found J M S

N78-32836*# Pratt and Whitney Aircraft Group East Hartford Conn

FLIGHT EFFECTS ON THE AERODYNAMIC AND ACOUSTIC CHARACTERISTICS OF INVERTED PROFILE COANNULAR NOZZLES Final Report

Hilary Kozlowski and Allan B Packman Aug 1978 197 p refs

(Contract NAS3-17866)

(NASA-CR-3018 PWA-5501) Avail NTIS HC A09/MF A01 CSCL 20A

The effect of forward flight on the jet noise of coannular exhaust nozzles suitable for Variable Stream Control Engines (VSCE) was investigated in a series of wind tunnel tests The primary stream properties were maintained constant at 300 mps and 394 K A total of 230 acoustic data points was obtained Force measurement tests using an unheated air supply covered the same range of tunnel speeds and nozzle pressure ratios on each of the nozzle configurations A total of 80 points was taken The coannular nozzle OASPL and PNL noise reductions observed statically relative to synthesized values were basically retained under simulated flight conditions The effect of fan to primary stream area ratio on flight effects was minor At take-off speed the peak jet noise for a VSCE was estimated to be over 6 PNdB lower than the static noise level High static thrust coefficients were obtained for the basic coannular nozzles with a decay of 0 75 percent at take-off speeds L S

N78-32903# Pennwalt Corp , King of Prussia, Pa Central Research and Development Dept

PIEZOELECTRIC POLYMER TRANSDUCERS FOR DETECTION OF STRUCTURAL DEFECTS IN AIRCRAFT Final Report, 12 Jan. - 27 Apr 1977

Phillip E Bloomfield 22 Jul 1977 22 p

(Contract N62269-77-M-3186, Proj 989156)

(AD-A055729) Avail NTIS HC A02/MF A01 CSCL 09/1

A new versatile thin film material, PVF2 (poly-vinylidene fluoride), has been fabricated into sensors for ultrasonic transducers because of its outstanding piezoelectric properties as well as its mechanical strength and chemical stability PVF2 has a compliance ten times higher than that found in ceramics, and its g-constant (voltage per unit stress) is very high Since the material can be made into very thin films very wide-band electro-acoustic transducers can be incorporated into sensors that are flexible variable in shape and a wide range of sizes This fabrication versatility along with its relatively low cost and its attractive piezoelectric, mechanical strength, and chemical stability makes this material a prime candidate for a large range of applications to monitor or inspect aircraft structures A number of inspection techniques have been explored and are discussed These include acoustic impact testing for ball bearing wear and crack formation in metal structures pulse-echo and transmission ultrasonics to inspect composites Author (GRA)

N78-32911# Air Force Flight Dynamics Lab Wright-Patterson AFB Ohio

AIR FORCE FLIGHT DYNAMICS LABORATORY FISCAL YEAR 1979 TECHNICAL OBJECTIVE DOCUMENT

Jan 1978 57 p Supersedes AFFDL-TR-77-33

(AD-A055711 AFFDL-TR-78-6 AFFDL-TR-77-33) Avail NTIS HC A04/MF A01 CSCL 01/3

The document presents an overview of the Technical Planning Objectives and supporting data for each These are extracted from the technical plan of the Air Force Flight Dynamics Laboratory (AFFDL) Information is largely based on AFFDL fiscal 1979 technology plan omitting specific funding and timing information of an Official Use Only nature Technical objectives are described for the four technical areas of Structural Mechanics Vehicle Equipment/Subsystems and Flight Control and Aeromechanics Points of contact for more information in each of the areas are identified GRA

N78-33015# Joint Publications Research Service, Arlington Va

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY. PHYSICAL SCIENCE AND TECHNOLOGY, NO. 42

3 Aug 1978 90 p refs Transl into ENGLISH from various Russian journals

(JPRS-71612) Copyright Avail NTIS HC A05/MF A01

Articles are presented on the following topics standard data processing in COBAL and PL-1, reliability of orbital stations, hydraulic weightlessness, communication between orbital station and control center, and remote sensing of earth resources

N78-33019# Joint Publications Research Service, Arlington, Va

EARTH-TO-ORBITAL STATION RADIO BRIDGE

B Pokrovskiy *In its* Transl on USSR Sci and Technol Phys Sci and Technol , No 42 (JPRS-71612) 3 Aug 1978 p 61-67 Transl into ENGLISH from Aviat Kosmonavt (Moscow), no 6, 1978 p 38-39

Copyright Avail NTIS HC A05/MF A01

A description is given of an U S S R flight control center and the work of controlling and monitoring a spacecraft is explained L S

N78-33024# Joint Publications Research Service Arlington, Va

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCE AND TECHNOLOGY, NO 44

10 Aug 1978 92 p Transl into ENGLISH from various Russian journals
(JPRS-71659) Copyright Avail NTIS HC A05/MF A01

Topics discussed include editing and translating computer programs debugging processors instrument making, instrument modeling, and measurement systems

N78-33038# Office of Air Force History, Washington D C
ENCYCLOPEDIA OF US AIR FORCE AIRCRAFT AND MISSILE SYSTEMS. VOLUME 1 POST-WORLD WAR II FIGHTERS 1945 - 1973
1978 178 p
(AD-A057002) Avail NTIS HC A09/MF A01 CSCL 01/3

This volume contains basic information on all Air Force fighters developed between World War II and 1973, including all configurations It is based primarily on US Air Force sources The origin of each aircraft is noted as well as its most troublesome development production, and operational problems Also covered are significant modifications, most of which can be attributed to ever-changing aeronautical technology Production totals, delivery rates unit costs phaseout dates, and other important milestones are provided, as well as a brief description of each version s new features The book begins with the first postwar American jet fighter the F-80 Shooting Star It ends with Northrop s F-5 Freedom Fighter Complete consistency of data on each fighter was not always available, but each section describes the aircraft s basic development production decision dates, program changes, test results, procurement methods, and the like Technical data and operational characteristics also are provided
Author (GRA)

N78-33043*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
LASER-VELOCIMETER SURVEYS OF MERGING VORTICES IN A WIND TUNNEL COMPLETE DATA AND ANALYSIS
Victor R Corsiglia James D Iversen (Iowa State Univ , Ames) and Kenneth L Orloff Oct 1978 48 p refs
(NASA-TM-78449 A-7262) Avail NTIS HC A03/MF A01 CSCL 01A

The merger of two corotating vortices was studied with a laser velocimeter designed to measure the two cross-stream components of velocity Measurements were made at several downstream distances in the vortex wake shed by two semispan wings mounted on the wind-tunnel walls The velocity data provided wall-defined contours of crossflow velocity stream function, and vorticity for a variety of test conditions Downstream of the merger point the vorticity was found to be independent of the downstream distance for radii smaller than r/b = 0 05 For larger radii the vorticity depended on the distance from the wing Upstream of the merger, a multicell vorticity pattern was found
Author

N78-33045*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
AERODYNAMIC LOAD DISTRIBUTIONS AT TRANSONIC SPEEDS FOR A CLOSE-COUPLED WING-CANARD CONFIGURATION. TABULATED PRESSURE DATA
Karen E Washburn and Blair B Gloss Oct 1978 231 p refs
(NASA-TM-78780) Avail NTIS HC A11/MF A01 CSCL 01A

Wind tunnel studies are reported on both the canard and wing surfaces of a model that is geometrically identical to one used in several force and moment tests to provide insight into the various aerodynamic interference effects In addition to detailed pressures measurements the pressures were integrated to illustrate the effects of Mach number canard location, and canard-wing interference on various aerodynamic parameters Transonic pressure tunnel Mach numbers ranged from 0 70 to 1 20 for data taken from 0 deg to approximately 16 deg angle-of-attack at 0 deg sideslip
G G

N78-33046*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
GEOMETRY REQUIREMENTS FOR UNSTEADY AERODYNAMICS IN AEROELASTIC ANALYSIS AND DESIGN
E Carson Yates, Jr and Luigi Morino Sep 1978 30 p
(NASA-TM-78781) Avail NTIS HC A03/MF A01 CSCL 01A

Aircraft geometry requirements for unsteady aerodynamic computations are discussed and differences between requirements for steady and unsteady flow are emphasized within the framework of a general potential-flow aerodynamic formulation Its implementation in a computer program called SOUSSA (Steady Oscillatory, and Unsteady Subsonic and Supersonic Aerodynamic is detailed
G G

N78-33047*# National Aeronautics and Space Administration Langley Research Center, Hampton Va
EFFECTS OF WING LEADING-EDGE DEFLECTION ON THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A LOW-ASPECT-RATIO HIGHLY SWEPT ARROW-WING CONFIGURATION
Paul L Coe Jr and Robert P Weston Sep 1978 70 p refs
(NASA-TM-78787) Avail NTIS HC A04/MF A01 CSCL 01A

Wing leading-edge deflection effects on the low-speed aerodynamic characteristics of a low-aspect-ratio highly swept arrow-wing configuration were determined Static force tests were conducted in a V/STOL tunnel at a Reynolds number of about 2 5 x 1 million for an angle-of-attack range from -10 deg to 17 deg and an angle-of-sideslip range from -5 deg to 5 deg Limited flow visualization studies were also conducted in order to provide a qualitative assessment of leading-edge upwash characteristics
G G

N78-33048*# Illinois Univ Urbana Dept of Aeronautical and Astronautical Engineering
A DISTRIBUTION MODEL FOR THE AERIAL APPLICATION OF GRANULAR AGRICULTURAL PARTICLES Final Report
S T Fernandes and Allen I Ormsbee Sep 1978 75 p refs (Grant NsG-1400)
(NASA-CR-157745, AAE-TR-78-5, UILU-ENG-78-0505) Avail NTIS HC A04/MF A01 CSCL 01A

A model is developed to predict the shape of the distribution of granular agricultural particles applied by aircraft The particle is assumed to have a random size and shape and the model includes the effect of air resistance, distributor geometry and aircraft wake General requirements for the maintenance of similarity of the distribution for scale model tests are derived and are addressed to the problem of a nongeneral drag law It is shown that if the mean and variance of the particle diameter and density are scaled according to the scaling laws governing the system, the shape of the distribution will be preserved Distributions are calculated numerically and show the effect of a random initial lateral position particle size and drag coefficient A listing of the computer code is included
Author

N78-33049# Naval Ship Research and Development Center Bethesda, Md Aviation and Surface Effects Dept
ASSESSMENT OF LOAD ALLEVIATION DEVICES INSTALLED ON A POWER-AUGMENTED-RAM WING OVER IRREGULAR WAVES Final Report, Oct 1976 - Aug 1977
Earl F McCabe, Jr Aug 1977 70 p
(AD-A045425, DTNSRDC-ASED-383) Avail NTIS HC A04/MF A01 CSCL 01/1

An investigation was conducted to determine the motions and performance of a power-augmented wing-in-ground-effect model with load alleviation devices The effects of soft and bumpered endplates and a flexible flap were investigated for a range of velocities thrust-to-weight ratios and irregular wave sea states Results showed that the flexible flap can provide a smoother, softer ride for a thrust-to-weight ratio of 0 20 but at the expense of decreased average heave and increased average drag Results also indicated a transport efficiency degradation from 23 18 to 10 06 with increase in sea state from 0 to 5 for the model without load alleviation The results were inconclusive for the soft and bumpered endplates
Author

N78-33050*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
SUBSONIC DYNAMIC STABILITY CHARACTERISTICS OF TWO CLOSE-COUPLED CANARD-WING CONFIGURATIONS

Richard P Boyden Oct 1978 80 p refs
(NASA-TP-1291 L-12057) Avail NTIS HC A05/MF A01 CSCL 01A

The pitch yaw and roll damping as well as the oscillatory stability in pitch and in yaw were measured for two canard wing configurations with wing sweeps of 44 deg and 60 deg Tests were made at free stream Mach number of 0 3 0 4 and 0 7 and for angles of attack from about -4 deg to 20 deg The effects of various components such as the canard, nose strakes wings, vertical tail and horizontal tail were determined The basic canard wing vertical tail configurations generally had positive damping in pitch, yaw and roll The effect of the canard was generally beneficial except for its tendency to decrease the oscillatory directional stability J A M

N78-33061*# National Aeronautics and Space Administration Langley Research Center Hampton Va
ESTIMATION OF LEADING-EDGE THRUST FOR SUPERSONIC WINGS OF ARBITRARY PLANFORM
Harry W Carlson and Robert J Mack Oct 1978 51 p refs
(NASA-TP-1270 L-12283) Avail NTIS HC A04/MF A01 CSCL 01A

A numerical method for the estimation of leading edge thrust for supersonic wings of arbitrary planform was developed and was programmed as an extension to an existing high speed digital computer method for prediction of wing pressure distributions The accuracy of the method was assessed by comparison with linearized theory results for a series of flat delta wings Application of the method to wings of arbitrary planform both flat and cambered is illustrated in several examples J A M

N78-33062# Southampton Univ (England) Dept of Aeronautics and Astronautics
A THEORETICAL AND EXPERIMENTAL STUDY OF CIRCULATION CONTROL WITH REFERENCE TO FIXED WING APPLICATIONS Ph.D Thesis
R V Smith Jul 1978 217 p refs
(RP-582) Avail NTIS HC A10/MF A01

