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AERONAUTICAL ENGINEERING

A SPECIAL BIBLIOGRAPHY WITH INDEXES

Supplement 91

JANUARY 1978

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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NASA SP-7037 (91)

AERONAUTICAL ENGINEERING

A Special Bibliography

Supplement 91

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 1977 in

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

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This supplement to *Aeronautical Engineering -- A Special Bibliography* (NASA SP-7037) lists 359 reports, journal articles, and other documents originally announced in December 1977 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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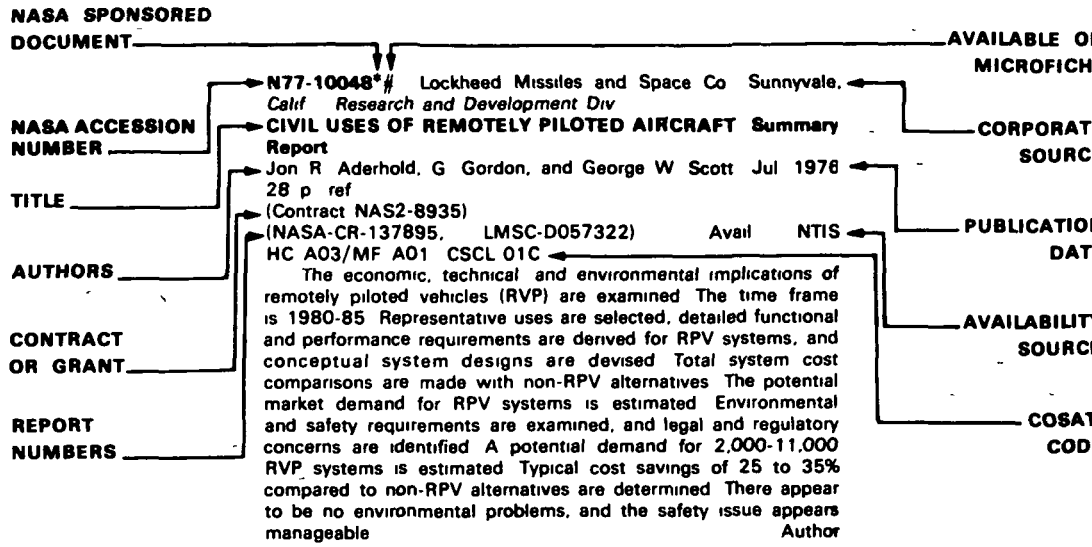

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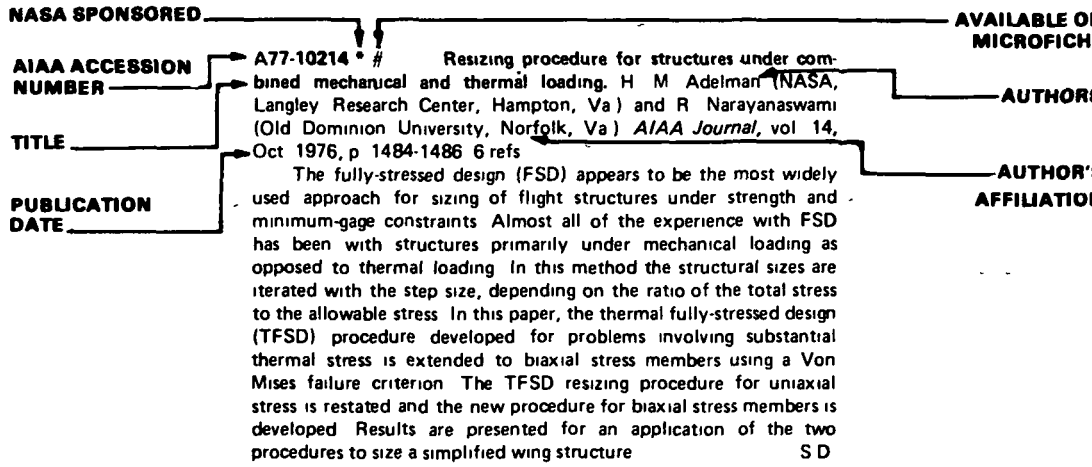

AERONAUTICAL ENGINEERING

A Special Bibliography (Suppl. 91)

JANUARY 1978

IAA ENTRIES

A77-47979 **The new airport radar systems** L Kroll (Bundesanstalt fur Flugsicherung, Frankfurt am Main, West Germany) *Airport Forum*, vol 7, Aug 1977, p 109, 110, 113 (9 ff) In English and German

The design of airport radar systems is discussed, and the characteristics of commercially available transmitters, antennae and receivers are assessed Features of automated aircraft detection and tracking systems, such as digital moving target indication, crystal-controlled frequency generation, frequency diversity operation, multiple stacking and dual beam antennae, are described Fully coherent radar systems giving very good subclutter visibility, as well as systems working with L and C-bands, are considered Advanced concepts of airport radar design under development, including antennae with adaptive controls, clutter-controlled signal processing techniques, multiple excitation antennae, and variable combination reception beams, are also mentioned J M B

A77-47980 **Reducing walking distances at existing air ports** J P Braaksma (Carleton University, Ottawa, Canada) *Airport Forum*, vol 7, Aug 1977 p 135 138, 141, 142 In English and German National Research Council of Canada Grant No A 8927

Appropriate gate allocation to shorten walking distances for passengers at airport terminals is proposed, with the emphasis on making the most effective use of existing facilities An analysis of gate allocation procedures at a terminal of the Toronto, Canada International Airport over a period of several years was performed, various categories of passenger flow, such as arriving, departing, domestic, foreign and transferring were studied It was found that the average walking distance for passengers could be reduced by as much as 57% through effective management of gate scheduling Maximum walking distances established by the reference manual of the International Air Transport Association are also discussed J M B

A77-47999 **Detail design aspects of a helicopter transmission system** V A B Rogers In Detail design, Proceedings of the Conference, Keele, Staffs , England, April 3, 4, 1975 London and New York, Mechanical Engineering Publications, Ltd , Institution of Mechanical Engineers, 1976, p 55-57

The introduction outlines the various components that make up a helicopter transmission, tracing the path of power from the engines to main and tail rotors and describing briefly the task of each member A brief description is given of the dynamic issues that have to be considered leading to a summary of the major dynamic forces imposed on those members The main text selects for detailed description, various mechanical components which, whilst not peculiar to helicopter design, are less common in other fields of mechanical engineering, (e g , The Main Free-wheels, Shafts, Couplings and Tail Shaft Disconnect Coupling) The design parameters necessary for successful operation are considered together with results from Development Tests (Problems encountered together with solutions are also given) Finally, in a more general manner, the steps taken to ensure maximum life and reliability of the components is outlined (Author)

A77 48000 **Detail design in aircraft** S J Swadling (British Aircraft Corp , Ltd , Filton, Bristol, England) In Detail design, Proceedings of the Conference, Keele, Staffs , England, April 3, 4, 1975 London and New York, Mechanical Engineering Publications, Ltd , Institution of Mechanical Engineers, 1976, p 63 72

An examination is conducted of some of the problems encountered in the structural areas of design The characteristics of the problems and the approaches adopted to solve them are illustrated with the aid of examples related to the design of the engine air intakes of Concorde Attention is given to design guides, ground rules, design loadings, design allowables and design factors, the forward sidewall assembly, the forward bottom corner, the frame corner problem, the joint between forward and aft structures, a typical frame, and the sidewall link assembly G R

A77-48001 **Some detail design problems in aircraft gas turbines** L Haworth In Detail design, Proceedings of the Con ference, Keele, Staffs , England, April 3, 4, 1975 London and New York, Mechanical Engineering Publications, Ltd , Institution of Mechanical Engineers, 1976, p 86-93

Approaches used in detail design procedures to improve the life of a component in aircraft gas turbines are illustrated with the aid of four examples In the case of problems associated with thermal expansion, an oval bolt which permits free relative expansion of the flanges without loss of accuracy of location was employed In another example difficulties in connection with an apparently simple stud were experienced and had to be overcome by various means Attention is also given to problems related to the introduction of the long root turbine blade and difficulties concerning a turbine shaft assembly G R

A77-48054 # **Heat transfer at the critical point of a cylinder during intensive blowing (Teploobmen v kriticheskoi tochke tsilindra pri intensivnom vduve)** B N Baskarev, V P Motulevich, and E D Sergievskii (Gosudarstvennyi Nauchno Issledovatel'skii Energeticheskii Institut, Moscow, USSR) *Inzhenerno-Fizicheskii Zhurnal*, vol 33, July 1977, p 5-10 8 refs In Russian

Heat transfer at the frontal critical point of a porous cylinder in transverse flow with intensive blowing of helium, nitrogen, and carbon dioxide gas was investigated Experiments were conducted in a subsonic wind tunnel with the application of thermoanemometric and interferometric methods in the following parameter range freestream velocity = 2 65 6 75 m/sec (Re = 3,00 7,500), tempera ture = 400 500 K, and blowing intensity F = 0-0 48 Agreement with calculated values of heat transfer was satisfactory in the moderate blowing range Under strong blowing of nitrogen and carbon dioxide there occurred loss of stability of laminar flow in the frontal region and some increase in heat transfer P T H

A77-48174 **The effect of drop size on emissions from the primary zone of a gas turbine type combustor** R W Anderson, P B Patil, J Chin, J A Nicholls, W Mirsky, and V Lyons (Michigan

University, Ann Arbor, Mich) In Symposium on Combustion (International), 16th, Cambridge, Mass , August 15-20, 1976, Proceedings Pittsburgh, Pa , Combustion Institute, 1977, p 265-274, Comments, p 274, 275 8 refs U S Environmental Protection Agency Grant No R-802925

An experimental gas turbine combustor designed to permit independent controlled variation of fuel droplet size, local equivalence ratio, inlet air temperature, combustor pressure, residence time and recirculation is used to study the processes of liquid fuel combustion and pollutant generation The combustor is capable of producing a stable flame without a physical flame holder, allowing for a more accurate approximation of actual combustion processes A variety of mean fuel droplet diameters and primary zone equivalence ratios were employed in obtaining pollutant emission samples In general, it is found that as droplet size increases, the level of unburned hydrocarbons and the mean value of NO concentrations decrease, while the CO level at the point of sampling increases An analysis of droplet sizes in the fuel atomization is also given J M B

A77-48181 Aerodynamic and thermodynamic characteristics of kerosene-spray flames E E Khalil and J H Whitelaw (Imperial College of Science and Technology, London, England) In Symposium on Combustion (International), 16th, Cambridge, Mass , August 15-20, 1976, Proceedings Pittsburgh, Pa , Combustion Institute, 1977, p 569-575, Comments, p 576 17 refs Research supported by the Atomic Energy Research Establishment

Experiments measuring velocity, turbulence, mean and fluctuating temperatures and droplet concentration in vertical kerosene spray flames burning in the atmosphere were conducted with the aim of testing numerical methods that employ models for droplet combustion to describe gaseous flames Velocity, turbulence intensity and droplet concentration readings were obtained with a laser anemometer operating in forward scatter, mean and fluctuating temperatures were obtained with platinum rhodium thermocouple wires Results suggest that a significant shortening of the flame length occurs as the droplet size is decreased from a Sauter mean diameter of 100 microns to 45 microns The calculated values for the length of a gaseous flame do not appear to provide good approximations for this behavior J M B

A77-48240 * Direct-connect tests of hydrogen-fueled supersonic combustors P J Waltrup, G L Dugger, F S Billig, and R C Orth (Johns Hopkins University, Laurel, Md) In Symposium on Combustion (International), 16th, Cambridge, Mass , August 15-20, 1976, Proceedings Pittsburgh, Pa , Combustion Institute, 1977, p 1619-1629 8 refs NASA-supported research

Direct-connect tests of hydrogen-fueled supersonic combustors were performed using arc-heated air at combustor inlet Mach numbers of 2 9 to 3 2 Various axisymmetric combustor geometries of 5 89 and 6 96 cm (inner diameter) inlet were investigated, the fuel was injected from the wall either from a ring of equally spaced holes normal to the air stream, or from a circumferential slot oriented 45 deg downstream The hole-type injectors consistently gave better results The effects of various parameters are examined, and the performance comparison procedure is described A theoretical model of the supersonic combustion process which includes a pre combustion shock-compression is used to explain the character of the observed pressure distributions and to assess the effects of the measured heat transfer rates, deduced wall shear, and combustor geometry on performance M L

A77-48241 Combustion considerations for future jet fuels W S Blazowski (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio) In Symposium on Combustion (International), 16th, Cambridge, Mass , August 15-20, 1976, Proceedings Pittsburgh, Pa , Combustion Institute, 1977, p 1631-1638, Comments, p 1638, 1639 14 refs

The effects of fuel hydrogen and nitrogen content have been studied using a T56 combustor rig Increases of combustor liner temperature with decreased fuel hydrogen content were found to be substantial A new nondimensional temperature parameter which provides a means of correlating results for combustors having rich primary zones designs is presented Limited data for new low-smoke lean designs indicate much less sensitivity of combustor liner temperature to fuel hydrogen content Although smoke emission increased with decreased hydrogen content, gaseous exhaust emissions were unchanged The conversion of fuel bound nitrogen to NOx under practical aircraft combustion conditions is described, and recommendations for alternate jet fuel combustion efforts are summarized M L

A77-48252 New air traffic control communications and data systems (Neue FS-Kommunikations- und Datensysteme) G D Priewe (Luft- und Raumfahrttechnik, Berlin, West Germany) *Nachrichten Elektronik,* vol 31, Aug 1977, p 222-224 In German

Suitable display units for air traffic control operations are examined, taking into account a device developed by a German company for air traffic-control applications in the 1980s The modular display unit considered has the capability to collect, process, and display synthetic radar image data Attention is given to the general requirements which have to be satisfied by a display unit employed in air traffic control operations, the configuration and function of the display system, the control section as central unit of the display device, the characteristics of the employed minicomputer, and the properties of suitable devices for a display in color G R

A77-48289 # Non-equilibrium flow of an inviscid gas past a thin profile D Homentcovschi (Bucuresti, Institutul Politehnic, Bucharest, Rumania) *Zeitschrift fur angewandte Mathematik und Mechanik,* vol 57, Aug 1977, p 461-469 7 refs

This paper considers the steady and linearized motion of a non-equilibrium inviscid gas past a thin profile The form in distributions of the equations of the aerodynamics is used For the symmetrical profile the problem is completely solved For the case of the profile without thickness the problem calls for a separate consideration of the completely subsonic, intermediate and completely supersonic regimes respectively In the first two cases the determination of the function n(x) reduces to the resolution of a Fredholm type regular integral equation of the second species The paper gives the asymptotic solution of the problem for high values of relaxation time For the case of the completely supersonic regime the problem is solved to the end The motion of a fluid over a wall is also analysed (Author)

A77-48290 # The role of the boundary layer in supersonic pressure perturbations along a weak wavy wall (Das Druckstorungsfeld im Uberschall langs einer schwach welligen Wand unter Berucksichtigung der Grenzschicht) H. W Stock (Dornier GmbH, Friedrichshafen, West Germany) *Zeitschrift fur angewandte Mathematik und Mechanik,* vol 57, Aug 1977, p 471-476 10 refs In German

Pressure perturbations, generated by a wavy wall in supersonic flow, are calculated by the linearized small perturbation theory including boundary layer effects The boundary layer is divided in an inviscid, rotational outer layer and a viscous sublayer Laminar and turbulent boundary layers are investigated The pressure perturbations, i e , their amplitude and phase position, are related to those evaluated by the inviscid theory It is shown that the influence of the boundary layer can be neglected, if the wavelength of the wavy wall *is much larger than the boundary layer thickness For smaller* wavelengths the boundary layer has a damping effect on the outer flow, i e., the amplitudes of the pressure perturbations are smaller than those for the inviscid case Especially for laminar boundary layers and smaller wavelengths of the wavy wall the pressure perturbations close to the wall exhibit a subsonic character, although the outer flow is supersonic (Author)

A77-48362 # L-band antenna for aircraft-to-satellite communications E Hormann, D Lovis, and R Reitzig (Siemens AG,

Munich, West Germany) In European Microwave Conference, 6th, Rome, Italy, September 14-17, 1976, Proceedings Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd , 1976, p 288 291

An L-band aircraft transmit/receive antenna for the future Aerosat system is proposed It consists of two identical phase-scanned four-spiral antenna arrays mounted laterally on either side of the upper area of the aircraft body The fan-beam is pointed in 10 different angular directions such as to satisfy the 4 dBi minimum gain coverage in the field-of-view 10 deg above horizon The antenna mounts flush with the skin cutout between two stringers and frames in aircraft with transoceanic capability The coverage performance of the antenna is demonstrated theoretically and experimentally (Author)

A77-48377 # **Surface roughness measurements by using low-resolution FM-CW radar altimeters** S R J Axelsson (Saab-Scania AB, Linkoping, Sweden) In European Microwave Conference, 6th, Rome, Italy, September 14-17, 1976, Proceedings Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd , 1976, p 389-393 6 refs Research supported by the Svenska Rymdaktiebolaget

When a radar altimeter is used over a rough ground surface, a noise component is added to the output signal The mean deviation of the noise mainly depends on the range spread of the reflectors located within the antenna beam. The close relationship between noise and range spread can be used to estimate the height of surface roughnesses by low-resolution radar altimetry Experimental results compare favorably with theoretical predictions (Author)

A77-48378 # **A method to reduce the need for large antennas in Microwave Landing Systems /MLS/** B Forssell (ELAB, Trondheim, Norway) In European Microwave Conference, 6th, Rome, Italy, September 14 17, 1976, Proceedings Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd , 1976, p 394-398

The replacement of the present Instrument Landing System (ILS) by the new Microwave Landing System (MLS) which is supposed to begin about 1980 is caused by increasing requirements for capacity, accuracy and coverage which ILS cannot meet A method to obtain good performance with relatively small antennas is to utilize a larger bandwidth for the transfer of signals as space and frequency are interrelated quantities The transmitted signals are then modulated with a frequency much higher than the information bandwidth and demodulated in the receiver In this way, a compressed pulse (for pulsed signals) or an efficient delay discrimination (for continuous signals) can be obtained by means of a correlating receiver By exploiting the whole frequency band allocated for MLS use at C-band, the angle measurement accuracy can be improved as much as 20-80 times (Author)

A77-48411 **Civil and military air traffic in France Management and compatibility** J R Bauchet (EUROCONTROL, Nord Regional Centre, Bretigny-sur-Orge, Essonne, France) *Eurocontrol,* Mar 1977, p 3-9 Translation

The French system of air traffic classification is described with regard to general air traffic (such as public transportation) and operational air traffic (such as military aircraft), and the co ordination between the respective controllers Attention is given to dialogue procedures between civil and military controllers via a computer system known as STRIDA-CAUTRA, handling flight plan information, radar data, and flight identification data for the purpose of determining control clearances S C S

A77-48412 **The transfer of the German North MATRAC to the EUROCONTROL Centre of Maastricht** M A Woods (EUROCONTROL, Computers, Programming and Processing Div , Brussels, Belgium) *Eurocontrol,* Mar 1977, p 10-19

The German North Military Air Traffic Radar Control Centre (MATRAC) was transferred to the Maastricht Centre in 1975 in order to increase the capacity and flexibility of air traffic services The operational concept is outlined with regard to the area of responsibility, airspace structure, and method of control and sectorization Principal components of MATRAC procedures, hard ware, and software are described including radio telephone inter communication systems, the main computer complex, the peripheral computer complex, operator input and display subsystem, processing systems, and civil-military coordination S C S

A77 48413 **EUROCONTROL and radar** E Morgan (EUROCONTROL Radar and Data Handling Div , Brussels, Bel gium) *Eurocontrol,* Mar 1977 p 20 28 14 refs

EUROCONTROL has implemented radar systems for automated air traffic control in Maastricht, Netherlands, Shannon, Ireland, and Karlsruhe Federal Republic of Germany The primary elements of the radar chains are described including (1) radar data display, such as the operator input device and display system, (2) the radar data processing system consisting of reception, processing, and trans mission and (3) the data acquisition system, with primary and secondary surveillance radar heads, and digital extractor and data transmission systems Equipment and procedures are being devised for the evaluation of the radar chain in terms of continuity of radar positional information, information accuracy monitoring, and control of unwanted and/or confusing information Studies for the future development of radar technology include the implementation of radar automatic failure and alignment detectors, and the ap plication of color to the display system S C S

A77 48414 **Aircraft trajectories from radar extrapolations to long term prediction** A Benoit, S Swierstra (EUROCONTROL, Navigation Systems Div , Brussels, Belgium), and J Storey (EURO CONTROL, Programming and Analysis Div , Bretigny sur Orge, Essonne, France) *Eurocontrol,* Mar 1977, p 29 41

Methods are proposed for predicting aircraft trajectory using radar extrapolations and making the results available to the control function The primary stages are (1) utilization of available control centre data and radar information, (2) introduction of additional data without the need for additional on line communications, and (3) generation and/or collection of data not available to the control for transfer to the computer trajectory module, forming a long term trajectory prediction system for the purpose of traffic management An accuracy analysis has been conducted on a test sample of thirteen commonly used aircraft to determine degree of prediction error, to compare the three methods proposed, and to evaluate the limitation of radar extrapolation Applications have been made to a series of actual flights for trajectory prediction, techniques for prediction method monitoring and updating have been derived, and areas for future research have been identified S C S

A77 48415 **Air traffic control and the initial operation of supersonic transport aircraft A review of preparatory measures** H Schmid (EUROCONTROL, Operational and Requirements Div , Brussels, Belgium) *Eurocontrol,* Mar 1977, p 42 45

A77-48416 **Austria's role in international civil aviation** M Halbmayer (Ministry of Transport, Vienna, Austria) *Eurocontrol,* Mar 1977, p 46-53 Translation

The history of the Austrian civil aviation industry is discussed with reference to (1) the development of the industry both before and after the First World War, (2) air transport, including the establishment of the Osterreichische Luftverkehrs AG, (3) airports and air traffic control prior to 1938, (4) the beginning of the Austrian Airlines, and (5) current studies for partial restructuring and automation of air traffic control, and the development of a modern airspace surveillance system S C S

A77-48474 **Rationalization of the European air net** S Gordon (Simat, Helliesen and Eichner, Inc , Newton Centre, Mass) and R de Neufville (MIT, Cambridge, Mass) *Transportation Research,* vol 11, Aug 1977, p 235 244 30 refs Research supported by the University of California and Massachusetts Institute

of Technology, U S Department of Transportation Grant No OS-5023947

This paper investigates the question of whether it might be possible to rationalize, that is to increase the quality of service for a given cost, the airline network within Europe Various policy analysts have suggested that significant benefits might be achieved along these lines if the Common Market were to reduce the bilateral restrictions on European airlines Our conclusion is that this is not the case A main interest of this paper should be the approaches we propose for analyzing transport nets First, we argue that, when one considers the multidimensional output of scheduled service, we should recognize that economies of scale do exist even for transport modes which are ordinarily not thought to have this characteristic This provides an important motivation for concentration of services, as does in fact exist Second, we propose a measure of network connectivity which takes into account the intensity of connections between the nodes This measure permits a much more precise discussion of the nature of any transportation network (Author)

A77-48480 Space-based solar power study near completion B M Elson *Aviation Week and Space Technology,* vol 107, Sept 19, 1977, p 58, 59, 62-65, 68, 69

The concept of solar power systems is discussed with regard to potential energy conversion schemes Two such systems have been found to be equally effective for the project (1) photovoltaic devices (solar cells) which would convert sunlight directly into electricity by means of solar cell arrays scaled at about 100 sq km for a 10 GW output at the busbars on the ground, and (2) thermal engines (two versions of which are feasible at the present time, the closed Brayton cycle using helium as the working fluid, and the potassium vapor Rankine cycle) which would convert sunlight into electricity via turbomachinery rather than solar cells Satellite construction techniques, cost evaluation, and flight experimentation are reviewed S C S

A77-48513 # The aerodynamic noise of gliders (Issledovanie aerodinamicheskogo shuma planerov) E V Vlasov and V F Samokhin *Akusticheskii Zhurnal,* vol 23, July-Aug 1977, p 550-556 8 refs In Russian

The noise caused by air flowing around KAI-12 or L 13 sport gliders was studied with attention to the intensity, spectral composition, and directional pattern The dependence of aerodynamic flow noise on the flight regime and the positions of the flaps and wing interceptors was investigated The basic causes of the noise were examined M L

A77-48515 # Aerodynamic effects during supersonic flow past a laser beam (Aerodinamicheskie iavleniia pri sverkhzvukovom obtekanii lazernogo lucha) V A Belokon', O V Rudenko, and R V Khokhlov (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) *Akusticheskii Zhurnal,* vol 23, July-Aug 1977, p 632-634 In Russian

Supersonic flow past a laser beam is studied In an analogous situation, modulated light causes acoustic perturbations in a resting absorbing medium In the case of flow past a laser, effects occur without modulation since variability is obtained at the time of heating as a consequence of displacements in the medium The paper is concerned with a one-dimensional gas flow passing through an immobile heated region which has the form of a normal cylinder extending infinitely The reduction of light intensity is assumed to be small in the heated region A mathematical analysis of this system is provided M L

A77-48632 # Investigation of the state of dynamic stress and the influence of service time on the fatigue strength of turbine rotor blades of aircraft gas-turbine engines (Issledovanie dinamicheskoi napriazhennosti i vliianiia ekspluatatsionnoi narabotki na ustalostnuiu prochnost' rabochikh lopatok turbin AGTD) Iu S Nalimov (Akademiia Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR) *Problemy Prochnosti,* Aug 1977, p 34-37 6 refs In Russian

A77-48686 Simulation of traffic loading for approach and landing systems with statistical interrogation (Simulation der Verkehrsbelastung bei Anflug- und Landesystemen mit statistischer Abfrage) W Skupin and R Ullrich (Braunschweig, Technische Universitat, Braunschweig, West Germany) *Frequenz,* vol 31, Aug 1977, p 246-253 In German

In evaluating an approach and landing system with statistical interrogation the total air traffic that influences the reply probability and measurement accuracy of the system must be taken into account On the basis of a traffic model in which the possibility of interference between the replies in different channels of a given frequency is taken into account, the traffic loading is modeled by statistical generators that simulate interference due to same channel interrogation (pulse overlapping, blocking of the ground station), foreign channel interrogation, and foreign channel reply A complete simulation facility is defined Some preliminary results on using this facility on a model of the distance measuring equipment based landing system for the case of single-channel operation are presented P T H

A77-48689 Avionics first principles II - Airborne radars M Hirst *Flight International,* vol. 112, Sept 3, 1977, p 695-699

A review is presented of the major advances in airborne radar technology including (1) development of microwave-emitting radars made possible by the discovery of the magnetron, (2) planar-array and cassegrain antennas which supersede the traditional dish antenna in many applications, (3) the travelling-wave tube, (4) developments in receiver electronics technology, and (5) electronic display technology Several areas of current research are identified, such as electronic countermeasure resistance, antenna component miniaturization, and various types of reconnaissance radar systems S C S

A77-48693 Design of nonlinear automatic flight control systems W L Garrard (Minnesota, University, Minneapolis, Minn) and J M Jordan (U S Army, Missile Command, Redstone Arsenal, Ala) *Automatica,* vol 13, Sept 1977, p 497 505 16 refs

A method for the synthesis of nonlinear automatic flight control systems is developed, and the performance of a control system synthesized by use of this method is compared to the performance of control system designed by use of linear quadratic optimal control theory Comparisons are made on the basis of aircraft dynamic response at high angles of attack It is found that the nonlinear controller reduces the altitude loss during stall and increases the magnitude of the angle of attack for which the aircraft can recover from stall (Author)

A77-48698 # New lidar concept for measuring the slant range transmission in aircraft landing approaches R H Kohl (Tennessee, University, Tullahoma, Tenn) *American Meteorological Society, Optical Society of America, and NASA Langley Research Center, International Laser Radar Conference on Laser Atmospheric Studies, 8th, Drexel University, Philadelphia, Pa , June 6-9, 1977, Paper* 11 p

The single-scatter, single-wavelength, scalar-backscatter lidar equation is investigated to determine the transmission along a line from a point on the ground to what is known as the decision point on the 3 degree aircraft glide slope It may be applied in aircraft landing approaches for measuring the slant range transmission S C S

A77-48709 Alternate fuels for future aircraft G D Brewer (Lockheed-California Co , Burbank, Calif) In Intersociety Energy Conversion Engineering Conference, 12th, Washington, D C , August 28-September 2, 1977, Proceedings Volume 1 La Grange Park, Ill , American Nuclear Society, Inc , 1977, p 62-68 10 refs

The paper mentions some results of comparisons of the applicability of liquid hydrogen-fueled aircraft of the future and equivalent aircraft fueled with Jet A Liquid hydrogen-fueled aircraft show clear superiority stemming from better lift to-drag ratio in cruise and the specific fuel consumption realized during cruise These advantages are retained when supersonic transport aircraft are

considered as well At the moment, studies indicate that it would cost more to build and operate a hydrogen-fueled fleet than a fleet fueled with synthetic Jet A, but if one takes into account projected improvements in the production process for liquid hydrogen (hydrogen gasification) and for synthetic Jet A, the LH2-fueled aircraft comes out ahead P T H

A77-48819 * The liquid hydrogen option for the subsonic transport - A status report P F Korycinski (NASA, Langley Research Center, Hampton, Va) In Intersociety Energy Conversion Engineering Conference, 12th, Washington, D C , August 28-September 2, 1977, Proceedings Volume 1 La Grange Park, Ill , American Nuclear Society, Inc , 1977, p 964-972 22 refs

Studies dealing with the use of liquid hydrogen for fuel in subsonic air transport systems are reviewed Topics of the studies include the possibility for economical production of hydrogen, the problems associated with the efficient liquefaction of the gas, the development of insulation materials and materials for long-lasting liquid hydrogen fuel tanks, the difficulties related to fueling processes and the installation of liquid hydrogen fuel stations at major air terminals, an assessment of the hazards connected with liquid hydrogen fuels, and the engineering and design problems involved in incorporating liquid hydrogen fuel systems into large subsonic passenger aircraft J M B

A77-48898 * Experimental data and theoretical analysis of an operating 100 kW wind turbine B S Linscott, J Glasgow (NASA, Lewis Research Center, Cleveland, Ohio), W D Anderson, and R E Donham (Lockheed California Co , Burbank, Calif) In Intersociety Energy Conversion Engineering Conference, 12th, Washington, D C , August 28-September 2, 1977, Proceedings. Volume 2 La Grange Park, Ill , American Nuclear Society, Inc , 1977, p 1633-1650 8 refs Contract No NAS3-20036

Part of the cooperative effort between NASA and ERDA has been the design and the erection of an experimental wind turbine by the NASA-Lewis Research Center This 100 kW turbine, designated the Mod-O, is located at the NASA Plum Brook site near Sandusky, Ohio Experimental test data have been correlated with analyses of turbine loads and complete system behavior of the 100 kW Mod-O wind turbine generator over a broad range of steady state conditions, as well as during transient conditions The deficit in the ambient wind field due to the upwind tower turbine support structure was found to be very significant in exciting higher harmonic loads associated with the flapping response of the blade in bending (Author)

A77-48899 Fluid dynamics of diffuser augmented wind turbines B L Gilbert, R A Oman, and K M Foreman (Grumman Aerospace Fluid Dynamics Laboratory, Bethpage, N Y) In Intersociety Energy Conversion Engineering Conference, 12th, Washington, D C , August 28-September 2, 1977, Proceedings Volume 2 La Grange Park, Ill , American Nuclear Society, Inc , 1977, p 1651-1659 6 refs Contract No E(11-1)- 2616

The Diffuser Augmented Wind Turbine (DAWT) is one of the advanced concepts being investigated to improve the economics of wind energy conversion systems (WECS) Application of modern boundary layer control techniques has reduced the surface area requirements of an efficient diffuser by an order of magnitude Many parameters that effect the performance of the diffuser system have been examined in small scale wind tunnel tests with a family of compact diffusers, using screens and centerbodies to simulate the presence of a turbine Flow field surveys, overall performance, the effect of ground proximity, and the prospects for further improvement are described The baseline configuration is a conical, 60 deg included angle diffuser with an area ratio of 2 78 controlled by two tangential injection slots This first generation DAWT can provide about twice the power of a conventional WECS with the same turbine diameter and wind Economic estimates show that this DAWT can be as much as 50% cheaper than conventional WECS for the same rated power (Author)

A77-49180 * Aeroelastic stability of complete rotors with application to a teetering rotor in forward flight J Shamie and P Friedmann (California, University, Los Angeles, Calif) *Journal of Sound and Vibration*, vol 53, Aug 22, 1977, p 559-584 23 refs Grant No NGR-05-007-414

The derivation of a set of non-linear coupled flap-lag-torsion equations of motion for moderately large deflections of an elastic, two-bladed teetering helicopter rotor in forward flight is concisely outlined The following degrees of freedom are included in the mathematical model rigid body flapping, rigid body lead-lag, elastic bending in flap and lead-lag, blade root torsion, and shaft torsion Quasi-steady aerodynamic loads are considered and the effects of reversed flow are included The aeroelastic stability of the complete rotor is investigated by using a linearized system of equations of motion The equilibrium position about which the equations are linearized is obtained by considering the trim state of the helicopter, in true or simulated forward flight conditions The sensitivity of the aeroelastic stability boundaries to interblade structural and mechanical coupling is illustrated by comparing the complete rotor stability boundaries with those obtained from a single blade analysis for a number of hover and forward flight cases (Author)

A77-49224 A new high-brightness, all-weather, ASDE /Airport Surface Detection Equipment/ A G L M Weijts (Hollandse Signaalapparaten, Hengelo, Netherlands) *The Controller*, vol 16, Aug 1977, p 27-29

The Airport Surface Detection Equipment (ASDE) is described including a list of system requirements and operational considerations The system's main technological components include an antenna system with a turning speed of 60 rpm, transmitter/receivers, digital scan converters, and bright displays Discussed in greater detail is the digital scan converter memory which consists of 896 x 896 memory cells subdivided into 49 blocks, and four special controls which may be used to (1) freeze the displayed picture, (2) invert the displayed picture, (3) test the operability of the display system, and (4) control the luminance of the display The ASDE radar frequency has been selected as the optimum compromise between parameters necessary for adverse weather conditions and antenna size necessary for high resolution S C S

A77-49225 Convex 76 - Aircraft noise and air traffic control T S Johnston (Guild of Air Traffic Control Officers, London, England) *The Controller*, vol 16, Aug 1977, p 29-31

It is suggested that most noise abatement programs impair the efficient use of aircraft, decrease flexibility of operation, and require aircraft to operate below optimum performance Operational restrictions are listed, including minimum noise routings, use of reduced thrust on take-off, and power cutback on climb-outs Minimum noise routes are described with regard to problems incurred in take-off and landing stages, and proposals by the National Air Traffic Services, the Civil Aviation Authority, and the Guild of Air Traffic Control Officers are reviewed S C S

A77-49244 # Unsteady Oseen flow around a flat-plate airfoil S Murata, Y Miyake, and Y Tsujimoto (Osaka University, Suita, Japan) *JSME, Bulletin*, vol 20, July 1977, p 819-826 10 refs

The viscous flow around a flat plate making small unsteady motion in a uniform flow is analized on the basis of Oseen's equation The exact elementary solutions of the basic equations in the cases that concentrated force acts at the origin parallel and perpendicular to the uniform flow are presented at first These solutions yield the fundamental structure of each case The solutions are applied to the problems of plunging motion of a flat plate and of oscillation parallel to itself Substantial understanding was obtained from the interpretation of the calculated results concerning the effects of viscosity of the fluid on the unsteady forces of a flat plate (Author)

A77-49340 # Stability of the pilot aircraft system in maneuvering flight J R Broussard and R F Stengel (Analytic Sciences

Corp , Reading, Mass) *(Annual Conference on Manual Control, 12th, Urbana, Ill , May 25-27, 1976) Journal of Aircraft,* vol 14, Oct 1977, p 959-965 9 refs Contract No N00014-75-C-9432