An experimental investigation is described of two circulation control aerofoils and the effects on them of short chord tabs designed to reduce the drag of such aerofoils at low lift coefficients Performance improvements are demonstrated at the expense of greater system complexity A new quasipotential flow model of circulation control applied to a circular cylinder is described This flow model is based on the use of discrete vortices to represent the shear layer between a Coanda wall jet and an external stream This prediction method is applicable to other Coanda and boundary layer control flows An arbitrary form of vortex decay is used to simulate dissipative processes within the wall jet and results in improvements in performance prediction L S

N78-33063*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards Calif
COMPARISON OF CONCURRENT STRAIN GAGE- AND PRESSURE TRANSDUCER-MEASURED FLIGHT LOADS ON A LIFTING REENTRY VEHICLE AND CORRELATION WITH WIND TUNNEL PREDICTIONS
Ming H Tang, Walter J Sefic and Robert G Sheldon Oct 1978 42 p refs
(NASA-TP-1331, H-1035) Avail NTIS HC A03/MF A01 CSCL 01A

Concurrent strain gage and pressure transducer measured flight loads on a lifting reentry vehicle are compared and correlated with wind tunnel-predicted loads Subsonic, transonic, and supersonic aerodynamic loads are presented for the left fin and control surfaces of the X-24B lifting reentry vehicle Typical left fin pressure distributions are shown The effects of variations in angle of attack angle of sideslip, and Mach number on the left fin loads and rudder hinge moments are presented in coefficient form Also presented are the effects of variations in angle of attack and Mach number on the upper flap lower flap, and aileron hinge-moment coefficients The effects of variations in lower flap hinge moments due to changes in lower flap deflection and Mach number are presented in terms of coefficient slopes Author

N78-33064*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards Calif
AERODYNAMIC DERIVATIVES FOR AN OBLIQUE WING AIRCRAFT ESTIMATED FROM FLIGHT DATA BY USING A MAXIMUM LIKELIHOOD TECHNIQUE
Richard E Maine Oct 1978 73 p refs
(NASA-TP-1336 H-1003) Avail NTIS HC A04/MF A01 CSCL 01A

There are several practical problems in using current techniques with five degree of freedom equations to estimate the stability and control derivatives of oblique wing aircraft from flight data A technique was developed to estimate these derivatives by separating the analysis of the longitudinal and lateral directional motion without neglecting cross coupling effects Although previously applied to symmetrical aircraft the technique was not expected to be adequate for oblique wing vehicles The application of the technique to flight data from a remotely piloted oblique wing aircraft is described The aircraft instrumentation and data processing were reviewed with particular emphasis on the digital filtering of the data A complete set of flight determined stability and control derivative estimates is presented and compared with predictions The results demonstrated that the relatively simple approach developed was adequate to obtain high quality estimates of the aerodynamic derivatives of such aircraft B B

N78-33065# Analytic Sciences Corp Reading, Mass
MISSILE AERODYNAMIC PARAMETER AND STRUCTURE IDENTIFICATION FROM FLIGHT TEST DATA Final Report, Feb - Oct. 1977
James E Kain Charles M Brown Jr, and Jang G Lee Eglin AFB Fla AFATL Nov 1977 205 p refs
(Contract F08635-77-C-0062, AF Proj 2068)
(AD-A056343 TASC-TR-1019-2, AFATL-TR-77-129) Avail NTIS HC A10/MF A01 CSCL 09/3

An extended Kalman filter algorithm for aerodynamic parameter identification from missile postflight data is developed and verified for realistic test conditions The algorithm includes a general purpose six-degrees-of-freedom missile airframe model suitable for representing a variety of missile configurations Verification studies consider low order linear aerodynamic models and higher order models with extensive nonlinear and pitch-yaw coupling effects The sensitivity of filter performance to initial conditions measurement data rate and accuracy, input selection and modeling errors is investigated A structure identification technique is used to select the most probable aerodynamic model for a given data set from a group of candidate models In addition, actual flight test data from a complex aerodynamically controlled vehicle is processed with the filter algorithm The resulting identified model is shown to be an improvement over the preflight model Author (GRA)

N78-33066# Dayton Univ Research Inst, Ohio
A COMPARATIVE STUDY OF TWO COMPUTATIONAL METHODS FOR CALCULATING UNSTEADY TRANSONIC FLOWS ABOUT OSCILLATING AIRFOILS Final Report, Apr. - Jun 1977
Donald P Rizzetta Nov 1977 44 p refs
(Contract F33615-76-C-3146 AF Proj 2307)
(AD-A056946 AFFDL-TR-77-118) Avail NTIS HC A03/MF A01 CSCL 20/4

This report provides a direct comparison of the calculations for the flow field about an oscillating airfoil in a transonic freestream predicted by two computational methods namely harmonic analysis and time integration Details of the two methods are summarized and results for NACA64A010 airfoil oscillating in pitch are considered Comparisons of the unsteady pressure distribution and resultant lift are presented for several values of free-stream Mach number, angle of attack and reduced frequency of oscillation Author (GRA)

N78-33080*# National Aeronautics and Space Administration Langley Research Center Hampton Va
PROSPECTS FOR A CIVIL/MILITARY TRANSPORT AIRCRAFT

Charles E Jobe (USAF/ASD), Larry W Noggle (USAF/ASD) and Allen H Whitehead Jr Sep 1978 46 p refs Presented at 1978 SAE Intern Air Transportation Meeting Boston, 3 May 1978
(NASA-TM-78724 Rept-791-40-13-01) Avail NTIS HC A03/MF A01 CSCL 01C

The similarities and disparities between commercial and military payloads design features missions and transport aircraft are enumerated Two matrices of civil/military transport aircraft designs were evaluated to determine the most cost effective payloads for a projected commercial route structure and air freight market The probability of this market developing and the prospects for alternate route structures and freight markets are evaluated along with the possible impact on the aircraft designs Proposals to stimulate the market and increase the viability of the common aircraft concept are reviewed and the possible impact of higher cargo demand on prospects for common civil/military freighters is postulated The implications of planned advanced technology developments on the aircraft performance and cost are also considered Author

N78-33061*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
CHARACTERISTICS OF FUTURE AIR CARGO DEMAND AND IMPACT ON AIRCRAFT DEVELOPMENT. A REPORT ON THE CARGO/LOGISTIC AIRLIFT SYSTEMS STUDY (CLASS) PROJECT
Allen H Whitehead, Jr Oct 1978 45 p refs
(NASA-TM-78774) Avail NTIS HC A03/MF A01 CSCL 01C

Current domestic and international air cargo operations are studied and the characteristics of 1990 air cargo demand are postulated from surveys conducted at airports and with shippers consignees and freight forwarders as well as air land, and ocean carriers Simulation and route optimization programs are exercised to evaluate advanced aircraft concepts The results show that proposed changes in the infrastructure and improved cargo loading efficiencies are as important enhancing the prospects of air cargo growth as is the advent of advanced freighter aircraft Potential reductions in aircraft direct operating costs are estimated and related to future total revenue Service and cost elasticities are established and utilized to estimate future potential tariff reductions that may be realized through direct and indirect operating cost reductions and economies of scale A R H

N78-33062# Transportation Systems Center Cambridge Mass
AIRLINE DELAY TRENDS, 1972-1977 Final Report
Stephen Morin and Seymour M Horowitz Jul 1978 51 p ref
(AD-A056867 FAA-EM-78-11) Avail NTIS HC A04/MF A01 CSCL 01/5

Estimates of block, airborne and ground delays for approximately 325 route segments connecting 20 of the most active U S airports and serviced by the domestic scheduled air carriers are presented Delay information consists of airborne and ground data displayed in both table and graph form for 20 airports for the years 1972 through 1977 A R H

N78-33063# National Aviation Facilities Experimental Center Atlantic City N J
THE ANALYSIS OF NATIONAL TRANSPORTATION SAFETY BOARD SMALL MULTIENGINE FIXED-WING AIRCRAFT ACCIDENT/INCIDENT REPORTS FOR THE POTENTIAL PRESENCE OF LOW-LEVEL WIND SHEAR Final Report, Jun. - Nov. 1977
Jack J Shrager Jun 1978 65 p refs
(FAA Proj 154-451-110)
(AD-A056780 FAA-NA-78-5, FAA-RD-78-55) Avail NTIS HC A04/MF A01 CSCL 01/2

The National Transportation Safety Board aircraft accident/incident data base covering the years 1964 through 1975 was screened to select those accidents involving multiengine aircraft of less than 12,500 pounds gross weight in which the potential of low-level wind shear as a factor could not be discounted The successive filtering techniques employed eliminated all but 27 small multi-engine fixed-wing aircraft accidents/incidents which were approximately similar to the results obtained for the large multiengine aircraft The presence of a low-level wind shear was a distinct possibility in these 27 takeoff approach or landing accidents/incidents The historical accident information indicates that orographic or local topographic induced wind shears are a more serious problem for this class aircraft than those shears related to thunderstorm and gust front activities Author

N78-33064# National Transportation Safety Board, Washington D C Bureau of Technology
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US GENERAL AVIATION, CALENDAR YEAR 1976
8 Mar 1978 202 p
(PB-281330/1 NTSB-ARG-78-1) Avail NTIS HC A10/MF A01 CSCL 01B

The record of aircraft accidents which occurred in U S general aviation operations during the calendar year 1976 is presented It includes an analysis of accident data relating to an overview, types of accidents, accident causal factors kinds of flying, and conclusions A statistical compilation of accident information presented in the form of accident and rate tables analytic tables, injury tables and cause/factor tables was reviewed These statistical data are divided into sections pertaining to all operations, small fixed-wing aircraft large fixed-wing aircraft, rotorcraft gliders and collisions between aircraft There were 4,193 total and 695 fatal general aviation accidents that occurred during 1976 GRA

N78-33065# National Transportation Safety Board Washington D C Bureau of Technology
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US AIR CARRIER OPERATIONS, 1976
5 Jan 1978 91 p
(PB-281329/3, NTSB-ARC-78-1) Avail NTIS HC A05/MF A01 CSCL 01B

The record of aviation accidents in all operations of the U S air carriers for calendar year 1976 is presented It includes an analysis by class of carrier and type of service in which the 1976 performances were compared with 5 year base period averages Scheduled passenger services of the certificated route carriers for the past 5 years (1972 through 1976) were compared with the previous 5 year period (1967 through 1971) for types of accidents and phases of operation Statistical tables which summarize the accidents, fatalities, and accident rates, causal tables, and briefs of accidents are included GRA

N78-33066# National Technical Information Service Springfield Va
BIRD STRIKES AND AVIATION SAFETY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jun. 1978
Guy E Habercom Jr Jul 1978 79 p Supersedes NTIS/PS-77/0606 and NTIS/PS-76/0538
(NTIS/PS-78/0694/6 NTIS/PS-77/0606, NTIS/PS-76/0538) Avail NTIS HC $28 00/MF $28 00 CSCL 01B

Hazards to aircraft created by engine ingestion or airplane interception of birds are investigated in these Government-sponsored research reports Bird damage assessment, structural strengthening, windshield design, and bird tracking and dispersal methods are studied This updated bibliography contains 73 abstracts 11 of which are new entries to the previous edition GRA

N78-33068# Mitre Corp McLean, Va Metrek Div
PARAMETERS OF FUTURE ATC SYSTEMS RELATING TO AIRPORT CAPACITY/DELAY Final Report
Andrew L Haines Jun 1978 26 p refs
(Contract DOT-FA78WA-4075)
(AD-A057059 MTR-7766-Rev-1 FAA-EM-78-8A) Avail NTIS HC A03/MF A01 CSCL 17/7

A series of site specific case studies were conducted to show how to increase airport capacity Estimates of changes in longitudinal spacing on final approach are presented The potential for reducing interarrival errors and runway occupancy time is also discussed The parametric values presented are to be used by the FAA/User Group-Airport-Case Study Teams in assessing the potential impact of airport air traffic control changes on delay capacity B B

N78-33069# National Aviation Facilities Experimental Center Atlantic City N J
VORTEX ADVISORY SYSTEM SIMULATION OF CHICAGO O'HARE AIRPORT Final Report, Mar - Jun 1977
Barry E Keeffe Jul 1978 26 p refs
(AD-A057112, FAA-NA-78-12 FAA-RD-78-76) Avail NTIS HC A03/MF A01 CSCL 17/7

The procedural implications of the Vortex Advisory System (VAS) on the Chicago O Hare terminal air traffic control environment were evaluated and simulated Cost benefits/capacity gains which may accrue using reduced VAS aircraft separation criteria on the final approach course based upon meteorological assurance of vortex dissipation were demonstrated A real time simulation of the Chicago O Hare International Airport airside operations was conducted between March 28 and June 24 1977 There were 105 data runs of 1 hour and 20 minutes duration completed during this period and two favored runway configurations were identified Three vortex clear zones were exercised middle marker to touchdown outer marker to touchdown and 20 nmi fix to touchdown Test results indicate that (1) no procedural implications emerged which would deter the implementation of VAS at Chicago O Hare Airport and (2) arrival rate increases are sufficient to support cost/benefit analysis studies B B