A control-theoretic pilot model is incorporated in the analysis of pilot-aircraft motions during maneuvers The pilot model is found to be of value for the definition of maneuvering flight stability boundaries, and it simulates pilot control actions during a representative task with reasonable fidelity The model also is used to demonstrate the consequences of improperly adapted pilot response strategy It is concluded that the pilot model presented here provides important capabilities for evaluation of flying qualities and for identifying proper piloting procedures during difficult maneuvers (Author)

A77-49341 # **Computer simulation of light aircraft crash** R J Melosh (MARC Analysis Research Corp , Palo Alto, Calif) and M P Kamat (Virginia Polytechnic Institute and State University, Blacksburg, Va) *Journal of Aircraft,* vol 14, Oct 1977, p 1009-1014 7 refs

A skeletal aircraft model capable of reflecting material yielding and large geometry changes is used in a computer prediction of the post impact response of a general aviation aircraft The three-dimensional stiffness-equivalent truss model is monitored from the time of first runway contact through structural translation, rotation, bending and ovalation Results indicate that post-impact response may be divided into three stages, of which the rebound phase is the most severe in terms of passenger trauma, peak acceleration, and structural plastic work dissipation Furthermore, it appears that the primary energy-dissipation mechanism is friction between the air plane and the runway, plastic work consumes less than 3% of the touchdown kinetic energy J M B

A77-49342 # **Documentation of the feasibility research on a destructible parachute** W B Pepper and R J Buxton (Sandia Laboratories, Albuquerque, N Mex) *Journal of Aircraft,* vol 14, Oct 1977, p 1015-1017 ERDA-supported research

A flammable impregnating mixture which was developed to promote disintegration of a nylon parachute after the deceleration phase of a drop is described It was specified that the parachute be *capable of decelerating a 37 2-lb terradynamic penetration store* from maximum release speeds of 550 knots at an altitude of approximately 250 ft above the terrain Mixture proportions for the impregnating agent, which contained the elastomer Viton A, magnesium particles and TNT, are given Drop tests of the 4 ft diameter ribbon parachute are also reported J M B

A77-49343 * # **Vortex lattice prediction of subsonic aerodynamics of hypersonic vehicle concepts** J L Pittman and J L Dillon (NASA, Langley Research Center, High-Speed Aerodynamics Div , Hampton, Va) *Journal of Aircraft,* vol 14, Oct 1977, p 1017, 1018 5 refs

The vortex lattice method introduced by Lamar and Gloss (1975) was applied to the prediction of subsonic aerodynamic characteristics of hypersonic body wing configurations The reliability of the method was assessed through comparison of the calculated and observed aerodynamic performances of two National Hypersonic Flight Research Facility craft at Mach 0 2 The investigation indicated that a vortex lattice model involving 120 or more panel elements can give good results for the lift and induced drag coefficients of the craft, as well as for the pitching moment at angles of attack below 10 to 15 deg Automated processes for calculating the local slopes of mean-camber surfaces may also render the method suitable for use in preliminary design phases J M B

A77-49344 # **Performance of plain-type spoilers applied to the GA/W/-1 wing** D H Neuhart (Douglas Aircraft Co , Long Beach, Calif) and R B Oetting (Missouri Rolla, University, Rolla, Mo) *Journal of Aircraft,* vol 14, Oct 1977, p 1019, 1020 6 refs

Plain-type solid spoilers were mounted on a finite aspect ratio GA/W/-1 wing in an experiment assessing the usefulness of spoilers as replacements for ailerons in flight path (direct lift) control Wind-tunnel tests of basic flap and wing performance at three flap settings showed that high lift coefficients could be obtained by the spoiler-wing configuration In addition, studies of the effect of spoiler deflection on pitching moment performance indicated that the device may be a useful aid to the pilot in the approach-to-landing phase It is concluded that a 15%-chord spoiler with the hingeline located at the 85% chord position could provide good results in terms of lift, drag and pitching moment performance J M B

A77-49345 # **Calculation of vortex breakdown locations for flow over delta wings** J D Wilson (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio) *Journal of Aircraft,* vol 14, Oct 1977, p 1020 1022 13 refs

Quasi-cylindrical approximations of the Navier-Stokes equations are employed to predict the location of breakdowns in strong vortices formed when leading-edge separation occurs on highly swept delta wings It is assumed that the viscous rotational vortex core is confined to a narrow region and thus has negligible influence on the location and shape of the spiral vortex sheet arising from the wing leading edge A potential flow model is used to supply the outer boundary conditions for the vortex core Initial boundary conditions on the velocity profiles (or swirl parameter) are treated through correlation with solutions to the core model for a range of initial conditions The results of the theoretical calculations are confirmed by previously reported experimental observations of vortex break down locations J M B

A77-49346 # **Lightning-hazard assessment - A first-pass probabilistic model** L McKague (General Dynamics Corp , Fort Worth, Tex) *Journal of Aircraft,* vol 14, Oct 1977, p 1022-1024 9 refs

A model for analyzing and predicting aircraft lightning hazards is described The model takes into account three basic factors in calculating the frequency with which a given type of aircraft will be struck by lightning a geometric factor, termed the effective receptor area, an environmental factor, which may be considered a measure of lightning flash density, and a service-related factor, which defines the probability of encountering lightning under a specified set of operating conditions The relative probabilities associated with lightning strikes to various parts of an airplane (radome, wingtip, fuselage, etc) are also given The model yields results that compare well with existing data on lightning strike frequency, suggesting that it could be a useful design tool J M B

A77-49374 # **Some regularities of the wearing of fuel pump plunger spheres (Nekotorye zakonomernosti protsessov iznosa sfer plunzherov toplivnykh nasosov)** I G Nosovskii and V M Levchenko (Vysshee Inzhenerno-Aviatsionnoe Voennoe Uchilishche VVS, Kiev, Ukrainian SSR) *Akademiia Nauk Uzbekskoi SSR, Doklady,* no 6, 1977, p 23-25 5 refs In Russian.

An experimental procedure for determining the slippage rate between the working surfaces of a plunger sphere and an inclined washer in fuel pumps is explained Slippage rates were determined for various washer inclination angles and rotor speeds at a constant exit pressure The damage to sphere surface resulting from pitting by metal particles or from plastic deformation is described M L

A77-49473 # **The need for improved aircraft crashworthiness design** R C Tennyson (Toronto, University, Toronto, Canada) and J W Bird (Department of National Defence, Ottawa, Canada) *(Canadian Aeronautics and Space Institute, Canadian Symposium on Recreational and New Generation Light Aircraft, 2nd, Toronto, Canada, Sept 13-15, 1976) Canadian Aeronautics and Space Journal,* vol 23, Sept -Oct 1977, p 269 278

Canadian aircraft accident statistics for the period 1970-1974 are surveyed, with emphasis given to cases in which fuselage and cabin damage occurred Separation of aircraft into specific weight categories and division of accidents into several types allow for determination of the prevalent conditions and extent of damage incurred during various kinds of crashes In particular, categories involving aircraft weights greater than 12,500 lb, less than 6,000 lb,

or between 6 000 and 12,500 lb are used in the survey Speed of the aircraft at impact is also assessed Recommendations are made for improving crashworthiness design, especially in the lighter weight categories J M B

A77-49564 **The initial region of subsonic coaxial jets II** A S H Kwan and N W M Ko (University of Hong Kong, Hong Kong) *Journal of Fluid Mechanics,* vol 82, Sept 7, 1977, p 273-287 16 refs Research supported by the University of Hong Kong

The phase relationships between the fluctuating pressure and the axial and radial velocity fluctuations in the initial region of coaxial jets were obtained from single- and two-point correlations The phase relationships were measured on the core side and the entrainment side of the vortices and in the mixing region The phase relationships obtained in the coaxial jets agree with experimental results for single jets, indicating that the coherent structures in coaxial jets and in single jets are physically similar P T H

A77-49645 **Acquisition of test compatible avionics - An updated approach** J K Scully (Litton Systems, Inc , Woodland Hills, Calif) In AUTOTESTCON '76, Proceedings of the Symposium, Arlington, Tex , November 10-12, 1976
New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 143-150

Automated test technology forms an integral part of complex avionic systems, although many problems exist with regard to the system relationship between test compatibility (constraints, procedures, and equipment that will result in cost-effective maintenance of avionic systems) and airborne performance requirements Three propositions are suggested to treat these problems (1) integration of test compatibility and airborne performance requirements within an incentive structure, (2) assignment of vertical design authority to the avionics unit design team, and (3) standardization of test systems to develop compatibility between avionics design, factory acceptance, and support levels S C S

A77-49651 # **Some aspects of the development of air traffic of the Socialist States II (Einige Aspekte der Entwicklung des Luftverkehrs der sozialistischen Staaten II)** A Kramer *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 13, no 3, 1977, p 129-133 20 refs In German

The increase in the volume of passenger traffic for the Socialist States in comparison to world air traffic levels during the considered period is related to various factors, including the development of the political relations between the involved states, their economic interrelation, and the technical advances in aircraft construction made, in particular, in the Soviet Union Tables are presented with data concerning the air traffic volume for different years and the various individual countries The role of charter air transportation within the general air traffic is also examined, taking into account differences regarding the conditions in socialist and capitalist countries G R

A77-49653 # **Jakowlew Jak-42 - Uncomplicated, reliable, economical (Jakowlew Jak-42 - Unkompliziert, zuverlassig, wirtschaftlich)** S Iakovlev (O Konstruktorskoe Biuro Iakovlev, USSR) *(Grazhdanskaia Aviatsiia,* no. 1, 1977.) *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 13, no 3, 1977, p. 146-150 In German. (Translation)

The Jak-42, which was designed for an employment on short-haul local routes in the Soviet Union, is to replace the Tu-134, IL-18, and An-24. The new airliner provides accommodations for 100 to 120 passengers Freight and mail can be carried in addition to the passengers and their baggage The Jak 42 can carry a normal commercial payload of 10.5 tons over a distance of 1850 km at a speed of 820 km/hr Attention is given to the takeoff and landing characteristics of the aircraft, aspects of wing design leading to a lowering of production costs, advances in the design of lift producing devices, aspects of aircraft control, problems of cockpit design, and various approaches used to obtain a high level of reliability and a long operational life for the aircraft G R

A77-49654 # **The determination of the center-of-gravity position with the aid of dimensionless values (Ermittlung der Schwerpunktlage mit Hilfe dimensionsloser Werte)** P Korrell (Gesellschaft fur internationalen Flugverkehr mbH, Berlin, East Germany) *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 13, no 3, 1977, p 151 154 In German

The preservation of the given center-of gravity position is an essential condition for the stability and the control of an aircraft The approaches used for the determination of the center of-gravity position are related to a use of balance charts, analytical studies, and investigations utilizing electronic computers All procedures of center-of-gravity determination involve the summation of the individual moments with respect to a reference point and the determination of the lever arm with the aid of the known total weight A description is presented of a computational procedure based on the IATA airport handling manual The procedure avoids a use of negative moments The center of gravity position in the procedure is determined from the dimensionless parameters The adaptation of the considered procedure for applications involving Interflug aircraft is discussed G R

A77-49655 # **The technical conception of the IL-62M Aerodynamic features (Die technische Konzeption der IL-62M - Aerodynamische Besonderheiten)** G Muravev and V Egorov (O Konstruktorskoe Biuro Iliushin, USSR) *(Grazhdanskaia Aviatsiia,* no 10, 1976) *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 13, no 3, 1977, p 155-158 In German (Translation)

The aircraft IL-62M has, in comparison to the IL-62, a greater operational range and better takeoff and landing characteristics The improvements are related to an employment of the D-30KU engine Differences of the new engine from the NK-8-4 engine of the IL-62 include lower fuel consumption rates, higher thrust values, and reduced noise levels at takeoff and landing operations Additional flaps are used for the improvement of the lateral aircraft control in the low speed range The general aerodynamic characteristics of the new aircraft are the same as those of the IL-62 Attention is given to the wing design, the installation of the engines, the aircraft control system, and aspects of flight safety G R

A77-49656 # **Noise emission of the agricultural aircraft Z-37 I - Sound intensity level measurements at the agricultural aircraft Z-37 II - Sound intensity level measurements at an agricultural airport (Larmemission des Agrarflugzeugs Z-37 I - Schallpegelmessungen am Agrarflugzeug Z-37 von Waltraud Krause II - Schallpegelmessungen an einem Agrarflugplatz)** W Krause (Gesellschaft fur internationalen Flugverkehr mbH, Berlin, East Germany) and H Findeis (Potsdam, Bezirkshygieneinspektion und Institut, Potsdam, East Germany) *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 13, no 3, 1977, p 159-170 6 refs In German

The agricultural aircraft considered is a low-wing monoplane Maximum energy components of the acoustic emission spectrum lie in the range from 63 to 250 Hz The characteristics of the frequency spectrum of the acoustic emission during takeoff are presented in a graph, taking into account distances of 50 m, 100 m, 200 m, and 400 m at various positional angles Attention is given to maximum sound intensity levels as a function of distance, sound emission during braking, the shielding effects of buildings on noise propagation, noise intensity levels during various types of flight operations, acoustic measurements in the aircraft during the flight, details regarding the operations at an agricultural airport, and sound intensity levels at the airport measured under operational conditions G R

A77-49657 # **The helicopter Ka-26 in the Special Purpose Flights Sector of Interflug II (Der Hubschrauber Ka-26 im Bereich Spezialflug der Interflug. II)** G Kronert (Gesellschaft fur internationalen Flugverkehr mbH, Berlin, East Germany) *Technisch-*

okonomische Information der zivilen Luftfahrt, vol 13, no 3, 1977, p. 171-175 In German

The employment of helicopter for obtaining aerial photographs and for making films increases in spite of the higher expenses per helicopter flying hour in comparison to the costs involved in the case of conventional aircraft The reasons for this development are related to the special effects which can only be obtained by utilizing the particular flight characteristics of helicopters The use of the Ka-26 for the considered applications is discussed Other described applications of the Ka-26 helicopter are related to an employment as an ambulance aircraft, a use in rescue operations, and a utilization as a flying crane G R

A77-49658 # **Electroenergy supply for airports IV (Elektroenergieversorgung von Flughafen IV)** H Krause (Gesellschaft fur internationalen Flugverkehr mbH, Berlin, East Germany) *Technisch-okonomische Information der zivilen Luftfahrt,* vol 13, no 3, 1977, p 176-179 In German

Approaches are discussed for the determination of limiting values of general validity concerning the continuing supply with electric power taking into account the available solutions for the existing supply problems Parallel systems containing storage batteries can assure a supply of electric power without interruption Power supply interruption periods in the case of other solutions are 1 sec, 8 sec, 30 sec, and 3 min The technical equipment required for various solutions is considered G R

A77-49731 # **Rain erosion resistant fluoroelastomer radome and antenna coatings** J F Moraveck (CAAP Co , Inc , Huntington, Conn) In Symposium on Electromagnetic Windows, 13th, Atlanta, Ga , September 21-23, 1976, Proceedings Atlanta, Ga , Georgia Institute of Technology, 1977, p 29-36 6 refs USAF-supported research

Sprayable and room temperature curable fluoroelastomer coating compositions having superior rain erosion resistance, thermal and thermal flash resistance have been developed for radome and antenna applications Rotating arm performance of these coatings as a function of free film rheology, adhesion and coating composition is discussed Flight testing of white and black pigmented coatings confirm the rotating arm evaluation Thermal and thermal flash testing have been performed and electrical properties consistent with radome and antenna applications have been achieved This development work has led to commercially available coating compositions which are currently under qualification testing (Author)

A77-49734 # **The protection of aircraft radomes against lightning strike** R H J Cary (Ministry of Defence, London England) and D A Conti (British Aircraft Corp , Ltd , Guided Weapons Div , Stevenage, Herts , England) In Symposium on Electromagnetic Windows, 13th, Atlanta, Ga , September 21 23, 1976, Proceedings Atlanta, Ga , Georgia Institute of Technology, 1977, p 67-71 6 refs

The high voltage aspects of lightning protection systems for radomes are considered with emphasis on the basic requirement that the radome should not be punctured Attention is given to maximum conductor separation, puncture factors, surface flashover factors, and external metal distribution Lightning protection is also discussed in reference to the microwave performance and current performance of radomes B J

A77-49743 # **B-1 forward radome microwave test range** J M Carter (Carco Electronics, Menlo Park, Calif) In Symposium on Electromagnetic Windows, 13th, Atlanta, Ga , September 21 23, 1976, Proceedings Atlanta, Ga , Georgia Institute of Technology, 1977, p 123-128

A radome microwave test range for use in qualifying the radome boresight error measuring system of the U S Air Force B 1 is described Factors influencing radar performance, such as radome beam deflections and reflections, transmission efficiency, depolarization and antenna pattern distortion, were monitored at the test range A five-antenna null seeking servo system was employed in tracking horizontal and vertical boresight errors and simultaneously plotting radome transmission loss Test data indicated that the servo tracking null seeker could be calibrated to an accuracy of better than 0 1 milliradians for a variety of antenna configurations and polarization modes J M B

A77-49745 # **Georgia Tech high temperature solar test facility** J D Walton, Jr (Georgia Institute of Technology, Atlanta, Ga) In Symposium on Electromagnetic Windows, 13th, Atlanta, Ga , September 21-23, 1976, Proceedings Atlanta, Ga , Georgia Institute of Technology, 1977, p 133-138 8 refs ERDA sponsored research

The Georgia Institute of Technology Solar Thermal Test Facility, which involves a 400 kW solar furnace suitable for simulating aerodynamic heating of radomes, is described Plans for the facility, scheduled to begin preliminary operation in 1977, call for an initial array of 550 circular mirrors made of low-iron window glass Mechanical drive mounts for directing the concentrated solar energy to various test areas are also included in the planning Calculations indicate that with maximum heat flux and concentration ratios, the solar furnace could provide a test area in which at least 175 kW of radiant thermal energy is available Additional documentation of the facility is also mentioned J M B

A77-49747 # **Design and test results of very broadband radomes for ECM applications** W Eckl (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) In Symposium on Electromagnetic Windows, 13th, Atlanta, Ga , September 21-23, 1976, Proceedings Atlanta, Ga , Georgia Institute of Technology, 1977, p. 143-148