N78-33070# Applied Physics Lab Johns Hopkins Univ Laurel, Md Dept of Fleet Systems
SYSTEM DEFINITION AND INVESTIGATION OF THE ON SITE PROCESSING OF EN ROUTE SENSOR SIGNALS ADDENDUM INVESTIGATION INTO POSSIBLE EN ROUTE ON SITE BEACON RING AROUND DISCRIMINANTS Final Report
J W Thomas Feb 1978 187 p refs Original contains color illustrations
(Contract DOT-FA75WA-3553)
(AD-A056941 FP2-E-034-Add FAA-RD-77-12,4) Avail NTIS HC A09/MF A01 CSCL 17/7

The characteristics existing in beacon reply data that could be used to identify false target reports generated by ring around were studied A specific technique using run length is suggested and evaluated via statistical methods and computer simulation A R H

N78-33071# National Aviation Facilities Experimental Center Atlantic City N J
TRSB MICROWAVE LANDING SYSTEM DEMONSTRATION PROGRAM AT SHIRAZ, IRAN Final Report
Mar 1978 45 p
(AD-A055526, FAA-NA-78-23, FAA-RD-78-23) Avail NTIS HC A03/MF A01 CSCL 17/7

An operational demonstration concerning the Time Reference Scanning Beam (TRSB) was carried out at Shiraz International Airport serving Shiraz Iran Data acquisition and operational demonstration flights were flown with the FAA B-727 aircraft over the period March 3-8 1978 During the flights, a radio telemetry theodolite was used for aircraft space position data Flight profiles included straight-in approaches at various elevation angles Results of the flight tests indicate that the performance of the TRSB Small Community System was within U S design requirements and the ICAO s reduced capability system and full capability system requirements The feasibility of having one TRSB ground system serving two parellel runways by using offset approaches was demonstrated B B

N78-33072# Federal Aviation Administration Washington D C Office of Systems Engineering Management
THE FAA CONCEPT FOR A BEACON COLLISION AVOIDANCE SYSTEM (BCAS) VOLUME 1 EXECUTIVE SUMMARY
E J Koenke, L Kleiman E Lucier L Schuchman and W Thedford Apr 1978 81 p refs
(AD-A056930 FAA-EM-78-5-Vol-1) Avail NTIS HC A05/MF A01 CSCL 01/4

A unique airborne aircraft collision avoidance system concept is presented which assures safe separation from the largest possible percentage of potential collision threats The concept is designed to operate in all airspace as a compatible backup to the present and evolving ATC system and to be acceptable to the pilot and the user community The system concept capitalizes on the aviation community s large existing investment in ATCRBS transponders and on the ground based beacon surveillance system network for the basic sources of the collision avoidance information Author

N78-33073# Federal Aviation Administration, Washington D C Systems Research and Development Service
ENGINEERING AND DEVELOPMENT PROGRAM PLAN DISCRETE ADDRESS BEACON SYSTEM (DABS)
May 1978 42 p
(AD-A057122 FAA-ED-03-1) Avail NTIS HC A03/MF A01 CSCL 17/7

The DABS development program consists of three major phases Phase 1, System Design & Validation Phase 2 Engineering Development and Phase 3 Production Deployment In Phase 1 a single sensor design compatible with ATCRBS, including an integral data link, was realized This effort resulted in developing Engineering Requirements for procurement of three industry built engineering model DABS sensors for further engineering development in Phase 2, the current phase of the program Phase 2 is system oriented focusing on investigations of such problems as multiple sensor coordination, target hand-off, ATC interface and procedures, failure mode operation ATARS operation, etc Primarily the second phase of the DABS development program is addressed since Phase 3 deployment is dependent upon efforts related to the decision to implement DABS and the attendant transition planning L S

N78-33075# Systems Control Inc Palo Alto, Calif
LORAN-C, OMEGA, AND DIFFERENTIAL OMEGA APPLIED TO THE CIVIL AIR NAVIGATION REQUIREMENT OF CONUS, ALASKA, AND OFFSHORE VOLUME 2 ANALYSIS Final Report, Jul 1976 - Dec 1977
W Heine, F G Karkalik and E D McConkey Apr 1978 222 p refs 3 Vol
(Contract DOT-FA75WA-3662)
(AD-A056741, FAA-RD-78-30-2-Vol-2) Avail NTIS HC A10/MF A01 CSCL 17/7

A detailed analysis supporting information contained in the executive summary is presented B B

N78-33085*# Kaman Aerospace Corp Bloomfield Conn
THEORETICAL STUDY OF MULTICYCLIC CONTROL OF A CONTROLLABLE TWIST ROTOR
A Z Lemnios and Frank K Dunn Apr 1976 68 p refs
(Contract NAS2-7738)
(NASA-CR-151959, R-1393) Avail NTIS HC A04/MF A01 CSCL 01C

Analytical studies were performed to ascertain the feasibility of reducing helicopter rotor induced 4/rev vibratory forces by means of multicyclic flap control input on a dual control four bladed rotor system The dual control consisted of a primary inboard pitch horn blade control and a secondary outboard flap control Flap control was put in at frequencies greater than the rotor rotational speed Author

N78-33086*# Lockheed-California Co Burbank
THE COMMON CASE STUDY LOCKHEED DESIGN OF A SUPERSONIC CRUISE VEHICLE Final Report, Jan - Aug 1978
J S Clauss, Jr, A P Hays, and J R Wilson 11 Aug 1978 51 p refs
(Contract NAS1-14625)
(NASA-CR-158935, LR-28705) Avail NTIS HC A04/MF A01 CSCL 01C

The objective was to compare the characteristics of SSTs designed for the same mission by Lockheed McDonnell Douglas, British Aerospace (U K), Aerospatiale (France), and the USSR This comparison was to be used to calibrate parametric design studies of the tradeoff between SST direct operating cost (DOC) and noise levels at the FAR 36 certification points The guidelines for this common case study were to design an aircraft with the following mission payload 23 247 kg (51 250 lbm), range - 7000 km (3780 n mi), and cruise Mach number - 2 2 Field length was constrained to 3505 m (11 500 ft) Other airfield constraints and fuel reserves were also specified but no noise constraints were applied J A M

N78-33037*# Vought Corp Hampton, Va Technical Center
PRELIMINARY DESIGN CHARACTERISTICS OF A SUBSONIC BUSINESS JET CONCEPT EMPLOYING LAMINAR FLOW CONTROL
R V Turriziani W A Lovell J E Price C B Quartero and G F Washburn Sep 1978 48 p refs
(Contract NAS1-13500)
(NASA-CR-158958) Avail NTIS HC A03/MF A01 CSCL 01C

Aircraft configurations were developed with laminar flow control (LFC) and without LFC The LFC configuration had approximately eleven percent less parasite drag and a seven percent increase in the maximum lift-to drag ratio Although these aerodynamic advantages were partially offset by the additional weight of the LFC system the LFC aircraft burned from six to eight percent less fuel for comparable missions For the trans-atlantic design mission with the gross weight fixed, the LFC configuration would carry a greater payload for ten percent fuel per passenger mile G G

N78-33038# Boeing Commercial Airplane Co, Seattle, Wash
WING PLANFORM GEOMETRY EFFECTS ON LARGE SUBSONIC MILITARY TRANSPORT AIRPLANES Final Technical Report, Mar 1976 - Feb 1977
Robert M Klufan and John D Vachal Feb 1978 66 p refs
(Contract F33615-76-C-3035)
(AD-A056124 D6-46317, AFFDL-TR-78-16) Avail NTIS HC A04/MF A01 CSCL 01/3

A Preliminary Design Study of large turbulent flow military transport aircraft has been made The study airplanes were designed to carry a heavy payload (350 000 lb) for a long range (10 000 nmi) The study tasks included Wing geometry/cruise speed optimization of a large cantilever wing military transport airplane Preliminary design and performance evaluation of a strut-braced wing transport airplane, and Structural analyses of large-span cantilever and strut-braced wings of graphite/epoxy sandwich construction (1985 technology) The best cantilever wing planform for minimum takeoff gross weight, and minimum fuel requirements as determined using statistical weight evaluations has a high aspect ratio low sweep low thickness/chord ratio, and a cruise Mach number of 0 76 A near optimum wing planform with greater speed capability (M = 0 78) has an aspect ratio = 12, quarter chord sweep = 20 deg, and thickness/chord ratio of 0 14/0 08 (inboard/outboard) GRA

N78-33039# Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
MECHANIZATION OF BLENDED A SUB N MODE FOR CCV YF-16 M S Thesis
Kenneth R Race Mar 1978 136 p refs
(AD-A056553, AFIT/GAE/AA/78M-16) Avail NTIS HC A07/MF A01 CSCL 01/3

A root locus analysis and computer simulation are used to determine the feasibility of one proposed method of mechanizing the blending of the normal acceleration mode with the basic aircraft response for the CCV YF-16 The root locus analysis predicts the stability and speed of response of the mechanized aircraft The computer simulation confirms these results Comparison is made of the responses of the basic, present CCV, and proposed mechanized YF-16 Author (GRA)

N78-33091# Army Troop Support and Aviation Materiel Readiness Command St Louis Mo
BELL UH-1H RAM/LOG REPORT Final Report, 21 May 1975 - 19 Jun 1976
Apr 1978 380 p
(AD-A057231 TSARCOM-TR-78-4) Avail NTIS HC A17/MF A01 CSCL 01/3

This RAM/LOG report was generated to establish a comprehensive base line for the UH-1H helicopter and to debug the new RAM/LOG data collection system The test used 7 aircraft for a total of 1339 4 flight hours over a period of 463 days Some of the test results are as follows System MTBR (3 62 hrs) Mission Reliability (99), Achieved Availability (95) and total number of parts replaced (455 items) Author (GRA)

N78-33092# Aeronautical Systems Div Wright-Patterson AFB, Ohio
B-1 EMUX AUTOMATED LOGIC DIAGRAMMER DEMONSTRATION PROGRAM Final Report, Jul. 1975 - Sep 1977
Ronald B Berger May 1978 53 p refs
(AD-A056964, ASD-TR-78-17) Avail NTIS HC A04/MF A01 CSCL 01/3

The B-1 aircraft Electrical Multiplex System (EMUX) is a programmable computer network which provides control of aircraft electrical loads, provides automatic electrical load management and provides digital data transfer Boolean (or logic) equations are used to program the system A computer program was developed in-house to demonstrate the feasibility of automatically creating logic diagrams of the Boolean equations directly from the same EMUX computer files used to program the system Program BOLD B-1 One (Logic Diagrammer) the result of this study is documented in this report Author (GRA)

N78-33093# Cortland Line Co N Y
DESIGN AND DEVELOPMENT OF HELICOPTER EXTERNAL CARGO SLING LEGS MADE WITH KEVLAR Final Report
E Scala Jun 1978 27 p refs
(Contract DAAJ02-76-C-0025, DA Proj 1F2-62209-AH76-06)
(AD-A056951, USARTL-TR-78-20) Avail NTIS HC A03/MF A01 CSCL 01/3

Quantitative equations and graphs for torque balanced Kevlar rope constructions have been applied to the preliminary design of sling legs for heavy lift helicopters Fifty one 14 foot sling legs were made and tested to determine minimum break strengths for the 10,000 lb (10K) 25 000 lb (25K) and 40,000 lb (40K) load capacity assemblies Three 10K assemblies using torque balanced Kevlar rope with eye-spliced terminations over No 2 SLIP-THRU thimbles were delivered to USAAMRDL (AVSCOM) for field testing Three 25K and four 40K assemblies made by an alternative torque balanced Kevlar grommet design were also delivered for field testing The four sling legs on each of these 10K assemblies were made using torque balanced Kevlar rope with eye-spliced terminations over No 2 SLIP-THRU thimbles The three 25 K and four 40 K assemblies delivered for field testing were made by an alternative torque balanced Kevlar grommet design No 3 and 4 size thimbles Author (GRA)

N78-33094# Army Test and Evaluation Command Aberdeen Proving Ground, Md
AIRCRAFT DEFOGGING AND DEFROSTING (TRANSPARENT AREA) Final Report
31 May 1978 15 p Supersedes MTP-7-3-522
(AD-A056976, TOP-7-3-522) Avail NTIS HC A02/MF A01 CSCL 01/3

Provides procedures for testing and evaluating aircraft defogging and defrosting equipment The test item may be an integral part of the aircraft environmental control system or a separate system designed to operate independently or in conjunction with the aircraft environmental control system The procedure is to determine if the test item can prevent or eliminate fogging or frosting of the interior and exterior surfaces of aircraft transparent areas in all aircraft operational modes Author (GRA)

N78-33096# Douglas Aircraft Co Inc, Long Beach, Calif
PRIMARY ADHESIVELY BONDED STRUCTURE TECHNOLOGY (PABST). PHASE 1: DETAIL DESIGN Final Report, Sep 1976 - Dec. 1977
Wright-Patterson AFB, Ohio AFFDL Dec 1977 305 p refs
(Contract F33615-75-C-3016, AF Proj 486U)
(AD-A056857, AFFDL-TR-77-135) Avail NTIS HC A14/MF A01 CSCL 01/3