The mechanical layout and electromagnetic properties of very broadband radomes for subsonic aircraft ECM applications are presented Constructions for the nose, tail, and under-fuselage radomes are described along with discussions of the electromagnetic properties and transmittivity, reflection coefficient, and boresight errors S C S

A77-49787 Model for the effect of electric fields on satellite-earth microwave radio propagation D P Haworth, P A Watson, and N J McEwan (Bradford, University, Bradford, Yorks , England) *Electronics Letters,* vol 13, Sept 15, 1977, p 562-564 15 refs

A model for cross polarization on satellite-earth radio paths is proposed in which particles lying in the horizontal plane under aerodynamic-gravitational forces are aligned by electric fields This model explains the abrupt cross polarization magnitude changes and abrupt 180-deg phase changes recently observed on satellite-earth paths at microwave frequencies (Author)

A77-49847 Theory of the lifting surface in unsteady motion in an inviscid fluid D Homentcovschi (Bucuresti, Institutul Politechnic, Bucharest, Rumania) *Acta Mechanica,* vol 27, no 1 4, 1977, p 205-216 7 refs

A lifting surface S in unsteady motion in a barotropic inviscid fluid which fills the whole space is considered The surface S can be an aircraft wing, a tail surface, or a propeller The determination of the velocity field and the pressure field is considered and a fundamental relation is derived The solution of the direct problem is reduced to the solution of a singular integral equation However, a solution of the obtained equation is difficult, even when numerical approaches are used For the sake of simplicity, it is assumed that the lifting surface S moves over an (abstract) fixed surface Attention is given to the case in which the fixed surface is a cylindrical surface and the case in which it is a helicoid with a directrix plane G R

A77-49873 An operational video tape recording system utilizing IRIG standard 129-73 segmented helical scan recording format S S Damron, G L Schoettmer, and A E Strahm (Echo Science Corp , Mountain View, Calif) In International Telemetering Conference, Los Angeles, Calif , September 28-30, 1976, Proceedings Pittsburgh, Pa , Instrument Society

of America, 1976, p 215-228 7 refs Contract No F33657-74-C-0562

The Operational Video Tape Recording (OVTR) system includes an airborne video recorder and remote control unit, designed to produce high band video recordings in the environments encountered on deployment in fighter aircraft The companion ground system consists of a video recorder/reproducer for playback of mission tapes and a video Discassette recorder/reproducer with a slow motion/stop action capability for complete analysis of the recorded data The system incorporates multi-line rate flexibility to provide record capability of video signals from many electro-optical sensors The OVTR system is easily expanded in capability to enable the recording of any type of instrumentation data that fits within a 0 5 MHz bandwidth, such as an 8 mB/s serial digital stream, spread spectrum or other down converted communications data B J

A77-49908 ATS-6 European L-band aeronautical experiments D L Brown, Y Guerin, G Melchior, and F Absolonne (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) In International Telemetering Conference, Los Angeles, Calif , September 28-30, 1976, Proceedings Pittsburgh, Pa , Instrument Society of America, 1976, p 642-654 13 refs

An ESA program is described in which the ATS-6 satellite was employed to conduct communication and navigation tests over the North Atlantic in an effort to define modulation techniques to be used with the Aerosat system The experiments, performed on a Comet IV aircraft equipped with a slot dipole antenna, consisted of voice tests comparing delta-PSK with adaptive NBFM, an investigation of multipath noise effects on the PSK data transmission system, and ranging measurements B J

A77-49926 Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976 193 p $10 00

Techniques and hardware for aiding escape, survival, and recovery in aerospace emergencies are discussed in the contributed papers Escape and recovery systems for outer space (Space Shuttle and untrained passengers in particular) and from oil platforms and tankers in sudden emergencies are also dealt with Articles deal with masks, hoods, goggles, pilots' helmets and helmet information displays, oxygen supply and masks, ejection seat and ejection pods, and antiexposure suits for water immersion and severe cold Other articles address automatic ripcord release, survival kits, testing of life support equipment, a pulsating seat cushion to counteract fatigue in prolonged sitting, fluidic controls, and cabin safety design and delethalization of structures and objects within the head strike envelope R D V

A77-49932 SENDS /Safe Ejection Envelope Display System/ C Woodward (U S Naval Material Command, Naval Air Development Center, Warminster, Pa) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 27-30

Simulation testing of a system designed to warn the pilot and aircrew on the time remaining within the safety envelope for safe ejection, the rate at which the craft in hazard is using up the envelope, and of flying conditions outside the safety envelope, is reported The SENDS system monitors aircraft dynamics by means of onboard sensors, furnishing data to an onboard computer which computes escape capability and displays current status in terms of time remaining for initiating an ejection within the safe recovery envelope of the escape system Human reaction time and total ejection event time can be predicted, but SENDS aids the human operator in the unpredictable component time to make the decision to eject R D V

A77-49933 Fluidic thrust vector control systems for ejection seats R B Beale In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 31-34

A two-axis, hydrofluidic thrust vector control (TVC) system was designed to improve the trajectory of an ejection seat under adverse conditions from 0 to 600 knots air speed Center of gravity misalignment and large aerodynamic oscillations are virtually eliminated by this method A vortex rate sensor, fluidic lag-lead compensation and a hydrofluidic servo actuator using hot gas pressurized oil were chosen to drive a hydrostatic ball and socket nozzle with 20 deg of thrust deflection of a 5000 lb rocket This system controls seat attitude and rotational rates in the pitch and yaw axes By stabilizing the escape system at its aerodynamic trim condition with the drogue chute deployed during the rocket burn phase, the remainder of the flight remains stable, according to the 6 DOF seat simulation Since this control system has only 1 moving part, no pressurized gas or initiators, it will have an MTBF exceeding 50,000 hrs and a maintenance requirement of zero (Author)

A77-49934 Fluidic event sequencing subsystem for AAES J W Morris (U S Navy, Naval Ordnance Station, Indian Head, Md), R K Brodersen (Martin Marietta Aerospace, Orlando, Fla), and V P Marchese (EMX Engineering, Inc , Cedar Grove, N J) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 38-41

The feasibility of employing fluidics to achieve event sequencing in aircrew automated escape systems (AAES) is explored Two fluidic subsystems developed, fabricated, and tested were a fluidic sequencer (FS) breadboard and a flueric cartridge initiator (FCI) An oscillator feeding pulses into frequency dividers arranged to form a counter comprises the FS breadboard Time delays for sequencing are generated as the fluidic logic circuits analyze counter outputs (and simulated altitude and velocity sensor inputs in the test) A gas-driven initiator with no moving parts heats an endwall to effect cartridge ignition within msec in the FCI Interfacing of FS and FCI is sketched R D V

A77-49935 Emergency escape from shuttle vehicles R T Kendall In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 42-47 17 refs

The Paracone emergency escape system for Space Shuttle passengers and its development are described Ejection seat and ejection pod concepts are compared Mission requirements dictate a versatile escape system for untrained passengers and personnel from a shirtsleeve situation at any point in the Shuttle mission on pad, pre-launch, during lift off, in trajectory, in orbit, or during the return trip The Paracone is an expandable gas-inflated structure enclosing the protected person and acting as aerodynamic decelerator in reentry Activation of the system in various mission phases is described and illustrated Paracone cloth materials, mechanical actuation devices, and auxiliary functions (large three-dimensional trackable target, flotation for a water landing or impact attenuation for a hard landing) are described R D V

A77-49936 Proposed helicopter safety system for catastrophic failures R T Kendall In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 66-70 17 refs

Helicopters are subject to several types of catastrophic failures any one of which renders the helicopter unsafe and subjects the occupants to possible injury or death There has been proposed a Kendall Paracone decelerator system that is attached and stowed at the top of the helicopter, around the main motor shaft When a catastrophic failure occurs, the main rotor blades are jettisoned via

pyrotechnics and at the same time the gas generators in the Paracone are ignited The gas generators inflate the Paracone upward and outward forming the decelerator in one-half to one second (as required) This Paracone decelerator holds the helicopter descent rate to an impact velocity of 25 to 50 fps (as required) All of the required technology, materials and techniques are in-being today The weight penalty as proposed would be approximately two percent of the gross weight of the helicopter (Author)

A77-49945 Performance and design of a vertical seeking seat steering system W J Stone (U S Naval Weapons Center, China Lake, Calif) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings , Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 110-113

The estimated performance and the design of a seat steering and control system that will select a vertical-up trajectory irrespective of aircraft attitude at the point of ejection is described Trajectory simulation studies indicate that a recovery can be accomplished as low as 50 ft above ground level during an ejection from a fully inverted aircraft The increase in total impulse required to achieve maximum inverted performance also greatly enhances wing level and sink rate capability The design that will be implemented for a series of feasibility demonstration tests consists of a three-axis strap-down rate gyro sensor system, microcomputer, gimbaled underseat rocket motor, hydraulic actuators, servo valves, hydraulic power supply, and electrical power supply The system also has the potential for development into a fully independent vertical-seeking control system (Author)

A77-49946 Evolution of automatic opening lap belts in high performance aircraft C S Goodman, Jr (USAF, San Antonio Air Logistics Center, Kelley AFB, Tex) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 114-119 5 refs

In connection with an employment of the ejection seats used for an ejection from an aircraft in the case of an emergency during the period from 1949 to 1956 the crewman had to manually release his lap belt, kick away from the seat, and then deploy his parachute Many fatalities occurred because the whole procedure was taking too much time The ejection seat was, therefore, made fully automatic with the incorporation of an automatic parachute and an automatic lap belt release The automatic features reduced the operation time of the escape system and provided a significant improvement in low altitude escape capability The chronological evolution of automatic opening lap belts is discussed, giving attention to the E-1 automatic lap belt release, the first automatic lap belt, the HBU-series lap belt, and considerations concerning a new design of lap belt G R

A77-49947 The development of new designs of emergency escape parachutes for ejection seats S B Jackson (Irvin Great Britain, Ltd , Letchworth, Herts , England) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 120-125

The initial investigation into two designs of Irvin G B emergency escape parachutes to the latest British specification for use on Martin-Baker MK 10 ejection seats is described The specification requires parachutes with better stability and descent rate than given by the I 24 flat parachute Trials are described up to medium high speed using ejection seats The programme which is intended to include a 650 knot trial on the Pendine rocket sled has not yet been completed because of delays in testing, not because of parachute performance (Author)

A77-49948 Teaching the practical techniques of establishing egress system performance in an accident environment R E Duran (USAF, San Antonio Air Logistics Center, Kelley AFB, Tex) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 126-128

Six training categories are considered, taking into account an introductory definition of the weapon system and type of escape system, aspects of ejection statistics, questions of escape system capability, canopy/airframe/ejection seat ballistic schematics, serviceable and ejected seats as training aids, and an analysis of past investigations In the final segment extracts from previous on-site investigation reports are used as training aids The concepts and procedures involved are illustrated with the aid of an extract from the T-37 aircraft accident investigation (egress systems) training pamphlet G R

A77-49949 USAF experience in aircraft accident survivability W D Tuttle (USAF, Inspection and Safety Center, Norton AFB, Calif) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 132-136 11 refs

After crash landing of transport-type aircraft, passenger survival depends upon the crashworthy design of that aircraft This study reviews the United States Air Force experience in crash landings and ditchings of aircraft when passengers were involved It is limited to passenger-type Air Force aircraft accidents which occurred between 1967 and 1974 The study relates to the primary cause of death and injury of those passengers involved in survival accidents and discusses crashworthy features which would have improved their survival potential or reduced their injuries It compares the crashworthiness of all Air Force transport aircraft and those Air Force aircraft performing missions similar to that proposed for the Advanced Medium Short Takeoff and Landing (STOL) Transport (AMST) (Author)

A77-49950 Aircrew escape and survival - Problems and solutions G R Drew In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 137-140 5 refs

This paper reviews operational ejection seat systems and cites reasons why ejection systems currently in service are considered obsolete or 'old technology' Ejection seat system problems with respect to performance, survival rates, reliability, maintenance, weight, cost, and complexity, are reviewed Advanced system concepts are presented as a means of stimulating overall solutions for current aircrew ejection seat system problems (Author)

A77-49951 Evaluation of inflatable /'air bag'/ occupant restraint systems for aircraft application R G Snyder (Michigan, University, Ann Arbor, Mich) In Survival and Flight Equipment Association, Annual Symposium, 14th, San Diego, Calif , September 13-16, 1976, Proceedings Canoga Park, Calif , Survival and Flight Equipment Association, 1976, p 147-150

The state-of-the-art of 'air bag' technology was assessed for potential applications to aircraft The design development is outlined, the subsystems assessed, and effectiveness discussed Problems ranging from toxicity to maintenance and reliability remain unresolved Since most aircraft crash deceleration environments differ significantly from that of the automotive vehicle, it is uncertain how effective this system will work in aircraft without further extensive testing No system of crash sensor known is capable of reliably sensing an impending crash, as distinguished from a hard landing or turbulence While future use of 'air bags' in aircraft is promising, these systems do not now offer as effective protection as other available systems (Author)

A77-50440 # Measurement of nondiagonal generalized damping ratios during ground vibration tests (Mesure des amortissements généralés non diagonaux d'une structure lors d'un essai au sol de vibration) G Coupry (ONERA, Châtillon sous Bagneux, Hauts-de-Seine, France) *(Congres Canadien de Mécanique Appliquée, 6th,*

Vancouver, Canada, May 30-June 3, 1977) La Recherche Aerospatiale, July-Aug 1977, p 239-244 In French

Problems in measuring the nondiagonal damping ratios of a structure during ground vibration tests are discussed, in particular, a theoretical difficulty arising in the analysis of nondiagonal damping ratios due to dissipative coupling between the modes of the structure Errors in the classical determination of vibratory effects through isolation of the excitations of the various modes are assessed, the use of generalized masses, deformations and damping ratios, instead of adapted values based on the concept of equiphase response, is suggested to eliminate the faulty analysis A sample problem involving the nondiagonal damping ratios of a small twin-engined plane is also given J M B

A77-50441 # The measurement of aircraft overflight noise - Errors due to its nonstationary character (Metrologie des bruits de survols d'avions - Erreurs dues au caractère non stationnaire) M Ernoult *La Recherche Aerospatiale,* July-Aug 1977, p 245-254 9 refs In French

Techniques for measuring noise during aircraft overflights are described, with emphasis on the correction of errors due to the nonstationary nature of the received acoustic signals Acoustic noise received by a fixed ground microphone is modeled as a Gaussian, nonstationary random process, the estimation bias, variance and mean square error are calculated for a stationary process modulated by an exponential Optimal integration times for minimizing the mean square error are given The results of the analysis, presented in graphical form, may be of use in interpreting spectral analyses of the acoustic noise, and in choosing the most appropriate parameters for the analysis J M B

A77-50456 Reliability, availability, maintainability/logistics /RAM/LOG/ L L Bishop, T A Cronogue, R Hoffman, D Reside, G Donald, and R Flynn (U S Army, Aviation Systems Command, St Louis, Mo) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa , January 18 20, 1977, Proceedings Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 49 68

The paper covers various aspects of the reliability, availability, maintainability/logistics (RAM/LOG) methodology of the U S Army Aviation for development aircraft RAM/LOG data acquisition, processing and computation, and assessment are described P T H

A77-50462 The life cycle cost impacts of unsafe designs R L Weber (USAF, Inspection and Safety Center, Norton AFB, Calif) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa , January 18-20, 1977, Proceedings Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 120-123

The paper outlines how accident costs can be incorporated into life cycle cost estimates The problem of analyzing costs due to accidents and combining them with operating and servicing costs is discussed P T H

A77-50463 Launch risk analysis J B Baeker, J D Collins, and J M Haber (J H Wiggins Co , Redondo Beach, Calif) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa , January 18 20, 1977, Proceedings Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 124-129 5 refs USAF-supported research

An analysis procedure is developed for assessing the risk associated with the launch of a missile or space booster The method considers the various hazardous vehicle failure modes and employs a statistical characterization of the vehicle state vector following a failure, the flight termination process and the effects of the atmosphere on the fragments resulting from vehicle breakup Based on these statistics, the impact distributions for all impacting vehicle debris are computed and used to define the impact probability and casualty expectation for locations hazarded by the launch An incremental technique is used in these risk computations whereby fragment impact distributions are computed for discrete vehicle flight times This allows for a considerably more accurate handling of the various sources of impact uncertainty (Author)

A77-50466 * Flight inspection data and crack initiation times W S Johnson (General Dynamics Corp , Fort Worth, Tex), R. A Heller (Virginia Polytechnic Institute and State University, Blacksburg, Va), and J N Yang (George Washington University, Washington, D C) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa , January 18-20, 1977, Proceedings Piscataway, N J , Institute of Electrical and Electronics Engineers Inc 1977 p 148-154 23 refs Grant No NsG-1099

Lockheed C-130 service-flight inspection data is reduced by means of fracture mechanics and statistical analysis into a form from which the probability of time to crack initiation and the distribution of initial flaw sizes for various locations on the aircraft can be determined Crack sizes are normalized by extrapolating a growing crack backwards from its first recorded size to 03 inches (crack initiation size) yielding the time to crack initiation In a similar fashion, the crack is grown backwards to a time equal to zero to yield an initial flaw size In order to perform the discussed computations, crack growth constants were computed for each individual location and were analyzed statistically Statistical distributions were fitted to times to crack initiation and to initial flaw sizes in order to describe their expected behavior Weibull and Johnson distributions have been found to fit the data reasonably well but for a better fit convolution integrals of Poisson load distributions and Weibull strength distributions are needed (Author)

A77-50467 Wear reliability of aircraft splines D Kececio glu and A Koharcheck (Arizona, University, Tucson, Ariz) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa , January 18 20, 1977, Proceedings Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 155-163 11 refs Contract No N00156-75 C-0944

Empirical mathematical models are developed, based on experimental research conducted with aircraft splines, which provide equations for predicting their reliability when spline tooth wear is the failure mode under consideration The methodology for obtaining the needed distributions of wear for specified operating times and of time for specified amounts of spline-tooth wear is presented Six applications are given which show how this distributional data can be used to predict the reliability of aircraft splines The need to generate realistic distributional aircraft spline wear-life data is pointed out (Author)

A77 50477 Reliability improvement warranty techniques and applications C A Hardy and R J Allen (General Dynamics Corp , Fort Worth, Tex) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa , January 18-20, 1977, Proceedings Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 222-228

Incentives provided by the Air Force to contractors of new systems to design and produce electronic equipment with low failure rates and low repair costs in operational use are included in the procurement contracts as Reliability Improvement Warranty (RIW) provisions These provisions obligate the contractor to accomplish repair and replacement of failed equipment at a fixed price during operational use of the equipment by the Air Force, and to guarantee the MTBF of the equipment during the warranty period This paper defines the RIW concept and discusses it in reference to F-16 development B J

A77-50483 RIW experience at ECOM R A Mlinarchik (U.S Army, Systems Analysis Office, Fort Monmouth, N J) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa , January 18-20, 1977, Proceedings Piscataway, N J , Institute of Electrical and Electronics Engineers, Inc , 1977, p 257-260

The paper reviews the RIW (Reliability Improvement Warranty) experience at the Army Electronic Command (ECOM) with two RIW programs - CONUS NAV and the Absolute Altimeter The RIW requirements for the two programs are examined with emphasis on warranty period, exclusions, operating-time adjustments and MTBF guarantee B J

A77-50488 Effectiveness of reliability system testing on quality and reliability J B Hovis (Westinghouse Electric Corp, Baltimore, Md) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa, January 18-20, 1977, Proceedings Piscataway, N J, Institute of Electrical and Electronics Engineers, Inc, 1977, p 281-285

This paper presents a reliability approach to a program for a high reliability airborne search and track combat radar which was based on three successful approaches evolved at Westinghouse Defense and Electronic Systems Center The reliability program plan implemented for this radar equipment was designed to produce a system which would perform in a flyoff test better than a predetermined mean-time-between-failure (MTBF) The basis of this approach was basically that used in the successful Electro-Optical system known as the B-52 Steerable TV (AN/AVQ-22) which achieved a field MTBF approximately equal to the predicted value and demonstrated in a Mil-Std-781 test a greater MTBF than the required value It is felt that the principles described herein could be applied to any program to achieve the desired results in field usage (Author)

A77-50494 AFSATCOM terminal segment reliability test program R P Hassett (Mitre Corp, Bedford, Mass) and E C Jonson (USAF, Electronic Systems Div, Bedford, Mass) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa, January 18-20, 1977, Proceedings Piscataway, N J, Institute of Electrical and Electronics Engineers, Inc, 1977, p 372-377 6 refs

The development program for the AFSATCOM terminal equipment and the next generation of high reliability airborne UHF radios included an extensive reliability test effort consisting of nine separate MIL-STD-781 tests Achievement of satisfactory reliability growth was a primary objective of the test program This paper describes the significant reliability requirements and features of the equipment and of the reliability program and presents an analysis of the results of the testing to date (Author)

A77-50497 Effects of temperature on avionics reliability J J Duhig, Jr and T E Weaver (Lockheed-Georgia Co, Marietta, Ga) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa, January 18-20, 1977, Proceedings Piscataway, N J, Institute of Electrical and Electronics Engineers, Inc, 1977, p 409-413

The effects of temperature on avionics reliability at the line replaceable unit level are determined Field failure rates for 42 avionics boxes flying on the USAF C-141 jet transport fleet are analyzed along with operating temperatures obtained in a comprehensive thermal survey A strong correlation between reliability and equipment price is shown where price is used as a measure of complexity Using multiple regression analysis techniques, it is shown that the reliability of more complex equipment using flow-through forced convection cooling is very sensitive to increases in temperature The reliability of less complex equipment cooled by free convection is not as sensitive to increases in temperature (Author)

A77-50501 Failure analysis of digital systems using simulation L Bertolino (Aeritalia S p A, Settore Avionica, Turin, Italy) and L E Grefsrud (Boeing Co, Seattle, Wash) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa, January 18-20, 1977, Proceedings Piscataway, N J, Institute of Electrical and Electronics Engineers, Inc, 1977, p 432-441

The paper describes a failure analysis method developed as part of the Boeing/Aeritalia 7X7 flight control system electronics development program A model of the complete digital system is developed and subsequently modified into a functionally identical fault model which has the additional capability of detailed gate level fault simulation The fault model combined with the self test program in a fault simulation run enables a quantitative evaluation of the self-test effectiveness by inserting faults one at a time and running the self-test for each one B J

A77-50504 Combined Environment Reliability Test /CERT/ A H Burkhard (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa, January 18-20, 1977, Proceedings Piscataway, N J, Institute of Electrical and Electronics Engineers, Inc, 1977, p 460, 461

The Air Force Combined Environment Reliability Test (CERT) is applied to avionics systems and takes account of the dynamic and synergetic nature of the field environment along with its temperature, humidity, random vibration and altitude changes This paper discusses the basic philosophy and assumptions that have been used to formulate the environmental conditions used for initial testing Two general conclusions have been drawn (1) the test approach using mission profiles for one aircraft appears to have the most promise for obtaining consistent reliability statistics, and (2) a composite mission profile that includes qualification test levels does not seem suitable for obtaining consistent reliability statistics B J

A77-50510 Logistics planning simulation model for USAF spare engine management H J Benet (Texas A & M University, College Station, Tex) and C H Shipman (USAF, Wright-Patterson AFB, Ohio) In Annual Reliability and Maintainability Symposium, Philadelphia, Pa, January 18-20, 1977, Proceedings Piscataway, N J, Institute of Electrical and Electronics Engineers, Inc, 1977, p 500-505 13 refs

The simulation model described herein is designed to assist Air Force Logistics Planners in predicting future aircraft engine removals and evaluating the adequacy of spare engine supplies Written in FORTRAN, the model will give quarterly predictions of both the mean and variance of removals and stockouts so that confidence limits may be set on the ability of the logistics system to support programmed flying requirements (Author)

A77-50623 # Solid state light emitting displays. E S Eccles *Aviation Review,* Aug 1977, p 4, 5

Solid-state light-emitting displays are being developed for aviation indicators Based on an examination of various display elements, yellow light-emitting diodes were chosen for the display, with a typical strip using up to 900 individual diodes It has been suggested that two standard forms of linear display, two sizes of circular display, and a four-digit 7-bar numeric readout would be sufficient for standard instrument replacement requirements Scale illumination and a wide range of light-emitting diode intensity modulation would be utilized along with a digital computing system using microprocessors Cost effectiveness may be enhanced by using the digital computer system for functions not applicable to conventional instruments S C S

A77-50624 # HUD and the retrofit market J R Caldow *Aviation Review,* Aug 1977, p 12-15

It has been suggested that aircraft with electro-mechanical gyro gunsight may be retrofit with modern Head-up Display (HUD) equipment on a cost-effective basis Among the advantages of the HUD system are (1) the ability to be integrated with a navigation system, (2) the display of position information, assisting in target search, and for the comparison of predicted position with visual sighting, (3) the ability to interface a HUD system with fire control radar operating in the air-to-air mode, and (4) continuous indication of predicted bomb impact regardless of delivery maneuver It is concluded that the numerous benefits offered by the HUD system compensate for the cost of a HUD retrofit program S C S

A77-50625 # **Gas turbine temperature techniques.** K G McAinsh *Aviation Review,* Aug 1977, p 16-18

The swaging of mineral insulated cable has been applied to thermocouple design, allowing for the production of exposed and submerged-junction thermocouples, butt-swaged hairpin elements, and several mineral insulated thermocouple harness assemblies Thermocouple assembly techniques include vacuum brazing, induction brazing and an electron-beam welding technique, with high reliabilities achieved by standard design techniques Areas for future research are identified including technological relevance to the nuclear power industry, the development of high turbine entry temperatures, the formation of thermocouple junctions on refractory substrates, and the development of alternative temperature measuring systems S C S

A77-50662 **The need for a workable collision avoidance system - Now** C L Smith (Western Air Lines, Inc, Los Angeles, Calif) *Safe Journal,* vol 7, Fall 1977, p 32, 33

The need to move ahead on achieving a workable collision avoidance system (CAS) for aircraft is argued The Beacon CAS (BCAS) is recommended as 'earliest possible installation milestone', and as capable of identifying an imminent collision 30 sec prior to impact Criteria on CAS acceptance recommended by the Air Line Pilots Assoc as 'of primary importance' are presented Data are presented on total system errors and midair near-misses for the years 1972 through 1975 R D V

A77-50676 # **Airport electrical and lighting equipment (Elektricheskoe i svetovoe oborudovanie aeroportov)** V V Zhukov, B A Vol'pert, and V A Voevodzinskii Moscow, Izdatel'stvo Transport, 1976 288 p In Russian

A comprehensive text on airport runway and taxiway lighting hardware and associated electrical power equipment Homing beacons, runway localizers, stopway lights, barrier lights, lead-in and lead-out lights, runway and taxiway lighting patterns and various types of luminaires are described Power supplies, transformer substations, brightness regulators, emergency standby power supplies, and automatic control and switching equipment for runway-side airport lighting systems are covered R D V

A77-50678 # **Aircraft electric machines with intensive cooling systems (Aviatsionnye elektricheskie mashiny s intensivnym okhlazhdeniem)** V I Naumenko and O G Klochkov Moscow, Izdatel'stvo Mashinostroenie, 1977 128 p 45 refs In Russian

The basic approach to the design of cooling systems for aircraft electric machines is presented along with a comparative evaluation of several cooling systems such as air cooling, systems using special cooling agents (e g., motor oils), convective liquid cooling, evaporation cooling, and hybrid systems using air and evaporation systems in conjunction Specific construction requirements for the systems are identified, and various heat transfer processes, using intensive free-cooling or forced-cooling modes are described, noting engineering methods for heat calculation Examples of structural solutions for basic subassemblies are discussed, including schematic drawings of system construction S C S

A77-50682 # **Appliances for assembling aircraft and helicopter subsystems and elements (Prisposobleniia dlia sborki uzlov i agregatov samoletov i vertoletov)** V P Grigor'ev and Sh F Ganikhanov Moscow, Izdatel'stvo Mashinostroenie, 1977 139 p. 25 refs In Russian

The textbook deals with some basic principles of developing the various technological processes involved in the construction of aircraft and helicopter airframes The design characteristics of various stands, jigs, devices, and appliances used for assembly purposes are examined A large number of complete arrangements developed for specific purposes are illustrated and discussed Means of mechanizing assembly processes are studied V P

A77-50684 # **Construction and design principles of aircraft gas-turbine engines (Konstruktsiia i osnovy proektirovaniia aviatsionnykh GTD)** S I Lovinskii, G I Linko, and G P Anuchkin Moscow, Izdatel'stvo Mashinostroenie, 1977 319 p 28 refs In Russian

The textbook deals essentially with the design characteristics of aircraft gas-turbine engines and their assemblies, subsystems, and elements Attention is centered on methods of designing the principal engine assemblies and methods of suppressing vibrations and increasing reliability and service life The discussion includes lubrication, starting, fuel-supply, and automatic control systems Some typical compressor and turbine designs are examined V P

A77-50687 # **The determination of ship location by means of navigation satellites (Opredelenie mesta sudna s pomoshch'iu navigatsionnykh sputnikov)** Iu K Baranov Moscow, Izdatel'stvo Transport, 1976 84 p 14 refs In Russian

The geometric bases of satellite movement are reviewed, and several methods of determining ship location by means of earth satellites are examined Techniques considered include a goniometer method, a rangefinder method, a radial velocity method, a differential distance method, and the isoline gradient during the measurement of distance differences by satellite The determination of ship location by means of the Transit navigation satellite system is discussed, and data used to locate ships by means of Transit are analyzed M L

A77-50693 # **Practical aerodynamics of maneuvering aircraft /A manual for flight personnel/ (Prakticheskaia aerodinamika manevrennykh samoletov /Uchebnik dlia letnogo sostava/)** V A Altukhov, V G Braga, G F Butenko, N M Lysenko, A A Manucharov, S A Mikoian, Iu N Nechaev, M I Radchenko, and G F Sivkov Moscow, Voenizdat, 1977 440 p 19 refs In Russian

The book gives descriptions of the main flight characteristics of modern maneuvering aircraft The central aspects to which attention is given are the main types of aerodynamic configurations and power plants of modern aircraft, the stability and control of the aircraft, and the behavior of the aircraft during various flight stages Much of the information is given in the form of graphs illustrating, for example, the matching of air intake conditions with engine conditions, altitude-speed characteristics of the engine, regions of limits on jet engine operating regimes, effect of angle of attack on wing load distribution, onset of pitch and rolling moments, the trends of parameters of motion in aeroinertial rotation, methods of leading an aircraft out of spin, forces acting on aircraft during various flight phases, and landing schemes P T H

A77-50709 # **Some mathematical aspects of the correlation theory of aircraft precision and reliability (O nekotorykh matematicheskikh aspektakh korreliatsionnoi teorii tochnosti i nadezhnosti letatel'nykh apparatov)** V V Pozniakov *Kosmicheskie Issledovaniia na Ukraine,* no 7, 1975, p 26-32 18 refs In Russian

Nonovershoot of a multidimensional random process with dependent components is treated, as a problem to which many aircraft precision and reliability problems are reducible The validity of the normal distribution hypothesis for such a process, and the possibility of solving precision and reliability problems at the level of random functions correlation theory, are demonstrated Techniques for computing multidimensional normal integrals and nonovershoot probabilities of random processes are reviewed The solutions now available are acknowledged as a powerful tool for operations based on the correlation theory of precision and reliability R D V

A77-50917 # **The importance of monotonicity of finite difference schemes in straight-through calculation methods (O znachenii monotonnosti konechno-raznostnykh skhem v metodakh skvoznogo scheta)** A N Minailos *Zhurnal Vychislitel'noi Matematiki i Matematicheskoi Fiziki,* vol 17, July-Aug 1977, p 1058-1063 14 refs In Russian

Monotone finite difference schemes of high order of approximation have several advantages over nonmonotone schemes and first order schemes for the description of discontinuous solutions of supersonic flow problems Some of the problems associated with nonmonotone schemes and low order schemes, such as smearing of shocks and growth of the entropy function, are illustrated by some results taken from the literature A modification of a method based on the concept of donor cells is proposed as a means of eliminating artificial entropy layers The main idea is that, instead of projecting the equation of motion onto the X-axis in regions of flow expansion, one introduces an isentropic flow equation P T H

A77-50938 # **Numerical analysis of the axisymmetric flow past a pervious shell with a hole at the vertex (Chisel'ne doslidzhennia osesimetrichnogo obtikannia proniknikh obolonok z poliusnim otvorom)** M K Tsiganov (Akademiia Nauk Ukrains'koi RSR, Institut Gidromekhaniki, Kiev, Ukrainian SSR) *Akademiia Nauk Ukrains'koi RSR, Dopovidi, Seriia A - Fiziko-Matematichni ta Tekhnichni Nauki,* July 1977, p 634-636 In Ukrainian

The potential inviscid incompressible flow through an open spherical shell (the flow enters through the open base of the shell and exits through a circular hole at the vertex) is examined A numerical solution to the flow problem is obtained, by Belotserkovskii's (1965) method of discrete vortices, for circulatory and noncirculatory flow A pronounced influence of the dimensions of the vertex hole on the hydrodynamic characteristics and apparent mass of the shell is demonstrated V.P

A77-50983 **A navigation device to help helicopters to land on ocean platforms (Dispositif de navigation et d'aide à l'apontage des hélicoptères sur plates-formes en mer)** M Staron, J P Eglizeaud, and D Vasseur (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(Association Technique Maritime et Aéronautique, Session, Paris, France, May 2-6, 1977) ONERA, TP* no 1977-71, 1977 27 p 8 refs In French

The paper describes the Astrolabe device which provides data facilitating all-weather helicopter approaches and landings Several features of the device, including its basic organization, the numerical processing of the signal, simulation and experimental results, and intended uses, are discussed The construction of the device is also explained, the device relies on a synthetic antenna and an airborne data processor for analyzing signals emitted from beacons located on the ocean platform M L

A77-50987 # **Review of optical techniques with respect to aero-engine applications** C Véret (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(NATO, AGARD, Lecture Series on Laser Optical Measurement Methods for Aero Engine Research and Development, 90th, Trenton, N J , London, England, Urbino, Italy, Aug 25-Sept 6, 1977) ONERA, TP* no 1977-80, 1977 18 p 17 refs

Optical methods in aerodynamic research are used for flow visualization and for measurements of density and temperature distribution Optical methods are employed in the study of the flow characteristics of aero-engines by making use of experimental set-ups which include optical windows Interferometry provides the basic optical method permitting visualization and density measurements in a flow field The principles of interferometric studies are demonstrated for a Michelson-type interferometer which is easier to use in aero-engine research than other interferometer types The employment of holographic interferometry is also considered Attention is given to applications involving the use of the optical methods in aero-engine studies and in the investigation of flames G R

A77-50988 # **New computation method of turbine blades film cooling efficiency (Méthode nouvelle de calcul de l'efficacité de refroidissement des aubes de turbine par film d'air)** E Le Grives and J J Nicolas (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(NATO, AGARD, Symposium on High Temperature Problems in Gas Turbine Engines, Ankara, Turkey, Sept 19-23, 1977) ONERA, TP* no 1977-85, 1977 13 p 14 refs In French Research supported by the Direction de Recherches et Moyens d'Essais

A new analytical technique is presented for the computation of film cooling effectiveness of gas turbine blades It is based on a mathematical description of the counter rotating vortex structure associated with the injection of coolant through discrete holes The transport of mass induced by these vortices plays the major part in the mixing process of hot gas with the individual jets, which defines the adiabatic effectiveness of the resulting film When merging of the jets and entrainment by turbulent diffusion effects are also taken into account, data from various experiments performed on flat plates are found to be in good agreement with predictions following this approach Simple rules for computing film effectiveness with injection through several rows of holes allow an extension of this analysis to a large variety of injection patterns Curvature effects not accounted for in this presentation are left for further investigations (Author)

A77-50989 # **Coherent structures in the mixing zone of a subsonic hot free jet** C Dahan, G Elias, J Maulard (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France), and M Perulli (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, Compiegne, Universite de Technologie, Compiegne, France) *(Symposium sur la Turbulence, Technische Universitat Berlin, Berlin, West Germany, Aug 1-5, 1977) ONERA, TP* no 1977-88, 1977 9 p