This report covers the design analysis, and trade studies conducted during Phase 2 Detail Design of the Primary Adhesively Bonded Structure Technology (PABST) Program During this Phase, drawings were made and released to Manufacturing for the construction of a 42 foot long test component simulating the forward fuselage of the C-15 airplane The design concept selected at the completion of Phase 1b-Preliminary Design consisted of wide spaced/close spaced internal longerons in the upper fuselage and external longerons in the lower (bilge area) fuselage External loads were developed for both fatigue and ultimate loading conditions in conformance with the military

specifications The external shears and bending moments were matched to the Full Scale Demonstration Component test curves, adjusted for the actual test fixture loading points Internal loads were generated and static, damage tolerance and fatigue analyses were performed on the Full Scale Demonstration Component A spectra was developed based on a statistical analysis of information accumulated from Air Force operations and used for the fatigue and damage tolerance analyses Author (GRA)

N78-33097# Battelle Columbus Labs, Ohio
SYSTEM AVIONICS VALUE ESTIMATION (SAVE): AN AID FOR AVIONICS LOGISTICS-AND-SUPPORT-COST ANALYSES Final Report, 15 Jul. 1976 - 30 Jun. 1977
Thomas R Cork and Joan F Mulcahy Sep 1977 284 p refs
(Contract F33615-76-C-1299)
(AD-A056348, AFAL-TR-77-179) Avail NTIS
HC A13/MF A01 CSCL 01/3

This report documents a research effort to develop an interactive graphics computer system which will allow government cost analysts to exercise five existing logistics and support cost models in an integrated, consistent, and efficient manner GRA

N78-33098# Naval Postgraduate School, Monterey, Calif
A STUDY OF ALTERNATIVES FOR VSTOL COMPUTER SYSTEMS Final Report, Feb. - Dec. 1977
Uno R Kodres, James D Buttinger Richard W Hamming, and Carl R Jones Apr 1978 252 p refs
(AD-A056105 NPS52-78-001) Avail NTIS
HC A12/MF A01 CSCL 01/3

This study assesses the impact of Large Scale Integration on future airborne digital systems, with a focus on the VSTOL systems The study addresses the design implementation testing, servicing and the associated life cycle costs of airborne digital computer systems both the hardware and the programs necessary for successful operation of the system The scope of the study is limited to the computer system not the sensors keyboards, displays and other peripheral equipment The study provides information for decision making on the future course of action, a design philosophy a process analysis methodology, and a life cycle cost analysis method Author (GRA)

N78-33099# Naval Aerospace Medical Research Lab Pensacola Fla
HUMAN FACTORS ENGINEERING FOR HEAD-UP DISPLAYS: A REVIEW OF MILITARY SPECIFICATIONS AND RECOMMENDATIONS FOR RESEARCH Interim Report
Dennis E Egan and James E Goodson Apr 1978 52 p refs
(AD-A056944, NAMRL-Monograph-23) Avail NTIS
HC A04/MF A01 CSCL 01/4

This report is a review of Human Factors literature and military specifications concerning Head-Up Displays (HUDs) The objective is to identify important categories of Human Factors research concerning virtual-image displays These research categories are questions that must be answered before specifications can be written for the optimal design of HUDs The review encompassed an exhaustive list of references available through the Defense Documentation Center (DDC) as well as other pertinent sources not given in the DDC listing Each requirement in the General Specification for Head-Up Displays, MIL-D-81641 (AS) was compared with the available data The data base for requirements and the importance of further research concerning each requirement were qualitatively rated Categories of necessary research were established Human Factors knowledge has not kept pace with the proliferating uses of HUDs and the expansion of HUD technology Consequently, the majority of existing Human Factors specifications for HUDs are based on expert opinion rather than emperical data Several categories of research are required to provide an adequate data base for future specifications, and to understand how specific issues in the design of HUDs affect performance Author (GRA)

N78-33100# IBM Federal Systems Div Owego, N Y
STANDARD MODULAR POWER SUPPLIES FOR AVIONICS Final Report, 15 Apr. 1976 - 15 Feb 1978
Craig D Smith and James F Malia May 1978 106 p
(Contract F33615-76-C-1240)
(AD-A057159, AFAL-TR-78-59) Avail NTIS
HC A06/MF A01 CSCL 10/2

The objective of this effort is to reduce avionic system life cycle cost by developing a set of standard power supply modules for application in Air Force avionics The results of this effort to develop such a set of power supply modules are discussed Included in this report are an examination of avionic power requirements to determine the extent of commonality in terms of output voltage and power level an analysis and evaluation of alternative power supply designs and selection of the optimum approach to meet the defined requirements and extension of these studies to include more equipment items of recent design and definition of other module types that offer cost advantages to the module set proposed and a prototype design, development and construction of a representative sample of the recommended module set and a life cycle cost comparison of the standard vs custom approach GRA

N78-33101* National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
REDUNDANT DISC Patent
William N Barack (GE, Cincinnati) Paul A Domas (GE, Cincinnati) and Stephen W Beekman, inventors (to NASA) (GE, Cincinnati) Issued 27 Jun 1978 7 p Filed 22 Mar 1976 Sponsored by NASA
(NASA-Case-LEW-12496-1, US-Patent-4 097 194, US-Patent-Appl-SN-668971, US-Patent-Class-416-244A, US-Patent-Class-416-214A US-Patent-Class-74-572, US-Patent-Class-29-463) Avail US Patent Office CSCL 21E

A rotatable disc is described that consists of parallel plates tightly joined together for rotation about a hub Each plate is provided with several angularly projecting spaced lands The lands of each plate are interposed in alternating relationship between the lands of the next adjacent plate In this manner, circumferential displacement of adjacent sectors in any one plate is prevented in the event that a crack develops Each plate is redundantly sized so that, in event of structural failure of one plate the remaining plates support a proportionate share of the load of the failed plate The plates are prevented from separating laterally through the inclusion of generally radially extending splines which are inserted to interlock cooperating, circumferentially adjacent lands Official Gazette of the U S Patent Office

N78-33102*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
RESULTS AND STATUS OF THE NASA AIRCRAFT ENGINE EMISSION REDUCTION TECHNOLOGY PROGRAMS
R E Jones, L A Diehl D A Petrash, and J Grobman Oct 1978 53 p refs
(NASA-TM-79009 E-9793) Avail NTIS HC A04/MF A01 CSCL 21E

The results of an aircraft engine emission reduction study are reviewed in detail The capability of combustor concepts to produce significantly lower levels of exhaust emissions than present production combustors was evaluated The development status of each combustor concept is discussed relative to its potential for implementation in aircraft engines Also, the ability of these combustor concepts to achieve proposed NME and NCE EPA standards is discussed B B

N78-33103*# General Electric Co, Cincinnati, Ohio Aircraft Engine Group
BLADE ROW DYNAMIC DIGITAL COMPRESSION PROGRAM. VOLUME 2 J85 CIRCUMFERENTIAL DISTORTION REDISTRIBUTION MODEL, EFFECT OF STATOR CHARACTERISTICS, AND STAGE CHARACTERISTICS SENSITIVITY STUDY
W A Tesch and W G Steenken Jul 1978 76 p refs
(Contract NAS3-18526)
(NASA-CR-134953, R76AEG484-Vol-2) Avail NTIS
HC A04/MF A01 CSCL 21E

The results of dynamic digital blade row compressor model studies of a J85-13 engine are reported The initial portion of the study was concerned with the calculation of the circumferential redistribution effects in the blade-free volumes forward and aft of the compression component Although blade-free redistribution effects were estimated no significant improvement over the parallel-compressor type solution in the prediction of total-

pressure inlet distortion stability limit was obtained for the J85-13 engine Further analysis was directed to identifying the rotor dynamic response to spatial circumferential distortions Inclusion of the rotor dynamic response led to a considerable gain in the ability of the model to match the test data The impact of variable stator loss on the prediction of the stability limit was evaluated An assessment of measurement error on the derivation of the stage characteristics and predicted stability limit of the compressor was also performed Author

N78-33104*# AiResearch Mfg Co , Phoenix, Ariz
POLLUTION REDUCTION TECHNOLOGY PROGRAM FOR SMALL JET AIRCRAFT ENGINES, PHASE 2 Final Report
T W Bruce F G Davis, T E Kuhn, and H C Mongia Sep 1978 187 p refs
(Contract NAS3-20044)
(NASA-CR-159415, AiResearch-21-2817) Avail NTIS HC A09/MF A01 CSCL 21A

A series of iterative combustor pressure rig tests were conducted on two combustor concepts applied to the AiResearch TFE731-2 turbofan engine combustion system for the purpose of optimizing combustor performance and operating characteristics consistant with low emissions The two concepts were an axial air-assisted airblast fuel injection configuration with variable-geometry air swirlers and a staged premix/prevaporization configuration The iterative rig testing and modification sequence on both concepts was intended to provide operational compatibility with the engine and determine one concept for further evaluation in a TFE731-2 engine Author

N78-33105# Environmental Sciences Research Lab Research Triangle Park, N C Emissions Measurement and Characterization Div
NON-EXTRACTIVE ELECTRO-OPTICAL MEASUREMENT OF JET-ENGINE EMISSIONS Final Report, May - Dec 1977
William F Herget Jan 1978 27 p refs
(Contract DOT-FA77WAI-744)
(AD-A056783, FAA-RD-78-10) Avail NTIS HC A03/MF A01 CSCL 21/2

A series of measurements of jet engine emissions were conducted in an airport environment using several infrared gas filter correlation (GFC) instruments and a high resolution Fourier transform infrared (FTIR) spectrometer system The GFC instruments were shown to be suitable for measuring CO concentrations in the general airport environment and across the exhaust of a stationary jet Attempts to determine jet plume rise velocity from the GFC data were unsuccessful The FTIR system was used to make both absorption and emission measurements on single jets and to make long-path absorption measurements in the general airport environment Species observed in the single jet absorption measurements were CO (28 ppm), formaldehyde (1 ppm) ethylene (3 2 ppm), and cumulative hydrocarbons (8 6 ppm hexane equivalent) The instrumentation and the measurement programs are described and recommendations for additional work are given B B

N78-33106# IIT Research Inst Chicago Ill
TURBINE ENGINE PARTICULATE EMISSION CHARACTERIZATION, PHASE 2 Final Report
D L Fenton Oct 1977 103 p refs
(Contract DOT-FA75WA-3722)
(AD-A057370 C6352-17 FAA-RD-77-165) Avail NTIS HC A06/MF A01 CSCL 21/5

A particulate sampling system was designed and fabricated for the collection of exhaust particles emitted by aircraft turbine engines The samples obtained by the sampling system were suitable for the determination of total mass emission rate and characterization of the exhaust particles Two separate samples were necessary - a bulk sample for mass emission rate and a light deposit of particles for individual characterization Operational adjustments and performance evaluations were made utilizing a TF-30 mixed-flow turbojet engine The reliability of the data was established through repeated tests and the collaboration among the different techniques used to characterize the particles Author

N78-33107*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
PERFORMANCE OF A TRANSONIC FAN STAGE DESIGNED FOR A LOW MERIDIONAL VELOCITY RATIO
Royce D Moore, George W Lewis Jr and Walter M Osborn Nov 1978 83 p refs
(NASA-TP-1298, E-8994) Avail NTIS HC A05/MF A01 CSCL 21E

The aerodynamic performance and design parameters of a transonic fan stage are presented The fan stage was designed for a meridional velocity ratio of 0 8 across the tip of the stage a pressure ratio of 1 57, a flow of 29 5 kilograms per second and a tip speed of 426 meters per second Radial surveys were obtained over the stable operating range from 50 to 100 percent of design speed The measured peak efficiency (0 81) of the stage occurred at a pressure ratio of 1 58 and a flow of 28 7 kilograms per second L S

N78-33108*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
DESIGN AND OVERALL PERFORMANCE OF FOUR HIGHLY LOADED, HIGH SPEED INLET STAGES FOR AN ADVANCED HIGH-PRESSURE-RATIO CORE COMPRESSOR
Lonnie Reid and Royce D Moore Oct 1978 122 p refs
(NASA-TP-1337, E-9302) Avail NTIS HC A06/MF A01 CSCL 21E

The detailed design and overall performances of four inlet stages for an advanced core compressor are presented These four stages represent two levels of design total pressure ratio (1 82 and 2 05), two levels of rotor aspect ratio (1 19 and 1 63), and two levels of stator aspect ratio (1 26 and 1 78) The individual stages were tested over the stable operating flow range at 70, 90, and 100 percent of design speeds The performances of the low aspect ratio configurations were substantially better than those of the high aspect ratio configurations The two low aspect ratio configurations achieved peak efficiencies of 0 876 and 0 872 and corresponding stage efficiencies of 0 845 and 0 840 The high aspect ratio configurations achieved peak ratio efficiencies of 0 851 and 0 849 and corresponding stage efficiencies of 0 821 and 0 831 Author