The existence of a large scale structure of turbulence in a free hot jet is emphasized by measurements carried out on the initial assumption of a fine scale structure Second order analysis allows one to split the signals picked up in the jet and in the acoustic field into coherent and noncoherent components The validity of this decomposition with regard to the physical picture of the phenomenon, i e , vortices convected in the mixing zone, is tested by means of conditional sampling analysis, applied for several diagnostics (Author)

A77-50991 # **Protection of cooled blades of complex internal structure (Protection d'aubes refroidies à structure interne complexe)** P Galmiche (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(NATO, AGARD, Symposium on High Temperature Problems in Gas Turbine Engines, Ankara, Turkey, Sept 19-23, 1977) ONERA, TP* no 1977-90, 1977 10 p 12 refs In French

The SF technique for protection of cooled blades of complex internal structure permits protection of both external and internal surfaces, as well as those of the orifices of cooling air, of whatever diameter, in a single operation The SF method is most often a pack process, at controlled or high activity, its use can be envisaged for previously uncoated parts, but also for pieces already coated by a thermochemical, chemical or PVD method The respective thickness of external and internal coatings may be precisely predetermined, no parasitic particle being liable to remain inside the parts after application of the protecting treatment Results obtained to date by application of the ONERA-SF method are illustrated in the paper by the presentation and examination of quite various parts of advanced turbomachines, followed by operational tests by engine manufacturers or airlines (Author)

A77-50996 # **Influence of the noise level in a transonic wind tunnel on the aerodynamic characteristics of models (Influence du niveau de bruit des souffleries transsoniques sur les caractéristiques aérodynamiques des maquettes)** X Vaucheret (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(NATO, AGARD, Symposium on Unsteady Aerodynamics, Ottawa, Canada, Sept 26-28, 1977) ONERA, TP* no 1977-110, 1977 16 p 29 refs In French

For the purpose of studying the influence of noise in transonic wind tunnels, the perforated walls of the ONERA S2 Modane wind tunnel were covered with a gauze so that the noise level is reduced to that specified in the LEHRT project Standard models were used in this study Except for a shift of the pitch moments, the noise does not affect the overall steady characteristics The shock locations are strongly modified by the noise, but only when the separation occurs at the shock foot Without separation, the edge tones were easily perceived, especially as the lift decreased With separation and

suppression of wall noise, the pressure transducers reveal wing vibrations in their natural modes Without noise suppression this response is completely marked, which may falsify the conclusions concerning aerodynamics-structure coupling With strong separation, the noise effect disappears For fixed transition, the edge tone effect is damped in the absence of separation, but amplified by its presence (Author)

A77-50998 # **Aerodynamic problems of helicopter blade tips** B Monnerie and J-J Philippe (ONERA Châtillon sous-Bagneux, Hauts de-Seine, France) *(Forum Européen sur les Aérodynes a Voilure Tournante et a Sustentation Propulsive, 3rd, Aix-en-Provence, France, Sept 7-9, 1977) ONERA, TP* no 1977-112 1977 20 p 13 refs Research sponsored by the Direction Technique des Constructions Aéronautiques

Wind tunnel studies of wall mounted half wings and rotor models are reported Results for blades with straight or 30 deg-swept tips are presented with particular attention to the three-dimensional and unsteady aspects of the flows over these blade tips in zero lift configuration at high speed Available and planned computer programs for predicting these types of flows are described Results from an experimental investigation of phenomena related to vortex interaction are also considered M L

A77-51002 # **Techniques and facilities used at ONERA /Modane Center/ for icing tests (Techniques et moyens d'essais de givrage utilises à l'ONERA /Centre de Modane/)** C Armand, F Charpin, G Fasso, and G Leclere *(NATO, AGARD, Round Table on Icing in Aircraft, Ottawa, Canada, Sept 29, 1977) ONERA, TP* no 1977-123, 1977 33 p 19 refs In French

Since 1962, the large S1 wind tunnel at Modane has been used to perform icing tests on full-scale aircraft parts such as the wings, tail surfaces, and radome During recent years, experimental studies have promoted a technique for conducting tests on reduced-scale fixed wings Equations are provided which define the conditions for which the amount of ice formed is about the same as the amount of trapped water Lately this reduced-scale icing test technique has been extended to rotary wings The evolution of aerodynamic coefficients for rotors in icing conditions and the area distribution of ice on the blades are very similar to these observed in true flight (Author)

A77-51004 # **Evolution of aircraft design through the concept of the control configured vehicle (Evolution de la conception des avions grace aux commandes automatiques generalisees)** P Poisson Quinton and J C Wanner (ONERA, Châtillon-sous-Bagneux, Hauts de-Seine, France) *(Societé des Electriciens, des Electroniciens et des Radioélectriciens, Congres Annuel, Grenoble, France, Sept 20-24, 1977) ONERA, TP* no 1977-129, 1977 31 p 35 refs In French

The paper examines some of the future aircraft design possibilities opened up by the concept of the control configured vehicle Some of the new design goals discussed include artificial stability, direct control of forces by means of two additional degrees of freedom (direct lift and direct lateral force), load limitation during maneuvering, antiturbulence capability for greater comfort of passengers and crew, pushing back the flutter limit, and the integration of systems P T H

A77-51006 * # **Producibility aspects of advanced composites for an L-1011 Aileron** J Van Hamersveld and L D Fogg (Lockheed California Co , Burbank, Calif) *Society of Manufacturing Engineers, Paper EMR76-04*, 1976 48 p Contract No NAS1-12939

The design of advanced composite aileron suitable for long-term service on transport aircraft includes Kevlar 49 fabric skins on honeycomb sandwich covers, hybrid graphite/Kevlar 49 ribs and spars, and graphite/epoxy fittings Weight and cost savings of 28 and 20 percent, respectively, are predicted by comparison with the production metallic aileron The structural integrity of the design has been substantiated by analysis and static tests of subcomponents The producibility considerations played a key role in the selection of design concepts with potential for low-cost production Simplicity in fabrication is a major factor in achieving low cost using advanced tooling and manufacturing methods such as net molding to size, draping, forming broadgoods, and cocuring components A broadgoods dispensing machine capable of handling unidirectional and bidirectional prepreg materials in widths ranging from 12 to 42 inches is used for rapid layup of component kits and covers Existing large autoclaves, platen presses, and shop facilities are fully exploited (Author)

A77-51007 **Deburring - Requirements of the aircraft** W I Satler (Douglas Aircraft Co , Long Beach, Calif) *Society of Manufacturing Engineers, Paper MR76-124*, 1976 11 p

The major problem of the deburring process for sheet metal and machined parts, as it relates to aerospace manufacturing, is identified as the volume of parts which must be hand burred Suggestions to alleviate this problem, within the defined requirements and limitations, are presented, including the development of a universal deburring machine, the creation of a portable deburring facility, and organization of a centralized deburring facility S C S

A77-51009 * **Trapped rubber processing for advanced composites** P J Marra (Douglas Aircraft Co , Long Beach, Calif) *Society of Manufacturing Engineers, Paper EM76-172*, 1976 17 p 6 refs NASA-supported research

Trapped rubber processing is a molding technique for composites in which precast silicone rubber is placed within a closed cavity where it thermally expands against the composite's surface supported by the vessel walls The method has been applied by the Douglas Aircraft Company, under contract to NASA-Langley, to the design and fabrication of 10 DC-10 graphite/epoxy upper aft rudder assemblies A three-bay development tool form mold die has been designed and manufactured, and tooling parameters have been established Fabrication procedures include graphite layup, assembly of details in the tool, and a cure cycle The technique has made it possible for the cocured fabrication of complex primary box structures otherwise impracticable via standard composite material processes S C S

A77-51010 **Design, fabrication and test of an F-14 composite overwing fairing** H Forsch (Grumman Aerospace Corp , Bethpage, N Y) *Society of Manufacturing Engineers, Paper EM76-175*, 1976 17 p Navy-supported research

The objectives of the program described in this report were to fully demonstrate the cost and weight savings and the performance improvement made possible by utilization of hybrid composite materials for aircraft primary structures In the present case, this was demonstrated by defining, developing, and testing the design for an F-14 overwing fairing made of hybrid fiberglass/graphite/epoxy material Design allowables were first analytically established for the hybrid laminate and then confirmed in a series of 72 coupon tests at room temperature and 300 F A total of 28 element tests at 300 F completed the confirmation of the design concepts P T H

A77-51015 **Rohrbond** M M Schwartz (Rohr Industries, Inc , Chula Vista, Calif) *Society of Manufacturing Engineers, Paper AD76-280*, 1976 10 p

Advanced engineering techniques have been developed for high-strength titanium alloy structures used in thrust engines and airframe and space-oriented structures One such technique is a diffusion welding system used as a joining process for non-honeycomb applications Another process is a joining system combining brazing and diffusion welding for honeycomb sandwich structures Selected materials are applied to the faying surfaces in small amounts and when exposed to heat they react with the substrate and form a eutectic melt which creates a bridge between the components Diffusion is used to dilute subsequent thermal treatment, which results in a diffusion weld Several test programs have been conducted by NASA-Langley and Lockheed Aircraft Corporation for evaluation of the methods for titanium and advanced composite materials, and other applications of the technique have been suggested S C S

A77-51016 **Deburring - Some of the problems and requirements of the aircraft industry** J F Cochran (General Dynamics Corp , St Louis, Mo) *Society of Manufacturing Engineers, Paper MR76-547*, 1976 11 p

The necessity, dictated by cost considerations, of carrying out more deburring operations on aircraft components and structures by machines rather than manually is underscored Some examples of potential cost reductions by machine deburring are cited Items for possible consideration include automatic abrasive brush machines and computer controlled robots P T H

A77-51028 * # **Theoretical jet exhaust noise model for the duct burning turbofan** R S Larson (United Technologies Corp , Pratt and Whitney Aircraft Group, East Hartford, Conn) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1264* 13 p 22 refs Contract No NAS3-17866

A model was developed to predict the acoustic power spectrum for a Duct Burning Turbofan (DBTF) whose cycle results in a high velocity, high temperature fan stream and a lower velocity, lower temperature primary stream Model tests have demonstrated that a DBTF may produce substantially less noise than a conventional turbojet with the same thrust and weight flow Predictions from the model agreed well with measured data from the model tests The characteristics of the DBTF acoustic power spectrum were shown to be related to the rapid mixing of the fan and primary streams The effects of fan to primary velocity ratio, temperature ratio, area ratio, and the effect of nozzle geometry on DBTF jet noise were determined (Author)

A77-51032 # **Airframe noise - A status report, 1977** R L Chapkis and A H Marsh (DyTec Engineering, Inc , Huntington Beach, Calif) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1268* 8 p 35 refs

Numerous studies of airframe generated noise have now been conducted As a result, nonpropulsive noise sources are now routinely considered in evaluating landing noise levels of future airplanes All of the present methods for predicting airframe noise are largely empirical Uncertainty still exists as to the proper fluid mechanical and acoustical models to employ to describe airframe noise Further development of scaling laws and noise prediction models requires knowledge of Reynolds number and component-interaction effects Progress since 1975 has included development of new experimental techniques for noise source identification and acquisition of high-quality flyover noise data (Author)

A77-51033 # **Are wheel-well related aeroacoustic sources of any significance in airframe noise** W M Dobrzynski and H H Heller (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Abteilung technische Akustik, Braunschweig, West Germany) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1270* 9 p 7 refs

An experimental program was initiated to determine the relative importance of wheel-well related aeroacoustic sources in the farfield airframe noise spectrum Both model tests (employing geometric replicas of nose and main landing gear/wheel-well configurations) and full-scale tests (using a DC-10 series 30 aircraft) were conducted to study the aeroacoustic behavior of wheel-wells under flow-(respectively flight-) conditions corresponding to a landing approach situation Both model and full-scale tests indicate that aircraft wheel-wells respond primarily in their volume modes, however, levels of discrete frequency pressure modes within a wheel-well were found to be relatively low - on the order of 115 dB - for a typical approach condition and not very pronounced with respect to the neighboring random noise Prediction of farfield signatures due to wheel-well internal pressure resonances from model and full-scale data, and comparison with total aircraft airframe noise signatures strongly suggest that wheel-well related aeroacoustic sources are rather unimportant in relation to other airframe noise contributors, such as landing-gears and wings (Author)

A77-51034 # **Noise component method for airframe noise** M R Fink (United Technologies Research Center, East Hartford, Conn) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1271* 11 p 18 refs U S Department of Transportation Contract No FA76WA-3821

A method was developed for predicting aerodynamic noise radiated by an airframe Separate contributions are calculated for the clean wing, horizontal tail, vertical tail, landing gear, leading edge slats and flaps, and trailing edge flaps Each noise component is predicted using scaling laws appropriate to that component, with amplitudes matched to available data Spectra calculated by this method, the NASA ANOPP total aircraft method, and the drag element method are compared with flyover noise data for a sailplane, a twin-propeller lightplane, a business jet, and a jumbo jet (Author)

A77-51035 * # **Airframe noise of the DC-9** A B Bauer and A G Munson (Douglas Aircraft Co , Inc , Long Beach, Calif) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1272* 8 p 11 refs Research supported by the Douglas Aircraft Independent Research and Development Program, Contract No NAS1-14696 (DOUGLAS-6658)

Airframe noise measurements are reported for the DC-9 31 aircraft flown at several speeds and with a number of flap, landing gear, and slat extension configurations The data are corrected for atmospheric attenuation and spherical divergence, and are presented for an overhead position normalized to a 1-meter height The sound pressure levels are found to vary approximately as the fifth power of flight velocity Both lift and drag dipoles exist as a significant part of the airframe noise The data are compared with airframe noise predictions using the drag element and the data analysis methods Although some of the predictions are very good, further work is needed to refine these methods, particularly for the gear-down and flaps-down configurations (Author)

A77-51036 * # **Experimental and analytical separation of hydrodynamic, entropy and combustion noise in a gas turbine combustor** M Muthukrishnan, W C Strahle, and D H Neale (Georgia Institute of Technology, Atlanta, Ga) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77 1275* 11 p 12 refs Grant No NsG 3015

This paper deals with noise sources which are central to the problem of core engine noise in turbopropulsion systems The sources dealt with are entropy noise and direct combustion noise, as well as a non-propagating psuedosound which is hydrodynamic noise It is shown analytically and experimentally that a transition can occur from a combustion noise dominant situation to an entropy noise dominant case if the contraction of a terminating nozzle to the combustor is high enough In the combustor tested, entropy noise is the dominant source for propagational noise if the combustor is choked at the exit Analysis techniques include spectral, cross spectral, cross correlation, and ordinary and partial coherence analysis Measurements include exterior and interior fluctuating and mean pressures and temperatures (Author)

A77-51037 # **Gas turbine engine core noise source isolation by internal-to-far field correlations** B N Shivashankara (Boeing Commercial Airplane Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1276* 6 p

An auxiliary power unit (APU) was tested for exhaust noise in an anechoic chamber Six internal and numerous near- and far-field microphones were employed Extensive cross-correlation and coherence function analysis was performed The combustor was found to be one of the dominant sources of exhaust noise in the far field below 400 Hz Additional noise generation around 375 and 600 Hz was apparent between the combustor exit and the turbine exit which may be entropy noise or flow noise generated in the turbine inlet torus The mixing process between the cooling air and the exhaust

flow (which takes place a short distance upstream of the nozzle exit) was also identified as an important source of low frequency noise (Author)

A77-51038 * # **Measurement of far field combustion noise from a turbofan engine using coherence functions** A M Karchmer, M Reshotko, and F J Montegani (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1277* 33 p 14 refs

Coherence measurements between fluctuating pressure in the combustor of a YF-102 turbofan engine and far-field acoustic pressure were made The results indicated that a coherent relationship between the combustor pressure and far-field existed only at frequencies below 250 Hz, with the peak occurring near 125 Hz The coherence functions and the far-field spectra were used to compute the combustor-associated far field noise in terms of spectra, directivity, and acoustic power, over a range of engine operating conditions The acoustic results so measured were compared with results obtained by conventional methods, as well as with various semiempirical predictions schemes Examination of the directivity patterns indicated a peak in the combustion noise near 120 deg (relative to the inlet axis) (Author)

A77-51047 # **New scaling laws for hot and cold jet mixing noise based on a geometric acoustics model** C L Morfey, V M Szewczyk (Southampton, University, Southampton, England), and B J Tester (Lockheed-Georgia Co , Marietta, Ga) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77 1287* 26 p 29 refs Research supported by the Ministry of Defence (Procurement Executive), Contract No F33615-76-C 2021

New scaling laws are presented for hot turbulent jet mixing noise outside the cone of silence These account for mean flow field effects on sound radiation via an analytical high-frequency approximate solution to Lilley's equation Numerical calculations for sound radiation from sources in a cylindrical shear flow are used to test the validity of the approximation The proposed scaling laws yield an excellent collapse of jet noise measurements over a wide range of conditions The resulting information has been incorporated into a jet mixing noise prediction scheme which, with appropriate modifications to the analytical high-frequency approximation, can be applied both inside and outside the cone of silence (Author)

A77-51048 = **Shielding aspects of heated twin jet noise** R A Kantola (GE Research and Development Center, Schenectady, N Y) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77 1288* 15 p 9 refs U S Department of Transportation Contract No OS-30034

A thorough experimental study of the noise characteristics of twin jets is presented in this paper Both twin round and twin rectangular jets are investigated at typical jet engine conditions, that is with heated high velocity flow By varying the nozzle to nozzle spacing, it is possible to discriminate between the effects of turbulent mixing and acoustic shielding As a result of this investigation, it was established that the turbulent mixing effects (both interaction noise generation and mixing suppression) occur for closely spaced nozzles and while acoustic shielding occurs at all nozzle spacing, it plays the dominant role at wide nozzle spacings The levels of this acoustic shielding afforded by an adjacent jet can be sufficient to cause a nearly complete masking of the noise of the shielded jet A significant discovery of this investigation was the importance of the layer of cooler slower moving ambient air that exists between the twin jet plumes This interjet layer causes refraction and reflection of acoustic waves and as the nozzle separation increases, the layer extends further downstream, thereby shielding more of the jet noise sources (Author)