N78-33109*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
DESIGN AND PERFORMANCE OF A 427-METER-PER-SECOND-TIP-SPEED TWO-STAGE FAN HAVING A 2 40 PRESSURE RATIO
Walter S Cunnan William Stevans, and Donald C Urasek Oct 1978 96 p refs
(NASA-TP-1314 E-9005) Avail NTIS HC A05/MF A01 CSCL 21E

The aerodynamic design and the overall and blade-element performances are presented of a 427-meter-per-second-tip-speed two-stage fan designed with axially spaced blade rows to reduce noise transmitted upstream of the fan At design speed the highest recorded adiabatic efficiency was 0 796 at a pressure of 2 30 Peak efficiency was not established at design speed because of a damper failure which terminated testing prematurely The overall efficiencies at 60 and 80 percent of design speed peaked at approximately 0 83 Author

N78-33110*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
DYGABCD A PROGRAM FOR CALCULATING LINEAR A, B, C, AND D MATRICES FROM A NONLINEAR DYNAMIC ENGINE SIMULATION
Lucille C Geyser Sep 1978 203 p refs
(NASA-TP-1295 E-9464) Avail NTIS HC A10/MF A01 CSCL 21E

A digital computer program DYGABCD was developed that generates linearized, dynamic models of simulated turbofan and turbojet engines DYGABCD is based on an earlier computer program DYNGEN that is capable of calculating simulated nonlinear steady-state and transient performance of one- and two-spool turbojet engines or two- and three-spool turbofan engines Most control design techniques require linear system descriptions For multiple-input/multiple-output systems such as turbine engines state space matrix descriptions of the system

are often desirable DYGABCD computes the state space matrices commonly referred to as the A B C, and D matrices required for a linear system description The report discusses the analytical approach and provides a users manual, FORTRAN listings, and a sample case L.S

N78-33111# Naval Postgraduate School, Monterey Calif
STRESS ANALYSIS OF CERAMIC TURBINE BLADES BY FINITE ELEMENT METHOD, PART 1 M S Thesis
Lael Ray Easterling Mar 1978 119 p refs
(AD-A056310 NPS69-78-009) Avail NTIS HC A06/MF A01 CSCL 21/5

The search for more efficient gas turbine engines has led to the proposal for the replacement of metal high temperature components with ceramic components Essential to this effort is the numerical analysis of proposed designs This thesis report describes the model discretization of a proposed blade design, the development of pre- and post-processors for the ADINA finite element code and the initial stress analysis of the modeled blade Author (GRA)

N78-33112 City Univ of New York
A LEARNING CONTROL SYSTEM WITH APPLICATION TO FLIGHT SYSTEMS Ph D Thesis
Solomon Nachmias 1978 221 p
Avail Univ Microfilms Order No 78-16144

The formulation of a learning control system and its utilization as a flight control system for NASA s F-8 Digital Fly-By-Wire (DFBW) research aircraft is presented An artificial plant is also presented in order to illustrate the performance of the learning control system and to compare two different designs based upon two different information acquisition subsystems (1) Liapunov s method and (2) Newton-Raphson method In applying the learning control system to the piloted six-degree-of-freedom simulation of the F-8 aircraft reduced order discrete models were used for the information acquisition subsystem to conform with the real-time constraint Simulation experiments indicate that the learning control system was effective in compensating for parameter variations caused by changes in flight conditions over the entire flight envelope Dissert Abstr

N78-33113*# General Dynamics/Fort Worth Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS PHASE 1 F-111A FLIGHT DATA ANALYSIS. VOLUME 1: SUMMARY OF TECHNICAL APPROACH, RESULTS AND CONCLUSIONS
David B Benepe, Atlee M Cunningham Jr, and W David Dunmyer 1978 188 p refs
(Contract NAS2-7091)
(NASA-CR-152109) Avail NTIS HC A09/MF A01 CSCL 01C

The structural response to aerodynamic buffet during moderate to high-g maneuvers at subsonic and transonic speeds was investigated The investigation is reported in three volumes This volume presents a summary of the investigation with a complete description of the technical approach, description of the aircraft its instrumentation, the data reduction procedures results and conclusion G Y

N78-33114*# *General Dynamics/Fort Worth, Tex*
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS PHASE 1 F-111A FLIGHT DATA ANALYSIS VOLUME 2 PLOTTED POWER SPECTRA
David B Benepe, Atlee M Cunningham, Jr and W David Dunmyer 1978 282 p refs
(Contract NAS2-7091)
(NASA-CR-152110) Avail NTIS HC A13/MF A01 CSCL 01C

Volume 2 of this three volume report is presented This volume presents plotted variations of power spectral density data with frequency for each structural response item for each data sampled and analyzed during the course of the investigation Some of the information contained in Volume 1 are repeated to allow the reader to identify the specific conditions appropriate to each plot presented and to interpret the data G Y

N78-33115*# General Dynamics/Fort Worth, Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS PHASE 2 F-111A FLIGHT DATA ANALYSIS VOLUME 3 TABULATED POWER SPECTRA
David B Benepe, Atlee M Cunningham Jr, and W David Dunmyer 1978 319 p refs
(Contract NAS2-7091)
(NASA-CR-152111) Avail NTIS HC A14/MF A01 CSCL 01C

Volume 3 of this three volume report is presented This volume presents power spectral density in tabular form for the convenience of those who might wish to perform additional analysis Some of the information contained in Volume 1 is again repeated (as in volume 2) in this volume to allow the reader to identify the specific conditions appropriate to each tabular listing and for further analysis G Y

N78-33116*# General Dynamics/Fort Worth, Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS. PHASE 2 F-3A FLIGHT DATA ANALYSIS. VOLUME 1· SUMMARY OF TECHNICAL APPROACH, RESULTS AND CONCLUSIONS
David B Benepe, Atlee M Cunningham, Jr Sam Traylor Jr, and W David Dunmyer 1978 150 p refs
(Contract NAS2-7091)
(NASA-CR-152112) Avail NTIS HC A07/MF A01 CSCL 01C

A detailed investigation of the flight buffeting response of the F-111A was performed in two phases In Phase 1 stochastic analysis techniques were applied to wing and fuselage responses for maneuvers flown at subsonic speeds and wing leading edge sweep of 26 degrees Power spectra and rms values were obtained This report gives results of Phase 2 where the analyses were extended to include maneuvers flown at wing leading edge sweep values of 50 and 75 5 degrees at subsonic and supersonic speeds and the responses examined were expanded to include vertical shear bending moment, and hingeline torque of the left and right horizontal tails Power spectra, response time histories, variations of rms response with angle of attack and effects of wing sweep and Mach number are presented and discussed Some Phase 1 results are given for comparison purposes G Y

N78-33117*# General Dynamics/Fort Worth Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS. PHASE 2: F-111A FLIGHT DATA ANALYSIS. VOLUME 2: PLOTTED POWER SPECTRA
David B Benepe Atlee M Cunningham, Jr, Sam Traylor, Jr, and W David Dunmyer 1978 724 p refs
(Contract NAS2-7091)
(NASA-CR-152113) Avail NTIS HC A99/MF A01 CSCL 10A

Plotted power spectra for all of the flight points examined during the Phase 2 flight data analysis are presented Detailed descriptions of the aircraft, the flight instrumentation and the analysis techniques are given Measured and calculated vibration mode frequencies are also presented to assist in further interpretation of the PSD data G Y

N78-33118*# General Dynamics/Fort Worth, Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS. PHASE 2· F-111A FLIGHT DATA ANALYSIS VOLUME 3 TABULATED POWER SPECTRA
David B Benepe Atlee M Cunningham Jr Sam Traylor, Jr and W David Dunmyer 1978 286 p refs
(Contract NAS2-7091)
(NASA-CR-152114) Avail NTIS HC A13/MF A01 CSCL 01C

Power spectral density (PSD) data for all of the flight points examined during the Phase 2 flight data analysis are presented in tabular form Detailed descriptions of the aircraft, the flight instrumentation and the analysis techniques are given Measured and calculated vibration mode frequencies are also presented to assist in further interpretation of the PSD data G Y

N78-33119# Federal Aviation Administration, Washington D C Systems Research and Development Service
ENGINEERING AND DEVELOPMENT PROGRAM PLAN ADVANCED INTEGRATED FLIGHT SYSTEMS (AIFS)
May 1978 83 p refs
(AD-A056770 FAA-ED-18-3) Avail NTIS HC A05/MF A01 CSCL 01/3

It appears that active controls and digital flight control and avionics will significantly impact transport aircraft technology and therefore FAA must examine the impact of these advances on airworthiness criteria To comply with its charged responsibilities the FAA must stay abreast of technology advancements and establish the necessary safety standards In the areas of active controls technology and digital flight control and avionics, a technology program entitled Advanced Integrated Flight Systems (AIFS) was established to support this responsibility L S

N78-33120# Systems Research Labs Inc , Dayton Ohio
A THEORY FOR LONGITUDINAL SHORT-PERIOD PILOT INDUCED OSCILLATIONS Interim Report, Nov 1975 - Apr 1977
Ralph H Smith Jun 1977 141 p refs
(Contract F33615-77-C-3011)
(AD-A056982, AFFDL-TR-77-57) Avail NTIS HC A07/MF A01 CSCL 05/8

This report presents a theory for longitudinal, short-period pilot-induced oscillations (PIO) The theory explains how the airplane's pitch attitude and normal acceleration modes can couple with pilot dynamics to produce large-amplitude, uncontrollable oscillations The effects of control system dynamics and feel system nonlinearities are encompassed by this theory It is concluded that an airplane s potential for PIO can be determined based entirely on linear systems analysis the prediction of fully-developed PIO frequency and amplitude requires that all significant nonlinearities be considered The theory postulates that PIO can develop either as a result of closed loop control of pitch attitude or from abrupt control or atmospheric inputs of size sufficient to excite a lightly damped dominant, stick-free airplane mode A number of PIO case histories are examined it is shown that these confirm the proposed theory The implications of the theory to flight test and to simulation are discussed A generalized definition for PIO is given which permits distinctions to be made between pilot-vehicle system oscillations due only to attitude control and those due to attitude plus path control modes It is suggested that the theory can be easily extended to the study of lateral-directional PIO A bibliography of PIO source material is included with this report Author (GRA)

N78-33121# Sandia Labs , Albuquerque, N Mex
HYBRID COMPUTER STUDY OF THE SENSITIVITY OF AIRCRAFT DYNAMICS TO AERODYNAMIC CROSS-COUPLING
W H Curry and K J Orlik-Rueckemann (National Aeronautical Establishment, Ottawa) 1978 16 p refs Presented at AGARD Symp on Dynamic Stability Parameters, Athens, 29-31 May 1978
(Contract EY-76-C-04-0789)
(SAND-77-1309C, Conf-780524-1) Avail NTIS HC A02/MF A01

The sensitivity of the predicted motion time histories to aerodynamic cross coupling between the longitudinal and the lateral degrees of freedom was examined A hybrid computer was utilized for the six-degree-of-freedom flight simulations required to evaluate the effects of aerodynamic cross-coupling derivatives Noticeable effects of aerodynamic cross-coupling were recorded in flight simulations of a fighter aircraft at high angle of attack when perturbed from straight and level flight ERA

N78-33122# National Technical Information Service Springfield Va
CLOSED LOOP CONTROL SYSTEMS PART 1 AIRCRAFT A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Mar 1975 - Jul 1978
Guy E Habercom Jr Aug 1978 127 p Supersedes NTIS/PS-77/0800 (NTIS/PS-78/0809/0, NTIS/PS-77/0800) Avail NTIS HC $28 00/MF $28 00 CSCL 01C

Adaptive control and feedback control closed loop systems relative to aircraft flight control are investigated Studies on guidance and control of drones and remotely piloted vehicles are included GRA

N78-33123*# National Aeronautics and Space Administration Langley Research Center Hampton Va
STATIC PRESSURE ORIFICE SYSTEM TESTING AND APPARATUS Patent Application
Randolph F Culotta and Donald L Posey, inventors (to NASA) Filed 17 Aug 1978 14 p
(NASA-Case-LAR-12269-1, US-Patent-Appl-SN-934576) Avail NTIS HC A02/MF A01 CSCL 14B

A method and apparatus for pressure testing the static pressure orifices and associated connections used in wind tunnels is presented A cylindrical module having in one end an open hemispherical calibration pressure chamber separated from and surrounded by an annular vacuum chamber is placed over the orifice of the system to be tested Ports lead from each of the chambers out the other end of the module to tubes connected to a control box consisting of calibration pressure and vacuum supply lines, bleeder valves and gauges The vacuum chamber is evacuated to seat the module and seal off the system The center chamber is pressurized and the control box pressure gauge is monitored for changes which would indicate leaks in the system Comparison against the control box pressure gauge allows for calibration of the orifice system pressure receiving gauge NASA

N78-33124# Air Force Inst of Tech Wright-Patterson AFB Ohio School of Engineering
DEVELOPMENT OF A SYMBOLOGY EXERCISER FOR DISPLAY GENERATION AND ANALYSIS ON THE VISUALLY-COUPLED AIRBORNE SYSTEMS SIMULATOR (VCASS) M S Thesis
Hollace H Warner Mar 1978 170 p refs
(AD-A055464 AFIT/GCS/EE/78-8) Avail NTIS HC A08/MF A01 CSCL 05/9

The Visually-Coupled Airborne Systems Simulator (VCASS) is being developed by the Aerospace Medical Research Laboratory to aid in lowering the cost and increasing the performance of aircraft simulators An important prerequisite for the VCASS display development is a symbology exerciser that will allow the display presentation designer to rapidly and accurately design new display formats to be tested for the VCASS system The Symbology Exerciser development was begun by first doing a requirements analysis to establish the functions of the software The analysis was performed by using a graphical technique which relates the activities and the input output and control data Once the functional requirements were established the data required by a visual display was analyzed in preparation for the software design Finally a structured design technique was applied to produce a software design which has high cohesion and low coupling The design is presented by using structure charts input/output lists and module descriptions Author (GRA)

N78-33125# Prototype Development Associates Inc , Santa Ana Calif
HARDENED REENTRY VEHICLE DEVELOPMENT PROGRAM. EROSION-RESISTANT NOSETIP TECHNOLOGY Final Report, Dec. 1974 - Sep 1978
M M Sherman Jan 1978 239 p refs
(Contract DNA001-75-C-0054)
(AD-A056390 AD-E300253, PDA-TR-1031-90-58, DNA-4507F) Avail NTIS HC A11/MF A01 CSCL 16/3

A series of programs has been conducted to develop erosion-resistant nosetip (ERN) concepts to provide an all-weather flight capability for high-performance reentry vehicles In a previous effort, two ERN designs utilizing monolithic (solid) tungsten subtips were designed for flight tests on Advanced Nosetip Test (A N T) vehicles In the present program, ground tests were conducted in a rocket motor test facility to evaluate the thermal and structural performance of full-scale models of

these flight designs The results of these tests indicated a low probability of survival for monolithic tungsten subtips in ICBM flight environments Therefore, additional studies were performed to develop an improved subtip concept that would be more resistant to thermal stress failures These studies resulted in a segmented construction approach that will reduce the applied thermal stresses to acceptable levels and provide a high probability of survival in flight Two segmented and two monolithic tungsten subtips were then designed, fabricated and tested on HEARTS and FLAME flight test vehicles All four nosetips survived to impact with no evidence of thermostructural failure and with no development of vehicle trim angles-of-attack at low altitudes Additional tests at more severe conditions are required to verify the improvement in thermal stress performance provided by the segmented construction technique GRA

N78-33132# Naval Surface Weapons Center Dahlgren, Va
NONLINEAR ROLLING MOTION ANALYSIS OF A CANARD-CONTROLLED MISSILE CONFIGURATION AT ANGLES OF ATTACK FROM 0 TO 30 DEGREES IN INCOMPRESSIBLE FLOW Final Report
Samuel R Hardy May 1978 68 p refs
(AD-A056695, NSWC/DL-TR-3808) Avail NTIS HC A04/MF A01 CSCL 20/4

Dynamic subsonic wind tunnel test data are presented for four canard-controlled missile configurations at angles of attack from 0 to 30 deg The configurations included three body build-up configurations (canard plus body body plus tail, and canard plus body plus tail) with zero fin deflections A canard plus body plus tail configuration with a 15 deg canard pitch control deflection was also tested Nonlinear static and dynamic roll moment coefficients were extracted from the test data by fitting a differential equation of rolling motion to the test data using a global nonlinear least-squares procedure The results indicated that the equation of motion was adequate to describe the canard-controlled configurations rolling motion Extracted linear roll damping coefficients showed that the roll damping moment is a nonlinear function of angle of attack for all the configurations Roll damping was also found to vary with the missiles roll angle at angles of attack above 20 peg The results for the body build-up configurations show that there is a significant canard/tail interference present on the canard plus body plus tail configuration The canard contribution to the induced roll moment is small The results for the canard plus body plus tail configuration with the 15 deg pitch control deflection on the canards show that the canard deflection generally increases the roll damping moment Author (GRA)

N78-33134*# Lockheed Missiles and Space Co Huntsville Ala Research and Engineering Center
DEVELOPMENT OF BASE PRESSURE SIMILARITY PARAMETERS FOR APPLICATION TO SPACE SHUTTLE LAUNCH VEHICLE POWER-ON AERODYNAMIC TESTING Final Report
Peter R Sulyma and Morris M Penny Sep 1978 156 p refs (Contract NAS8-32658)
(NASA-CR-150826 LMSC-HREC-TR-D568366) Avail NTIS HC A08/MF A01 CSCL 22B

A base pressure data correlation study was conducted to define exhaust plume similarity parameters for use in Space Shuttle power-on launch vehicle aerodynamic test programs Data correlations were performed for single bodies having, respectively, single and triple nozzle configurations and for a triple body configuration with single nozzles on each of the outside bodies Base pressure similarity parameters were found to differ for the single nozzle and triple nozzle configurations However, the correlation parameter for each was found to be a strong function of the nozzle exit momentum Results of the data base evaluation are presented indicating an assessment of all data points Analytical/experimental data comparisons were made for nozzle calibrations and correction factors derived, where indicated for use in nozzle exit plane data calculations L S

N78-33140* National Aeronautics and Space Administration Washington, D C
FROM SPACE ON A PARACHUTE
N Lobanov Oct 1978 9 p Transl into ENGLISH from Aviat Kosmonavt (USSR) no 19, Sep 1978 p 34-35 Transl by Kanner (Leo) Associates, Redwood City, Calif
(Contract NASw-3199)
(NASA-TM-75577) Copyright Avail NTIS HC A02/MF A01 CSCL 22B

Improvements in the landing system of the Soyuz spacecraft are discussed The system of parachutes is designed to guarantee a safe landing The design attempts to cover all possible emergency situations Selection of the landing area and time of ejection is an important aspect of safe descent Author

N78-33142*# Aerojet Liquid Rocket Co, Sacramento, Calif
DUAL THROAT THRUSTER COLD FLOW ANALYSIS Final Report
R B Lundgreen G R Nickerson, and C J OBrien Aug 1978 128 p refs
(Contract NAS8-32666)
(NASA-CR-150822) Avail NTIS HC A07/MF A01 CSCL 21/4

The concept was evaluated with cold flow (nitrogen gas) testing and through analysis for application as a tripropellant engine for single-stage-to-orbit type missions Three modes of operation were tested and analyzed (1) Mode 1 Series Burn, (2) Mode 1 Parallel Burn, and (3) Mode 2 Primary emphasis was placed on the Mode 2 plume attachment aerodynamics and performance The conclusions from the test data analysis are as follows (1) the concept is aerodynamically feasible, (2) the performance loss is as low as 0 5 percent (3) the loss is minimized by an optimum nozzle spacing corresponding to an AF-ATS ratio of about 1 5 or an Le/Rtp ratio of 3 0 for the dual throat hardware tested, requiring only 4% bleed flow, (4) the Mode 1 and Mode 2 geometry requirements are compatible and pose no significant design problems L S

N78-33152*# National Aeronautics and Space Administration Langley Research Center, Hampton Va
IMPACT TESTS ON FIBROUS COMPOSITE SANDWICH STRUCTURES
Marvin D Rhodes Oct 1978 43 p refs
(NASA-TM-78719, L-12455) Avail NTIS HC A03/MF A01 CSCL 11D

The effect of low velocity impact on the strength of laminates fabricated from graphite/epoxy and Kevlar 49/epoxy composite materials was studied The test laminates were loaded statically either in uniaxial tension or compression when impact occurred to evaluate the effect of loading on the initiation of damage and/or failure Typical aircraft service conditions such as runway debris encountered during landing were simulated by impacting 1 27-cm-diameter projectiles normal to the plane of the test laminates at velocities between 5 2 and 48 8 m/s G G

N78-33197# Naval Air Development Center, Warminster, Pa Aircraft and Crew Systems Technology Directorate
GALVANIC CORROSION FATIGUE TESTING OF 7075-T6 ALUMINUM BONDED WITH GRAPHITE-EPOXY COMPOSITE
S R Brown and J J DeLuccia 10 Jan 1978 18 p refs (ZF54590001)
(AD-A055714, NADC-77328-60) Avail NTIS HC A02/MF A01 CSCL 11/6

Galvanic corrosion effects were determined on 7075-T6 aluminum with attached adhesively bonded sections of graphite-epoxy composite material Fatigue tests were conducted on specimens exposed to a sulfur dioxide-salt spray environment in a chamber constructed on a Krouse direct-stress fatigue machine S-N curves were developed under tension-tension conditions (R = 0 1) and with unprotected specimens a 20 percent reduction in fatigue life was attributed to the contacting graphite-epoxy composite material Protective coatings and nonconductive barriers to break the galvanic corrosion circuit were evaluated under the same corrosion fatigue (tension-tension) test conditions Epoxy primer-polyurethane paint systems, polysulfide sealants and glass cloth barriers were used to measure their effectiveness in galvanic corrosion control Metallograph and SEM (Scanning Electron Microscope) observations were made of corrosion sites and fatigue surfaces Author (GRA)

N78-33243# Westinghouse Electric Corp., Crum Lynne, Pa Combustion Turbine Systems Div
CERAMICS TECHNOLOGY READINESS DEVELOPMENT PROGRAM PHASE 1 CONCEPTUAL DESIGNS AND MATERIAL SCREENING Monthly Technical Progress Report, Mar 1978
K L Rieke Apr 1978 24 p ref
(Contract EF-77-C-01-2786)
(FE-2786-12, MTPR-6) Avail NTIS HC A02/MF A01

Critical planning information in the form of ceramic turbine conceptual designs and delivery of ceramic test specimens for DOE initial evaluation of erosion/corrosion capability is presented Results include (1) The Weibull characteristic strength, sigma/sub to/ was developed for NCX-34 H P Si3N4 (2) the simplified method of estimating material uniaxial tensile strength was verified, (3) additional design study was initiated to improve ease of assembly and maintenance of the ceramic blading in the turbine rotor assembly (4) conceptual design arrangments of the use of ceramics for combustor transition ducting were developed to be used in conjection with a catalytic combustor element and (5) concept 3 thermal barrier coating performance calculations for coal-derived liquid fuels were extended from the simple engine cycle to the combined cycle performance ERA

N78-33278# National Technical Information Service, Springfield, Va
CLOSED LOOP CONTROL SYSTEMS. PART 2: MISCELLANEOUS APPLICATIONS A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Jul. 1978
Guy E Habercom, Jr Aug 1978 259 p Supersedes NTIS/PS-77/0801
(NTIS/PS-78/0810/8, NTIS/PS-77/0801) Avail NTIS HC $28 00/MF $28 00 CSCL 16D

Closed loop control systems are investigated relevant to design, application, and performance Such diversified application as gas turbine engine controls, feedback control of spacecraft and missiles, wind tunnel flow control, and feedback control of laser pulses are examined This updated bibliography contains 252 abstracts, 46 of which are new entries to the previous edition GRA

N78-33283*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
AN AIRBORNE METEOROLOGICAL DATA COLLECTION SYSTEM USING SATELLITE RELAY (ASDAR)
James W Bagwell and Bruce G Lindow 1978 17 p ref To be presented at the Intern Telemetering Conf Los Angeles 14-16 Nov 1978 Sponsored by the Instr Soc of America
(NASA-TM-78992, E-9768) Avail NTIS HC A02/MF A01 CSCL 17B

The National Aeronautics and Space Administration (NASA) has developed an airborne data acquisition and communication system for the National Oceanic and Atmospheric Administration (NOAA) This system known as ASDAR the Aircraft to Satellite Data Relay consists of a microprocessor based controller, time clock transmitter and antenna Together they acquire meteorological and position information from existing aircraft systems on B-747 aircraft, convert and format these and transmit them to the ground via the GOES meteorological satellite series The development and application of the ASDAR system is described with emphasis on unique features Performance to date is exceptional, providing horizon-to-horizon coverage of aircraft flights The data collected is of high quality and is considered a valuable addition to the data base from which NOAA generates its weather forecasts Author

N78-33290# National Aviation Facilities Experimental Center Atlantic City, N J
DIGITIZED RADAR DATA COMPRESSOR Final Report, Jan 1974 - Dec 1976
Edwin A Mack and Arthur R Moss Jul 1978 107 p
(AD-A057442 FAA-NA-78-2, FAA-RD-78-48) Avail NTIS HC A06/MF A01 CSCL 17/9

This special-purpose device is designed specifically to increase radar data recording capabilities at air route traffic control centers The DACOMP accomplishes this by compressing the number of channels each radar occupies prior to recording, thereby reducing the number of tape tracks required for each radar The three 2400 bit-per-second channels of a digitized radar are compressed onto one high-speed (9375 bit-per-second) channel Because of the threefold reduction in recording track requirements, DACOMP s will record information from an increased number of radar sites The installation use theory of operation and maintenance of the DACOMP are detailed G G

N78-33311# Ohio State Univ., Columbus Electroscience Lab
NEAR FIELD PATTERN COMPUTATIONS FOR AIRBORNE ANTENNAS Final Report, 15 Mar 1977 - 14 Jun 1978
W D Burnside, Nan Wang, and E L Pelton Jun 1978 47 p refs
(Contract N00019-77-C-0299)
(AD-A057244 ESL-784685-4) Avail NTIS HC A03/MF A01 CSCL 09/5