A77-51049 * = **An experimental investigation of the trailing edge noise mechanism** J C Yu (NASA, Langley Research Center, George Washington University, Joint Institute for Advancement of Flight Sciences, Hampton, Va) and C K W Tam (Florida State University, Tallahassee, Fla) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1291* 14 p 27 refs

An experimental investigation has been conducted to understand the physical mechanism of noise generation from a turbulent wall jet discharging over a flat plate and interacting with its sharp trailing edge An aspect ratio 10 rectangular nozzle was used to provide the wall jet Measurements made consist of farfield noise, surface pressure fluctuations, turbulent velocity fluctuations, and two-point space-time cross-correlations among these quantities Results are presented which suggest strongly that the generation mechanism is the interaction of the convecting large scale quasi orderly disturbance in the upper free shear layer of the wall jet with the trailing edge The interaction also excites large scale strong vortical motion in the trailing edge wake The dominant part of the sound field is highly coherent and in phase opposition across the trailing edge (Author)

A77-51052 # **Unsteady surface pressure characteristics on aircraft components and farfield radiated airframe noise** H H Heller and W M Dobrzynski (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Abteilung technische Akustik, Braunschweig, West Germany) *American Institute of Aeronautcs and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1295* 11 p 12 refs

Aircraft wings and landing gears have been identified as primary contributors to airframe noise An experimental and analytical research program was conducted to determine the relationship of aeroacoustic source mechanisms at the origin and the resulting farfield acoustic radiation for these particular aircraft components Employing an aerodynamically very clean glider both as test vehicle and test bed, fluctuating surface pressure characteristics were determined in regions that were suspected to be prime source areas, viz the wing flap trailing edges, and regions of highly turbulent flow impingement, or flow separation on fairly large models of 4-wheel main landing gears Source characteristics in terms of surface pressure spectra and longitudinal and lateral pressure correlation lengths were ultimately used to predict farfield acoustic radiation, the results of this prediction procedure compared favorably with measured data In review of this program, one may conclude that high-performance gliders offer themselves as excellent experimental tools in airframe noise research, providing near ideal test conditions, specifically inherent absence of disturbing (tunnel or engine) noise and flow turbulence, close to full-scale Reynolds-numbers and realistic relative motion of source and observer (Author)

A77-51057 * ≠ **A finite element algorithm for sound propagation in axisymmetric ducts containing compressible mean flow** A L Abrahamson (Wyle Laboratories, Inc , Hampton, Va) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1301* 12 p 26 refs NASA-supported research

The described investigation is concerned with he development of a finite element scheme which can be used in a study of the acoustics of aircraft engine ducts In the absence of suitable variational principles for acoustic fluctuations within an aircraft fan engine, an acoustic analysis must proceed directly from the differential equations which describe compressible flow The derived equations cannot be solved algebraically The numerical technique used for solving them makes use of a linear rectangular element of a type considered by Zienkiewicz (1971) Attention is given to aspects of element derivation, the global matrix assembly, the solution of the matrix equation, questions of acoustic attenuation, and illustrations of the potential of the current model in duct optimization G R

A77-51060 # **Source location by shielding with application to a large turbofan engine** J A Beasley, E G Broadbent, and S M Damms (Royal Aircraft Establishment, Farnborough, Hants , England) *American Institute of Aeronautics and Astronautics,*

Aeroacoustics Conference, 4th, Atlanta, Ga., Oct. 3-5, 1977, Paper 77-1304 13 p 12 refs

To investigate the distribution and directivity of the noise radiation from a large turbofan engine, it was mounted on a static test bed, and a movable screen was located successively at a number of positions partially shielding a microphone array The results are analyzed by assuming that the acoustic source distribution can be represented by a number of discrete point sources spaced out along the axis of the engine and the jet The directional strength of each point source is prescribed by a truncated Fourier series, whose coefficients are then evaluated by a least-squares fit to the measurements (Author)

A77-51069 * # **Forward flight effects on EBF noise** M R Fink (United Technologies Research Center, East Hartford, Conn) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1314* 12 p 16 refs Contract No NAS3 17863

Forward flight effects on local mean velocity and turbulence velocity profiles, surface pressure spectra, and far field acoustic pressure spectra were measured for a simple externally blown flap (EBF) Both upper-surface-blowing and under the wing configurations were tested Ratio of acoustic wind tunnel velocity to nozzle exhaust velocity was varied from 0 to 3/8 in steps of 1/8 A method was determined for predicting forward flight effects on surface-radiated noise This noise is decreased in amplitude and shifted to higher frequency relative to data obtained at zero flight speed Predictions are validated by comparisons with published NASA, Boeing, and Lockheed data (Author)

A77-51070 * # **Forward speed effects on blown flap noise** A P Pennock (Lockheed-Georgia Co , Marietta, Ga) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1315* 9 p 9 refs NASA-supported research

The effects of forward speed on the noise of under the-wing (externally blown flaps, EBF) and over-the-wing (upper surface blown, USB) blown flap configurations were measured in wind tunnel model tests with cold jets The results are presented without correction for the effects (e g , signal convection, shear layer refraction) associated with flight simulation in a wind tunnel or free jet facility Noise decreases were generally observed at microphones forward of the wing The reductions were larger at the low frequencies (below peak SPL) than at the high (above peak SPL) Noise increases of 10 dB or more were observed at the aft microphones, especially in the high frequency range (Author)

A77-51071 * # **Numerical prediction of aeroacoustic jet-flap flows** A J Baker (Tennessee, University, Knoxville, Tenn) and P D Manhardt (Computational Mechanics Consultants, Inc , Knoxville, Tenn) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1316* 11 p 26 refs Contract No NAS1-14282

Turbulent boundary layer flows departing an aerodynamic surface are experimentally verified to be strong sources of noise Analysis of the source tensor of the Lighthill equation identifies important gradients of mean and fluctuating velocity components Transition distributions of mean flow and select fluctuating velocity correlations, within the region immediately downstream of a sharp edged flap terminus are established by finite element solution of a parabolized form of the time-averaged steady flow Navier-Stokes equations closed with a turbulence kinetic energy model Numerical solutions are presented which quantize the localized large mean flow accelerations and resultant peaks in the distribution of turbulence kinetic energy in the near wake region Results are verified by comparison to experiment (Author)

A77-51072 * # **Interim noise correlation for some OTW configurations using external jet-flow deflectors** U von Glahn and D Groesbeck (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1317* 27 p 5 refs

Jet/flap interaction acoustic data obtained statically from a model-scale study of STOL-OTW configurations with a conical nozzle mounted above the wing and using various external deflectors to provide jet-flow attachment are correlated The acoustic data are correlated in terms that consider the jet/flap interaction noise contributions associated primarily with fluctuating lift, trailing edge, and configuration wake noise sources Variables considered include deflector geometry, flap setting and wing size Finally, the configuration overall noise levels are related to static lift and thrust measurements in order to provide insight into possible acoustic/aerodynamic performance trade-off benefits (Author)

A77-51073 * # **Over-the-wing model thrust reverser noise tests** J Goodykoontz and O Gutierrez (NASA, Lewis Research Center, V/STOL and Noise Div , Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1318* 20 p 10 refs

Experimental results are presented for static acoustic tests of a 1/12 scale model over-the-wing target type thrust reverser The model configuration simulates a design that is applicable to the over-the-wing short-haul advanced technology engine Aerodynamic screening tests of a variety of reverser designs identified configurations that satisfied a reverse thrust requirement of 35 percent of forward thrust at a nozzle pressure ratio of 1 29 The variations in the reverser configuration included, blocker door angle, blocker door lip angle and shape, and side skirt shape Acoustic data are presented and compared for the various configurations The model data scaled to a single full size engine show that peak free field perceived noise levels at a 152 4 meter sideline distance range from 98 to 104 PNdB (Author)

A77-51074 * # **Summary of forward velocity effects on fan noise** C E Feiler and J F Groeneweg (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct. 3-5, 1977, Paper 77-1319* 11 p 31 refs

The available experimental data comparing the in-flight and static behavior of fan noise are reviewed These results are then compared with recent data obtained for a fan stage tested with forward velocity in the NASA Lewis 9x15 low speed wind tunnel Tentative conclusions are presented, based on the author's judgments, about the significance and nature of the changes in noise observed when a forward velocity is imposed Finally, the implications of the emerging picture of in-flight fan source noise for suppressor design are discussed (Author)

A77-51075 # **Investigation of subsonic fan noise sources by fluctuating pressure measurements on rotating blades** P Raffy (SNECMA, Paris, France), S Lewy, J Lambourion, and M Chatanier (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1321* 14 p 18 refs

Discrete frequency noise generated by a subsonic fan is studied through different experiments involving current aerodynamic and acoustic characterization, space structure measurement of in-duct propagating waves, and blade pressure measurements These last tests were conducted on a six blades, low speed axial flow fan using electret miniature pressure transducers and on a scaled 0 47 meter diameter, high pressure ratio, subsonic fan using original thin film 50 micron thick - pressure transducers on blades Relationships between inflow distortion, blade pressure signature and in-duct modal structure are highlighted and differences in the results obtained with the two fans analyzed Finally, starting from inflow distortion data as an input to theoretical calculations, blade pressure spectra, modal power distribution, radiated noise are derived and compared to experimental results (Author)

A77-51079 # **Flight noise studies on a turbojet engine using microphones mounted on a 450 ft tower** J R Brooks (Rolls-Royce

/1971/, Ltd , Bristol, England) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1325* 12 p 8 refs

The reported investigation had the objective to obtain definitive noise data from a small turbojet engine, statically and in flight Tests were designed for studying flight effects on the exhaust noise of a turbojet engine by making measurements at a number of jet velocities and forward speeds It was attempted to obtain flight data for which ground effects were reduced to a minimum Corresponding static noise measurements included tests with the bare engine and tests in which the engine was installed in the aircraft It was found that a use of tower-mounted microphones provided flight noise data of unusually good quality and free from ground effects Noise increases which occur in the forward arc, particularly in going from static to flight conditions, can only be explained by a mechanism which amplifies the noise as measured during a flyover G R

A77-51080 * # **Acoustic scattering of point sources by a moving prolate spheroid** S L Padula and C H Liu (NASA, Langley Research Center, Hampton, Va) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1326* 10 p

The theories of geometrical optics and diffraction are used to investigate the scattering of sound generated by a distribution of point sources in the neighborhood of a prolate spheroid Source positions, source frequencies, and spheroid sizes which correspond to source distributions and fuselage sizes in jet aircraft are selected The alteration of the scattered field due to the simultaneous forward motion of the body and sources is illustrated It is observed that the sound levels produced by rapidly moving point sources are significantly higher than those produced by the moving source and body system The results suggest that scattering of acoustic sources should be considered in any theoretical or experimental study of aircraft flyover noise (Author)

A77-51081 # The noise from unheated supersonic jets in simulated flight W D Bryce and R A Pinker (National Gas Turbine Establishment, Farnborough, Hants , England) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1327* 13 p 18 refs

In an attempt to define the effect of flight on supersonic jet noise using controlled model scale experiments, a circular convergent nozzle passing an unheated airflow has been tested in an anechoic chamber with the addition of a co-flowing airstream to simulate flight The results show that while the frequency of the shock-associated noise changes little in flight, the amplitude is modified both by changes in the source strength as measured at 90 deg to the jet axis and by a convective term which can be specified The jet mixing noise reduces in flight by an amount consistent with that expected for a subsonic jet at the same velocity (Author)

A77-51082 * # Effect of flight on jet noise from supersonic underexpanded flows V Sarohia (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77 1328* 9 p 20 refs Contract No NAS7 100

Experiments on underexpanded cold jet flows from a convergent nozzle under simulated flight conditions have shown that a large periodic spinning motion of the jet can occur with greatly enhanced broadband noise production Shadowgraph pictures indicate that this oscillatory jet motion accompanies the generation of random weak shock waves at the source These waves appear to be generated at the point downstream of the nozzle exit where the shock cells in the jet begin to disappear The weak shock waves propagate upstream and have been identified to be the cause of enhanced broadband jet noise production in flight In addition, the results show that the boundary layer flow conditions over the outside of the primary nozzle (simulating engine cowl flow in flight) have a key role in the production of these random weak shock waves (Author)

A77-51083 * # Effect of simulated forward speed on the jet noise of inverted velocity profile coannular nozzles A B Packman K W Ng (United Technologies Corp , Pratt and Whitney Aircraft Group, East Hartford, Conn), and C Y Chen (United Technologies Research Center, East Hartford, Conn) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1329* 12 p 15 refs Contract No NAS3-17866

Tests were conducted of inverted velocity profile coannular nozzles and a conical nozzle in an acoustic wind tunnel facility to simulate flight effects on jet noise generation Coannular model nozzles were tested at fan to core nozzle exit area ratios of 75 and 1 2 Fan stream jet velocity ranged up to 2000 fps at a variety of fan exhaust pressure ratios and temperatures for a core stream of 1000 fps The wind tunnel airflow was varied from static to 425 fps The acoustic results indicated that the noise level differences seen previously under static conditions are retained in the flight environment (Author)

A77-51084 * # Effects of forward motion on jet and core noise J K C Low (Douglas Aircraft Co , Inc , Long Beach, Calif) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1330* 15 p 20 refs Contract No NAS3 20031 (DOUGLAS-6616)

A study was conducted to investigate the effects of forward motion on both jet and core noise Measured low-frequency noise from static-engine and from flyover tests with a DC-9-30 powered by JT8D 109 turbofan engines and with a DC-10-40 powered by JT9D 59A turbofan engines was separated into jet and core noise components Comparisons of the static and the corresponding in flight jet- and core-noise components are presented The results indicate that for the DC 9 airplane at low power settings, where core noise is predominant, the effect of convective amplification on core-noise levels is responsible for the higher in-flight low-frequency noise levels in the inlet quadrant Similarly, it was found that for the DC-10 airplane with engines mounted under the wings and flaps and flap deflection greater than 30 degrees, the contribution from jet flap-interaction noise is as much as 5 dB in the inlet quadrant and is responsible for higher in-flight low-frequency noise levels during approach conditions Those results indicate that to properly investigate flight effects, it is important to consider the noise contributions from other low-frequency sources, such as the core and the jet-flap interaction (Author)

A77-51087 * # Acoustic performance of inlet multiple-pure-tone suppressors installed on NASA Quiet Engine 'C' H E Bloomer, J W Schaefer, E J Rice, and C E Feiler (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1333* 10 p 11 refs

The purpose of the experimental program reported herein was to define the length of multiple pure tone (MPT) treatment required to reasonably suppress the MPT's produced by a supersonic tip speed fan and also determine what other suppression, broadband, and blade passing frequency (BPF), might be accomplished The experimental results are presented in terms of both far-field and duct acoustic data Front quadrant sound power level reduction in the far field is shown to agree with duct measurements over the range of treatment lengths Detailed one-third octave and narrow band spectra at the maximum forward noise angle are presented Some detailed analyses of one-third-octave band amplitudes are shown as a function of far-field angle An approximate spinning mode duct propagation analysis is then introduced which predicts the acoustic suppression by the treatment on the multiple pure tones (Author)

A77-51088 * # Effects of simulated flight on fan noise suppression M F Heidmann and D A Dietrich (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1334* 22 p 17 refs

Attenuation properties of three treated fan inlets were evaluated in the NASA-Lewis Anechoic Wind Tunnel using a subsonic tip speed, 50 8 cm-diameter fan Tunnel flow simulated the inflow clean-up effect on source noise observed in flight and allowed observation of the blade passage frequency tone cut-off phenomenon Acoustic data consisted of isolated inlet noise measured in the far field at two positions and with traverses at four frequencies Averaged attenuation properties showed relative agreement of the inlets with their design intent, however, tunnel flow significantly affected the attenuation spectra With no tunnel flow the strong blade passage tone was more highly attenuated than the adjacent broadband noise With tunnel flow, when cut-off was observed, the attenuation at the tone frequency was comparable to that for broadband noise Tunnel flow increased by several dB the maximum attenuation occurring at midfrequencies of the attenuation spectra The combined effect of tunnel flow on attenuation and source noise resulted in suppressed fan noise levels throughout the spectra Tunnel flow caused some substantial directivity variations that are interpreted as acoustic mode changes, with tunnel flow generally reducing the proportion of modes near cut-off (Author)

A77-51091 # **Helicopter rotor aerodynamic and aeroacoustic environments** C R Cox (Bell Helicopter Textron, Fort Worth, Tex) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1338* 11 p 11 refs

Results of flight tests are presented in which a helicopter rotor's blade surface pressure, leading edge stagnation point, surface flow magnitude and direction, and external noise were measured simultaneously Aerodynamic instrumentation installed at five radial blade stations is described and unsteady aerodynamic phenomena observed on the blades are identified Measured and theoretical normal force coefficients and angle of attack are compared General agreement is found for the azimuthal variation of each parameter Regions where theory and test disagree are identified and their importance to rotor performance design is discussed Airload fluctuations and acoustic signals are used to locate and define the origin of rotor noise during high speed flight and in operating regimes of strong wake interaction (Author)

A77-51092 * # **An experimental investigation of helicopter rotor high frequency broadband noise** A Lee, K S Aravamudan, P Bauer, and W L Harris (MIT, Cambridge, Mass) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1339* 11 p 16 refs Grants No DAAG29-C 027, No NsG 2095

The paper describes experiments involving a 4 17 foot diameter model rotor operating in a 5 times 7 5 ft open jet wind tunnel enclosed in an anechoic chamber The effects of rotor thrust, advance ratio, and the number of blades on the intensity and spectrum of high frequency broadband noise (HFBN) have been investigated The effects of each parameter were determined by keeping the other two constant The directivities of the two- and three-bladed rotors were measured in a direction perpendicular to the plane of the rotor disk The effects of heading edge, pressure side, and suction side serrations on HFBN were measured under several operating conditions, and the effects of the serrations on the mean thrust generated by the rotor were studied A scaling law is proposed to determine the location of the peak frequency and intensity of HFBN (Author)