This report presents the results of a newly formulated analysis for computing patterns of aperture or monopole antennas mounted on the fuselage of aircraft Approximate models of the aircraft structure are employed in conjunction with the Geometrical Theory of Diffraction to obtain the computed fields A major feature of the analysis is that it can accommodate receiver range specifications varying from as close as a wavelength to the aircraft surface to the true far field This feature is especially useful in that computed on-aircraft pattern performance can be compared with measurements taken at any convenient range including the near field Further, after such crucial checks between computations and measurements have been made the numerical solution can be employed to accurately predict the far field performance of the on-aircraft antenna system A general computer code, based on the new analysis has been written The accuracy of the numerical solutions obtainable with the analysis is demonstrated by comparison with numerous model measurements Author (GRA)

N78-33313# Arinc Research Corp., Annapolis Md
DESCRIPTION OF A MODEL FOR EVALUATING OPERATIONAL PERFORMANCE OF COMMUNICATIONS SYSTEM
J E Freedman Jun 1978 119 p refs
(Contract DOT-FA75WA-3686)
(AD-A057199, PUBL-1319-01-4-1775) Avail NTIS HC A06/MF A01 CSCL 17/2

This report documents on aeronautical communications operational performance model developed by ARINC Research Corporation in support of the Federal Aviation Administration's AEROSAT program The model is operationally oriented Its prime purpose is to serve as a tool for examining the impact of such factors as operational communications requirements and aircraft movements on the operational performance obtained by the user of a given communications system The model has a generalized structure and is highly versatile By judicious selection of input parameters it can portray a wide variety of communications issues In addition to providing a basic description of the model elements, this report reviews the background for the model s development describes the technical scope, applications, and capabilities of the model, and presents some test runs Author (GRA)

N78-33330 Oregon State Univ., Corvallis
A STUDY OF THE EFFECT OF THE ROTOR COIL COUPLINGS OF A SYNCHRONOUS MACHINE ON ITS PREDICTED TRANSIENT RESPONSE Ph.D. Thesis
Mohammad Hashem Nehrir 1978 108 p
Avail Univ Microfilms Order No 7811990

Two linearized models of the machine are considered In the first model, the root-locus technique of classical control theory is used as a tool to investigate the effect of mutual inductances on the short-circuit eigenvalues of the general Park model Transfer functions for the short-circuit stator and field current responses are derived in terms of the mutual inductances Numerical examples are presented for two (solid rotor) turbo-generators and one (salient pole) hydrogenerator unit with dampers In the second model, the effect of the rotor coil mutual inductances

on the dynamic behavior of the synchronous machine are investigated for the machine connected to an infinite-bus via a transmission line A numerical example is given for hydrogenerator unit Dissert Abstr

N78-33405*# Gustincic (J J) Consulting Engineer Marina Del Rey, Calif
AN AIRCRAFT RADIOMETER FRONT END, ADDENDUM Final Report
J J Gustincic 1 Aug 1978 19 p Prepared for JPL
(Contracts NAS7-100, JPL-954492)
(NASA-CR-157777 TR080) Avail NTIS HC A02/MF A01 CSCI 14B

A detailed description is given of a completely quasi-optical aircraft radiometer for use at frequencies of 150 GHz and above The radiometer calibration and beam switching is described as well as a reflection isolator utilizing a reciprocating mirror and a quasi-optical local oscillator injection system Receiver applications and performance levels are also given Author

N78-33413# Texas Technological Univ Lubbock Optical Sciences Lab
ELLIPSOMETRIC DETERMINATION OF PROPERTIES OF FILMS ON ROUGH SURFACES SUCH AS ALUMINUM ALLOY AIRCRAFT SKIN Interim Report, 1 Jan. 1976 - 1 Aug 1977
John D Reichert and Janet Shotton Brock 1 Aug 1977 141 p refs
(Grants AF-AFOSR-3278-77, AF-AFOSR-2451-73G)
(AD-A056782 TTCSL-OLT-3, AFOSR-78-1220TR) Avail NTIS HC A07/MF A01 CSCL 14/2

The properties of oxide layers on smooth and rough aluminum surfaces are considered in this study Using ellipsometric techniques, the layer thickness and the four parameters describing the complex indices of refraction for film and substrate are assigned effective values and interrelations are deduced The organizing feature of the work is the use of data trajectories generated by determining the ellipsometric parameters Psi and Delta over and over for samples that were heated between measurements The heating caused increases in the oxide layer thickness so that the data trajectories could be used along side theoretical thickness curves to determine appropriate effective media parameters One of the more interesting results was the representation of rolling grain marks on alclad by an effective complex index of refraction The effective index determined was dependent on the sample orientation Author (GRA)

N78-33442 Purdue Univ, Lafayette, Ind
ANALYSIS OF A HIGH SPEED RING VALVE SYSTEM FOR A SINGLE CYLINDER RECIPROCATING COMPRESSOR Ph D Thesis
Wanchai Pahnichaputt 1977 212 p
Avail Univ Microfilms Order No 78-13100

The theoretical natural frequencies and mode shapes of the free-free valve ring were determined These informations were then used to generate the theoretical natural frequencies and mode shapes of the spring supported ring valve by matching with the spring boundary conditions Mode curves representing the relationship between the natural frequency and spring constant for the various modes of vibration of the spring supported ring valve were also developed An analytical model of a discharge valve system which had a pocket behind the spring supported ring valve was derived The model was obtained in terms of several differential equations The effects of the pocket on the dynamics of the valve were determined by comparing the results from the simulation of the discharge valve system which had a pocket to those of the discharge valve system without a pocket Dissert Abstr

N78-33444*# Kansas Univ Center for Research, Inc, Lawrence
AN INVESTIGATION OF DRAG REDUCTION FOR TRACTOR TRAILER VEHICLES Final Report
Vincent U Muirhead Oct 1978 62 p refs
(Grant NsG-4009)
(NASA-CR-144877, KU-FRL-322-1) Avail NTIS HC A04/MF A01 CSCL 13F

Force and moment data were obtained from a one-twenty-fifth scale wind tunnel model of a cab-over-engine tractor trailer combination The tests define the aerodynamic characteristics of the baseline (unmodified) vehicle and several modified configurations The primary modifications consist of (1) greatly increased forebody corner radii, (2) a smooth fairing over the cab-to-trailer gap, (3) a smoothed underbody, and (4) rear streamlining (boattailing)of the trailer Tests were conducted for yaw angles from 0 deg to 30 deg The reduction in drag, relative to the baseline, obtained by combining the modifications are compared for the zero yaw condition with full scale coast down drag results for similar configurations The drag reductions obtained from the model and full scale tests are in good agreement Author

N78-33478*# General Electric Co, Cincinnati Ohio Aircraft Engine Group
EVALUATION OF CYCLIC BEHAVIOR OF AIRCRAFT TURBINE DISK ALLOYS Final Report, Jun 1976 - 1978
V Shahani and H G Pop Jun 1978 202 p refs
(Contract NAS3-20368)
(NASA-CR-159433) Avail NTIS HC A10/MF A01 CSCL 20K

An evaluation of the cyclic behavior of three aircraft engine turbine disk materials was conducted to compare their relative crack initiation and crack propagation resistance The disk alloys investigated were Inconel 718, hot isostatically pressed and forged powder metallurgy Rene '95, and as-hot-isostatically pressed Rene '95 The objective was to compare the hot isostatically pressed powder metallurgy alloy forms with conventionally processed superalloys as represented by Inconel 718 Cyclic behavior was evaluated at 650 C both under continuously cycling and a fifteen minute tensile hold time cycle to simulate engine conditions Analysis of the test data were made to evaluate the strain range partitioning and energy exhaustion concepts for predicting hold time effects on low cycle fatigue Author

N78-33483# Lockheed-California Co, Burbank
FLAW GROWTH IN COMPLEX STRUCTURE VOLUME 1 TECHNICAL DISCUSSION Final Report, 12 May 1975 - 12 Sep 1977
T R Brussat, S T Chiu and M Creager Dec 1977 309 p refs
(Contract F33615-75-C-3093)
(AD-A056372 LR-28272-Vol-1 AFFDL-TR-77-79-Vol-1) Avail NTIS HC A14/MF A01 CSCL 13/5

Fatigue crack growth testing and analysis were conducted to evaluate the effects of initial flaw location and multiplicity on fatigue crack growth life and element failure sequence in multiple element, mechanically fastened metallic structure The test program, which included 68 precracked structural specimens consisting of 26 joints and 42 stringer-reinforced panels is described in detail Stress intensity factor analyses and stress severity factor equations and the results of baseline static fatigue crack growth and fracture tests are presented for use in making crack growth predictions for the structural specimens Procedures are described for machining precracking assembling and testing the structural specimens The test results and corresponding analytical results are presented and compared GRA

N78-33599# National Technical Information Service Springfield, Va
FUEL CONSUMPTION: TRANSPORTATION, VOLUME 1 A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1976
Audrey S Hundemann Jul 1978 193 p
(NTIS/PS-78/0707/6) Avail NTIS HC $28 00/MF $28 00 CSCL 10A

Fuel consumption by automobiles trucks buses and general aviation aircraft is discussed Topic areas cover the effect of road conditions traffic conditions, and emission controls on fuel economy, projected growth and problems facing air transportation, energy efficiency of various urban transportation modes, energy use forecasts and projections of supply and demand in the transporation sector This updated bibliography contains 187 abstracts GRA

N78-33600# National Technical Information Service Springfield Va
FUEL CONSUMPTION. TRANSPORTATION, VOLUME 2 A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jun. 1978
Audrey S Hundemann Jul 1978 115 p Supersedes NTIS/PS-77/0552
(NTIS/PS-78/0708/4, NTIS/PS-77/0552) Avail NTIS HC $28 00/MF $28 00 CSCL 10A

This updated bibliography contains 109 abstracts dealing with fuel consumption by automobiles, trucks, buses and general aviation aircraft The effect of road conditions, traffic conditions and emission controls on energy efficiency is covered Projected growth and problems facing air transportation and energy use forecasts and projections of supply and demand in the transportation sector are included GRA

N78-33613 George Washington Univ Washington D C
ANNOYANCE DUE TO THE INTERACTION OF COMMUNITY NOISE SOURCES Ph.D Thesis
Clemans Ancelan Powell Jr 1978 289 p
Avail Univ Microfilms Order No 78-15803

The effects of a road traffic noise background on judgments of individual aircraft noise events were studied The results indicate that aircraft noise annoyance was reduced by increased levels of traffic noise Additional experiments were conducted to develop methodology for obtaining annoyance judgments to sessions of noise representative of situations with many aircraft noise events per day and to determine if the total noise energy concept was satisfactory in explaining subjects total annoyance to combined noises These experiments indicated that the total noise energy concept was not satisfactory A model which provides for the summation and inhibition of annoyance for combined noises was developed and subsequently tested with a final experiment good qualitative and quantitative agreement was found Dissert Abstr

N78-33615# MAN-Acoustics and Noise, Inc , Seattle Wash
COMMERCIAL AIRPORT OPERATIONS AND COMMUNITY NOISE CRITERIA Final Report
J E Mabry and B M S Sullivan Mar 1978 76 p refs
(Contract DOT-FA77WAI-723)
(AD-A057451 MAN-1031 FAA-RD-78-36) Avail NTIS HC A05/MF A01 CSCL 20/1

The responses of 48 persons exposed to seven different simulated commercial airport noise environments were examined Each exposure period was of 1 to 11/2 hours duration and subjects experienced and rated eight of these noise exposure periods The test environment simulated a conventional living room environment Conclusions are (1) noise exposure from a newer aircraft fleet mix (circa 1980) is more acceptable than that from an old fleet mix (circa 1965), (2) commonly used noise exposure methods such as NEF Leq, and mean peak dBA are level dependent, (3) depending on the noise exposure method used, 2 5 to 4 0 dB is perceived as a reliable change in noise exposure, (4) predictive capability of a noise exposure method is a function of the engineering calculation procedure employed to weight the acoustic energy, and (5) mean peak level exposure methods have greater predictive capability than energy summation methods S B S

N78-33617*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
QUANTITATIVE MAPPING BY REMOTE SENSING OF AN OCEAN ACID-WASTE DUMP
Craig W Ohlhorst Oct 1978 27 p refs
(NASA-TP-1275 L-11927) Avail NTIS HC A02/MF A01 CSCL 13B

Results from quantitative analysis show that airplane remotely sensed spectral data can be used to quantify and map an acid-waste dump in terms of its particulate iron concentration These same data however could not be used to map the dump in terms of total suspended solids organic suspended solids or inorganic-suspended-solids concentrations A single-variable equation using the ratio of band 2 (440 to 490 nm) radiance to band 4 (540 to 580 nm) radiance was used to quantify the iron concentration in the acid-waste dump The acid waste that was mapped varied in age from freshly dumped to 31/2 hr Particulate iron concentrations in the acid waste were estimated to range up to 1 1 mg/l at a depth of 0 46 m A classification technique was developed to identify pixels in the data set affected by sun glitter Author

N78-33618*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
OZONE CONCENTRATION IN THE CABIN OF A GATES LEARJET MEASURED SIMULTANEOUSLY WITH ATMOSPHERIC OZONE CONCENTRATIONS
Daniel Briehl and Porter J Perkins Oct 1978 20 p refs
(NASA-TP-1340 E-9653) Avail NTIS HC A02/MF A01 CSCL 13B

A Gates Learjet Model 23 was instrumented with monitors to measure simultaneously the atmospheric and the cabin concentrations of ozone at altitudes up to 13 kilometers Six data flights were made in February 1978 Results indicated that only a small amount of the atmospheric ozone is destroyed in the cabin pressurization system Ozone concentrations measured in the cabin near the conditioned-air outlets were only slightly lower than the atmospheric ozone concentration For the two cabin configurations tested, the ozone retention in the cabin was 63 and 41 percent of the atmospheric ozone concentration Maximum cabin ozone concentration measured during these flights was 410 parts per billion by volume Author

N78-33634# National Technical Information Service Springfield Va
URBAN NOISE POLLUTION A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Jul 1978
Edith Kenton Jul 1978 155 p Supersedes NTIS/PS-77/0653, NTIS/PS-76/0585, NTIS/PS-75/544 and NTIS/PS-74/106 (NTIS/PS-78/0686/2 NTIS/PS-77/0653 NTIS/PS-76/0585 NTIS/PS-75/544 NTIS/PS-74/106) Avail NTIS HC $28 00/MF $28 00 CSCL 13B

Aspects of noise in the urban environment are covered The topics were chosen for their interest to urban planners and include citizen attitudes transportation noise, and noise abatement techniques (This updated bibliography contains 152 abstracts, 24 of which are new entries to the previous edition) GRA

N78-33639# National Technical Information Service, Springfield Va
AIRPORT NOISE A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1924 - Jun. 1978
Guy E Habercom, Jr Aug 1978 253 p Supersedes NTIS/PS-77/0704, NTIS/PS-76/0625, NTIS/PS-75/530 (NTIS/PS-78/0807/4 NTIS/PS-77/0704 NTIS/PS-76/0625, NTIS/PS-75/530) Avail NTIS HC $28 00/MF $28 00 CSCL 13B

Aircraft created noise, noise intensity noise exposure, and physiological effects, all in airport environments, are investigated (This updated bibliography contains 246 abstracts, 27 of which are new entries to the previous edition) GRA

N78-33655# National Aviation Facilities Experimental Center Atlantic City N J
TWO LIGHTNING-FLASH COUNTER SYSTEMS Final Report, Dec 1975 - 1976
L William Einbinder Nicholas Mercado, and Robert C Greenwood Jul 1978 43 p refs
(AD-A057369 FAA-NA-77-18 FAA-RD-78-39) Avail NTIS HC A03/MF A01 CSCL 04/1

The battery operated recording instruments were used to determine local ambient lightning-flash activity and to evaluate the usefulness of these devices to air traffic control The first device CIGRE is an acronym for Conference International des Grande Reseaux Electrique The second device RSA-10, is an acronym for Republic of South Africa Data were collected for about 1-year and the resultant information indicates that the RSA-10 and the CIGRE lightning-flash counters are effective devices for determining the presence of lightning usually associated with cumulonimbus clouds G G

N78-33877# North American Weather Consultants, Goleta Calif
INITIAL DEVELOPMENT OF A TACTICAL SYSTEM FOR DISPERSING SUPERCOOLED STRATUS Final Report, Sep. 1976 - Jan. 1978
Chester Wisner John R Thompson and Don A Griffith 27 Jan 1978 127 p refs
(Contract F19628-76-C-0306)
(AD-A056570 AFGL-TR-78-0025, Rept-78-20) Avail NTIS HC A07/MF A01 CSCL 04/2

A silver iodide pyrotechnic seeding system was selected for the development of a tactically useful approach to the dispersal of supercooled stratus Various configurations of the pyrotechnic units were tested for nucleation effectiveness before choosing a 3/4-in diameter unit doped with a small amount of chlorine-bearing compound The system was field tested in northern Michigan in February of 1977 The tests showed the system capable of producing clearings comparable to those of previous studies using dry ice as a seeding agent Clearings were produced in clouds as warm as -8 C and as thick as 4000 feet Targeting the clearings over a predetermined ground location was not especially difficult While VFR flight conditions and good downward visibility were achieved visibility on a slanted line-of-sight was poor Author (GRA)

N78-33692# Oklahoma Univ, Norman Dept of Meteorology
DYNAMICAL MODEL OF GUST FRONT Final Report
Y K Sasaki and Tom Baxter Sep 1977 43 p refs
(Contract DOT-FA76WAI-622, Grant NOAA-04-6-022-44031)
(PB-283425/7, NOAA-78042004) Avail NTIS HC A03/MF A01 CSCL 04B

The dynamics of gust fronts generated by Great Plains thunderstorms were considered from the viewpoint of aviation safety The past and current understanding of the structure and mechanics of gust fronts was thoroughly reviewed and the major problems which are currently obstructing progress were outlined After a technical discussion of several simulation attempts, it is concluded that a well designed three dimensional simulation is required GRA

N78-33776*# National Aeronautics and Space Administration Langley Research Center Hampton Va
ENGINEERING AND SCIENTIFIC DATA MANAGEMENT
1978 255 p refs Proc of Conf held at Hampton, Va, 18-19 May 1978 Sponsored in part by the Inst for Computer Appl in Sci and Eng and the George Washington Univ Joint Inst for Advan of Flight Sci Hampton Va
(NASA-CP-2055 L-12043) Avail NTIS HC A12/MF A01 CSCL 09B

The application of data management systems to engineering and scientific data is described

N78-33778*# Pratt and Whitney Aircraft East Hartford Conn
CAD/CAM DATA MANAGEMENT NEEDS, REQUIREMENTS AND OPTIONS
Richard S Lopatka and Thomas G Johnson *In* NASA Langley Res Center Eng and Sci Data Management 1978 p 25-54 refs
Avail NTIS HC A12/MF A01 CSCL 09B

The requirements for a data management system in support of technical or scientific applications and possible courses of action were reviewed Specific requirements were evolved while working towards higher level integration impacting all phases of the current design process and through examination of commercially marketed systems and related data base research Arguments are proposed for varied approaches in implementing data base systems ranging from no action necessary to immediate procurement of an existing data base management system G G

N78-33780*# Bell Helicopter Co, Fort Worth, Tex
A DATA MANAGEMENT SYSTEM FOR WEIGHT CONTROL AND DESIGN-TO-COST
Jerry C Bryant *In* NASA Langley Res Center Eng and Sci Data Management 1978 p 65-84

Avail NTIS HC A12/MF A01 CSCL 09B

The definition of the mass properties data of aircraft changed on a daily basis as do design details of the aircraft This dynamic nature of the definition has generally encouraged those responsible for the data to update the data on a weekly or monthly basis The by-product of these infrequent updates was the requirement of manual records to maintain daily activity The development of WAVES changed the approach to management of mass properties data WAVES has given the ability to update the data on a daily basis thereby eliminating the need for manual records WAVES has demonstrated that a software product can support a data management system for engineering data G G

N78-33785*# Boeing Computer Services Inc Seattle Wash
RIM A PROTOTYPE FOR A RELATIONAL INFORMATION MANAGEMENT SYSTEM
Dennis L Comfort and Wayne J Erikson *In* NASA Langley Res Center Eng and Sci Data Management 1978 p 183-196

Avail NTIS HC A12/MF A01 CSCL 09B

An overview of the relational information management (RIM) system is provided RIM is a prototype data management system for the Aerospace Vehicle design (IPAD) project G G

N78-33873*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
COMPARISON OF LOW-FREQUENCY NOISE LEVELS OF THE CONCORDE SUPERSONIC TRANSPORT WITH OTHER COMMERCIAL SERVICE AIRPLANES
Clemans A Powell and David A McCurdy Oct 1978 48 p refs
(NASA-TM-78736, L-12210) Avail NTIS HC A03/MF A01 CSCL 20A

Fifty-two airplane noise recordings made at several locations around Dulles International Airport, were analyzed to compare the low-frequency noise levels of the Concorde supersonic transport with those of other commercial jet airplanes Comparisons of the relative low-frequency noise levels which were produced at close and distant locations for departures and arrivals were made for three noise measures the sound pressure level in the 1/3 octave band centered at 20 Hz the total sound pressure level in the 1/3 octave bands with center frequencies less than or equal to 125 Hz, and the total sound pressure level in the 1/3 octave bands with center frequencies less than or equal to 500 Hz Although the absolute noise levels for Concorde were found, in general to be higher than those for the other airplane types the level of low-frequency noise of the Concorde relative to the perceived noise level (PNL) effective perceived noise level (EPNL), and overall sound pressure level (OASPL) was within the range established by the other airplane types, except for the arrival operations of four-engine narrow-body airplanes The measure OASPL was found to be a significantly better predictor of low-frequency noise level than PNL or EPNL Author

N78-33874*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
NOISE-INDUCED BUILDING VIBRATIONS CAUSED BY CONCORDE AND CONVENTIONAL AIRCRAFT OPERATIONS AT DULLES AND KENNEDY INTERNATIONAL AIRPORTS Final Report
W H Mayes, D G Stephens H K Holmes, R B Lewis, B G Holliday, D W Ward, R DeLoach J M Cawthorn, T D Finley J W Lynch et al Aug 1978 18 p refs Original contains color illustrations
(NASA-TM-78769) Avail NTIS HC A02/MF A01 CSCL 20A

Outdoor and indoor noise levels resulting from aircraft flyovers and certain nonaircraft events were recorded, as were the associated vibration levels in the walls, windows and floors at building test sites In addition, limited subjective tests were conducted to examine the human detection and annoyance thresholds for building vibration and rattle caused by aircraft noise Representative peak levels of aircraft noise-induced building vibrations are reported and comparisons are made with structural damage criteria and with vibration levels induced by common

domestic events In addition, results of a pilot study are reported which indicate the human detection threshold for noise-induced floor vibrations G G

N78-33876*# Nielsen Engineering and Research Inc , Mountain View Calif

PROPAGATION OF SOUND THROUGH A SHEARED FLOW Final Report, 30 Aug. 1976 - 1 Jul. 1977

James P Woolley, Charles A Smith, and Krishnamurty Karamcheti Aug 1978 83 p refs

(Contract NAS2-9357)

(NASA-CR-152196, NEAR-TR-171) Avail NTIS HC A05/MF A01 CSCL 20A

Sound generated in a moving fluid must propagate through a shear layer in order to be measured by a fixed instrument These propagation effects were evaluated for noise sources typically associated with single and co-flowing subsonic jets and for subcritical flow over airfoils in such jets The techniques for describing acoustic propagation fall into two categories geometric acoustics and wave acoustics Geometric acoustics is most convenient and accurate for high frequency sound In the frequency range of interest to the present study (greater than 150 Hz), the geometric acoustics approach was determined to be most useful and practical G G

N78-33918# National Technical Information Service, Springfield, Va

FIBER OPTICS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun 1975 - Jul 1977

Mona F Smith Jul 1978 269 p

(NTIS/PS-78/0713/4) Avail NTIS HC $28 00/MF $28 00 CSCL 20F

This updated bibliography contains 263 abstracts The citations cover Federally-funded research on theory, fabrication properties and testing of fiber optical materials In addition, studies on fiber optical cables, connectors, waveguides, couplers, and other fiber optical system components are presented The uses of fiber optics in data transmission systems, optical communications, signal processing, display systems integrated optical circuits, measuring instruments detectors, avionics fire control systems, recording systems, and underwater communications are included GRA

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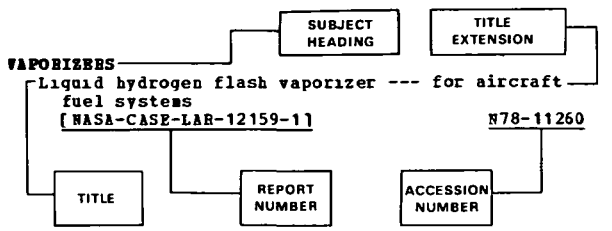

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A

B

C

D

E

F

G

H

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

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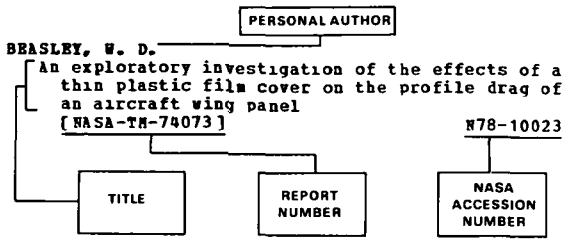

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A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

T

U

V

W

Y

Z

CONTRACT NUMBER INDEX

Typical Contract Number Index Listing

Listings in this index are arranged alphanumerically by contract number Under each contract number the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the *IAA* accession numbers appearing first The accession number denotes the number by which the citation is identified in either the *IAA* or *STAR* section

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AERONAUTICAL ENGINEERING A Continuing Bibliography (Supplement 104)	January 1979
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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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17 Key Words (Suggested by Author(s))	18 Distribution Statement
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NASA-Langley, 1979

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