A77-51093 * # **Some results of the testing of a full-scale Ogee tip helicopter rotor, acoustics, loads, and performance** W R Mantay (U S Army, Air Mobility Research and Development Laboratory, Hampton, Va), P A Shidler, and R L Campbell (NASA, Langley Research Center, Hampton, Va) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1340* 10 p 8 refs

Full-scale tests were utilized to investigate the effect of the Ogee tip on helicopter rotor acoustics, performance, and loads Two facilities were used for this study the Langley whirl tower and a UH-1H helicopter The test matrix for hover on the whirl tower involved thrust values from 0 to 44,480 N (10,000 lbs) 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 as well as 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 Flight testing of both rotors indicates that the strong impulsive noise signature of the standard rotor can be reduced with the Ogee rotor Forward flight performance was significantly improved with the Ogee configuration for a large number of flight conditions Further, rotor control loads and vibrations were reduced through use of this advanced tip rotor (Author)

A77-51094 * # **Some measured and calculated effects of a tip vortex modification device on impulsive noise** R J Pegg (NASA, Langley Research Center, Hampton, Va) and R P White, Jr (Systems Research Laboratories, Inc , Newport News, Va) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3 5, 1977, Paper 77-1341* 8 p 23 refs

The results of a recent wind tunnel test program to evaluate the effectiveness of the Tip Air Mass Injection (TAMI) system in modifying the blade tip vortex occurring during helicopter flight is described with attention to the effect of this modification on the impulsive noise The measurement program is explained, and the correlation between experimental and predicted results is discussed Topics considered include the effect of descent rate on noise pressure time histories, the effect of air mass injection on noise, and the analysis based on a dB(A) weighted approach Impulsive noise generated by the interaction of a helicopter rotor blade and the concentrated tip vortex during forward flight descent is a primary contributor to acoustic annoyance as it draws early attention to the presence of the helicopter M L

A77-51095 * # **Interaction of rotor tip flow irregularities with stator vanes as a noise source** J H Dittmar (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1342* 10 p 27 refs

The role of the interaction of rotor tip flow irregularities (vortices and velocity defects) with downstream stator vanes is discussed as a possible fan noise mechanism This is accomplished by indicating some of the methods of formation of these flow irregularities, observing how they would behave with respect to known noise behavior and, attempting to compare the strength of the rotor tip flow irregularity mechanism with the strength of the more common rotor wake stator mechanism The rotor tip flow irregularity-stator interaction is indicated as being a probable inflight noise source (Author)

A77-51099 # **Effect of forward motion on turbomachinery noise** G L Blankenship (Douglas Aircraft Co , Inc , Long Beach, Calif) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1346* 17 p 27 refs (DOUGLAS-6619)

A study was conducted to determine a procedure for correcting static-engine data for the effects of forward motion Data were analyzed from airplane flyover and static-engine tests with a JT8D-109 low-bypass-ratio turbofan engine installed on a DC-9-30, with a CF6-6D high-bypass ratio turbofan engine installed on a DC 10-10, and with a JT9D-59A high-bypass-ratio turbofan engine installed on a DC-10-40 The observed differences between the static and the flyover data bases are discussed in terms of noise generation, convective amplification, atmospheric propagation, and engine installation The results indicate that each noise source must be adjusted separately for forward-motion and installation effects and then projected to flight conditions as a function of source-path angle, directivity angle, and acoustic range relative to the microphones on

the ground High-frequency noise measured on the static-test stand and projected to flight must be adjusted for an additional source of atmospheric absorption, excess attenuation The level and the directivity of the fan tone at blade passing frequency generated under static conditions must be corrected for the reduced level of turbulence in flight and for the change in the modal constituents of the source At frequencies equal to and greater than the fan-blade-passing frequency, the increased flight levels of turbine noise must be considered (Author)

A77 51102 # **Simultaneous characterization of jet noise sources and acoustic field by a new application of conditional sampling** L Avezard, C Dahan, G Elias A Lelarge, J Maulard (ONERA, Châtillon-sous-Bagneux, Hauts de-Seine, France), and M Perulli (Compiegne, Universite de Technologie, Compiègne, France) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77 1349* 9 p 7 refs

A new method of signal processing involving conditional sampling permits the calculation of conditional coherence between an information representative of wave packets within an emitting medium and the acoustic field This method is applied to jet noise emission, with different diagnostics within the jet (hot wire, laser velocimetry, infrared radiometry) and leads to the characterization of the acoustic field associated with the wave packets isolated, even in a poor acoustic environment Furthermore, conditional schlieren photography triggered by the same conditioning criteria (on micro phone or jet probing signals) permits the visualization of these wave packets (Author)

A77-51103 * # **Experimental results of large-scale structures in jet flows and their relation to jet noise production** V Sarohia and P F Massier (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1350* 7 p 16 refs Contract No NAS7-100

Experiments have been performed to determine the role of large-scale turbulent structures in the production of jet noise Axisymmetric turbulent jet flows at ambient stagnation temperature have been observed with the aid of flow visualization techniques Jet Mach numbers at the nozzle exit ranged between 0 1 and 0 9, and the Reynolds number, based on nozzle exit diameter, was approxi mately 10 to the 6th Large organized turbulent structures existed as far downstream of the nozzle exit as 7 diameters High speed schlieren motion pictures synchronized with near field pressure measurements of an excited jet indicated that strong instantaneous peaks in the pressure signal occurred whenever a merging process between two large-scale organized structures occurred This pressure pulse propagated at a speed which was somewhat larger than the velocity of the jet at the nozzle exit (Author)

A77-51107 * # **Aeroacoustic performance of a scoop inlet** J M Abbott (NASA, Lewis Research Center, Cleveland, Ohio) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1354* 10 p 10 refs

Results of a low speed wind tunnel test program are presented which demonstrate the aerodynamic and acoustic performance of a scoop inlet Engine noise that would normally propagate toward the ground is directed upward by the extended lower lip of the scoop inlet In addition, more of the scoop airflow comes in from above the inlet than below, leading to relatively higher surface velocities on the upper lip and lower surface velocities on the lower lip These lower velocities on the lower lip result in a higher attainable angle of attack before internal flow separation occurs (Author)

A77-51108 * # **The influence of the inlet duct contour on forward radiated fan noise** D Sloan, B W Farquhar, and C Rayl (Boeing Commercial Airplane Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77 1355* 11 p 10 refs Contract No NAS1-14673

Measurements have been obtained to determine the extent to which the shape of the inlet duct affects the directivity pattern of forward radiated noise from aircraft gas turbine engines The test program was conducted using a model fan to which were attached any of three inlet ducts with each designed to cause a particular noise directivity pattern Existing information on the effects of wave refraction in inlet-type flow fields was used to design the duct contours Results indicated that the shape of the inlet duct strongly influenced the radiated noise field but that wave refraction was not the dominant factor in controlling the noise directivity pattern (Author)

A77-51109 # **A novel concept for suppressing internally generated aircraft engine noise** S L Sarin and D A Cornelisse (Fokker-VFW, Schiphol Airport, Netherlands) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1356* 6 p

A method for suppressing aircraft engine noise through injection of hot air over the duct surface was investigated The observed noise suppression capacity of an anti-icing system which injects hot air over the acoustical liners of engine intakes motivated static and in flight tests of the resultant noise levels Findings indicated an appreciable lowering of forward radiated pure tone over RPM ranges at which noise is increasing with RPM The phenomenon was also observed when untreated intakes were tested Further study to determine the physical mechanism involved and the applicability of the technique to a variety of aircraft is proposed J M B

A77-51115 * # **Acoustic loads on upper-surface-blown powered-lift systems** C M Willis, J A Schoenster, and J S Mixson (NASA, Langley Research Center, Hampton, Va) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1363* 8 p 12 refs

Powered lift concepts are utilized in aircraft currently under development for STOL application One of the concepts, upper surface blowing, places the jet exit just above the upper surface of the wing to produce powered lift from the jet exhaust blowing over the deflected flap New data are presented to show the effects of airspeed, angle of attack, and angle of jet impingement Scaling relationships are investigated concerning their applicability for extrapolating data to a different model size The effects of a number of test parameters are examined and full scale spectra are predicted from model data It is concluded that scale models are an effective means for obtaining fluctuating pressure spectra for use in aircraft design The prediction of full-scale loads from model data will require geometrically accurate models and closely spaced measure-ment locations G R

A77-51117 # **Cabin noise behavior of a USB STOL transport** L M Butzel, L D Jacobs, J V O'Keefe, and M B Sussman (Boeing Commercial Airplane Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1365* 10 p

Exterior fuselage fluctuating pressures and cabin noise were measured for a 100 ton, twin engine, upper surface blowing (USB) propulsive lift aircraft Measurements were accomplished in conjunc-tion with the developmental flight tests of the U S Air Force YC-14 Advanced Medium STOL transport for various ground, low speed and cruise conditions Results from preliminary analysis of the data show orderly and intuitively reasonable trends Interior and exterior levels are found to generally correlate with engine mixed exhaust relative jet velocity Modest changes in interior noise are associated with USB flap and vortex generator deployment The resultant data base should support further detailed analysis (Author)

A77-51118 # **An analytical model for entropy noise of subsonic nozzle flow** H Y Lu (Boeing Commercial Airplane Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga , Oct 3-5, 1977, Paper 77-1366* 7 p

An analytical model was developed for the evaluation of entropy noise generated in a low Mach number nozzle flow The acoustic intensity radiated from the nozzle exit was obtained in closed form Correlations among upstream temperature, pressure, and velocity fluctuations are required for calculation of radiated noise The mean flow and the flow inhomogeneities were assumed to be quasi one-dimensional, and an exponential nozzle was selected to simplify the analysis Results show that the upstream fluctuation of temperature is an important source of nozzle entropy noise and the noise intensity is roughly proportional to the nozzle contraction rate (Author)

A77-51178 Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings Symposium sponsored by the Institute of Electrical and Electronics Engineers New York, Institute of Electrical and Electronics Engineers, Inc , 1976 243 p Members, $15 , nonmembers, $20

Position location and navigation systems are discussed, with attention given to Doppler navigation concepts, inertial navigation systems, techniques involving distance measurement equipment (DME), hyperbolic range difference monitoring, the Navstar Global Positioning System and tactical radio frequency systems Topics of the papers include accuracy assessment of augmented multilateration tracking systems, a tracking system covering 100 test participants over a wide range, Doppler positioning for search and rescue missions, development of a range measurement system for tracking aircraft, optimal orthonormalization of strap-down inertial guidance systems, precise positioning of sonobuoys using DME techniques, low-altitude aircraft overflight monitoring, marine navigation systems, and the Joint Tactical Information Distribution System J M B

A77-51179 Position location systems technology N Lawhead (General Dynamics Corp , Electronics Div , San Diego, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 1-12

Inertial navigation and electromagnetic position location systems are discussed The advantages of inertial systems, including high short-term accuracy, resistance to jamming and capability of accommodating an unlimited number of users without performance degradation, are reviewed, disadvantages, such as poor long-term accuracy due to gyro drifts and unwieldy size, are also cited Electromagnetic systems, which have high long-term accuracy and can be reduced to convenient size, are suggested as complements to the inertial devices Range measurement techniques employed by position location systems are reviewed, and the correction of range measurement errors is also considered Several position location system configurations, including those that rely on range, azimuth and elevation readings, range and two direction angles, spherical range-only assessments, or hyperbolic range difference monitoring, are described J M B

A77-51180 Precision location, navigation and guidance using DME techniques J T Raney and K D Rehm (IBM Corp , Federal Systems Div , Owego, N Y) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 13-21 Grant No DAAD07-75-C-0108

A Distance Measurement Equipment (DME) approach for a precision location, navigation and control system which has multimission applications is presented Specifically, a description is given of the Drone Formation Control System (DFCS) which is intended to provide simultaneous location, navigation, guidance, control and telemetry functions of up to six Remotely Piloted Vehicles (RPVs) from takeoff to landing plus precision location and navigation of four additional vehicles Features discussed include automatic rendezvous, collision avoidance, manual/automatic control, and formation flying The control and navigational concepts leading to accuracies of 23 feet in absolute position and 19 feet in relative position are discussed The application of DME systems to other range instrumentation tasks, such as MSR (Mobile Sea Range), ATC (Air Traffic Control), RPV mission guidance and control, and weapon guidance applications is also considered (Author)

A77-51181 A multipurpose position accuracy verification system H I Brock and G Bonfanti (Martin Marietta Aerospace, Orlando, Fla) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 22-26 7 refs

A method for accurately estimating the position and velocity of aircraft during test flights at low altitudes is described The position-fixing technique involves distance measuring equipment (DME), including an interrogator, installed on board the test aircraft, and a grid of five ground stations The software developed for the interrogator is capable of compensating for hardware biases and atmospheric refraction errors, while producing real-time accuracy analyses, DME ground stations can be located on existing surveyed sites, eliminating the need for expensive resurveying Position estimates accurate to less than 20 ft may be obtainable with the method J M B

A77-51182 Accuracy evaluation of augmented multilateration tracking systems P H Lisman and J W Prausa (Stanford Research Institute, Menlo Park, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 27-32

Performance tests for high-accuracy aircraft tracking systems that combine multilateration position determination with inertial sensor attitude determination are discussed The tracking systems, also known as state vector tracking systems, are typically capable of accuracies within 5 to 50 feet in position and 0 2 to 3 deg in attitude The design of tests using independent reference instrumentation to verify that equipment will function within specified tolerance limits, or to measure the essential parameters of a particular cause-effect relationship in the system, is considered Reference instrumentation, which may include theodolites, laser trackers, photogrammetry, ballistic cameras and high-precision inertial systems, is described Data analysis schemes applicable to accuracy or precision tests are also mentioned J M B

A77-51183 Applications of augmented multilateration tracking systems L E Davies (Stanford Research Institute, Menlo Park, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings
New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 33-38

Basically, multilateration tracking involves the measurement of the distances between the test/training PIP (participant instrumentation package) and three or more remote stations, and the use of these data in a computer to track the PIP In the case of an augmented system other measurements that contribute to the tracking process are made at the participant vehicle Representative augmented multilateration tracking systems include the RMS (range measuring system), the ACMR (air combat maneuvering range), and the EATS (extended area test system) The characteristics that determine potential applications are examined, taking into account advantages which also apply to a conventional radar, advantages which are related to the absence of angle measurements, and the types of augmentation Present and potential applications are related to basic and primary flight training, air to surface weapon delivery, electronic warfare training, ground forces training, and fleet exercises G R

A77-51184 Technical objectives and approaches to the tracking subsystem of the Extended Area Test System /EATS/ J F Cline (Stanford Research Institute, Menlo Park, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November

1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 39-46 Contracts No N00019-70-C-0391, No N00019-71-C-0451, No N00019-73-C-0537, No N00123-74 C-0900, No N00123-75-C-0715

The tracking apparatus developed for the Extended Area Test System of the Pacific Missile Test Center is described The tracking subsystem is designed to perform multilateration tracking of up to 100 test participants (ships, aircraft, missiles and targets) within a 250-nautical mile range from an island station, the subsystem is also required to relay certain communication and instrumentation signals Problems addressed in feasibility studies, including altitude reporting by test participants, transponder peak power requirements, accuracy specifications, the analysis of radio frequency link failures and the use of airborne instrumentation stations, are reviewed Methods of increasing the capacity of the tracking apparatus, such as decreasing the interrogation rates of certain participants, are also mentioned

J M B

A77-51185 Application of UHF adaptive array to navigation/tracking systems W K Masenten and W R Jones (Hughes Aircraft Co , Fullerton, Calif.) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 47-52 8 refs. Contract No N00014-75-C-1198

The UHF Adaptive Array Processor was originally developed to suppress jammers and interference on UHF communication channels It can also effectively provide direction finding which uses signal sources, beacons, and interference/jammers This feature allows a UHF antenna system to be utilized as a navigation aid and provides both absolute and relative directional data in the presence of jamming/interference environments The UHF Adaptive Array Processor forms beams and nulls in the direction of the desired signal and interference, respectively Since a programmable computer implements the adaptation algorithms, a variety of array weighting algorithms can be used These algorithms include the angle estimation technique recently proposed by Davis, Brennan, and Reed (1976), this technique forms the equivalent of the monopulse sum/difference patterns to estimate the signal source location The ability of the UHF Adaptive Array Processor to implement this and other direction finding algorithms is discussed, and the function design and hardware implementation of the adaptive array processor are reviewed (Author)

A77-51186 * Single pass Doppler positioning for Search and Rescue satellite missions P E Schmid, F O Vonbun (NASA, Goddard Space Flight Center, Greenbelt, Md), and J J Lynn (Old Dominion Systems, Inc , Gaithersburg, Md) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 58-67 6 refs

This paper describes the implementation of beacon location experiments involving the NASA Nimbus-6 and the Amateur Satellite Corporation (AMSAT) Oscar-6 and Oscar-7 spacecraft The purpose of these experiments is to demonstrate the feasibility of determining the geographical location of a low power VHF 'distress beacon' via satellite Doppler data collected during satellite passes is reduced in a mini-computer by means of a simple algorithm resulting in the simultaneous recovery of the unknown receiver coordinates and the unknown Doppler bias frequency Results indicate point positioning to within a few kilometers - which is within the required accuracies for the positioning of downed aircraft for Search/Rescue missions (Author)

A77-51187 Development of the RMS-2 System of ODDR&E/T&E/ R Gehrke (System Planning Corp , Arlington, Va) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 68-72

The original Range Measurement System (RMS) was the result of a program conducted to obtain a multiple object tracking system There is now a family of such systems Each system utilizes the same basic concept and hardware to attain a multiple player tracking capability tailored to meet the needs of a particular test range The development of the first RMS is described and investigations which led to the construction of the RMS-2 are examined The first configuration of the RMS-2 is considered and the evolution of the early RMS-2 to its present RMS/SCORE configuration is discussed The RMS/SCORE is flexible and adaptable by the choice of software control It has tracked aircraft, helicopters, troops, and tanks G R

A77-51188 History and development of the SCORE pod P F Hughes (System Planning Corp , Arlington, Va) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 77-80

The Simulated Combat Operations Range Equipment (SCORE) whose development was sponsored by the Deputy Director of Defense Research and Engineering for Test and Evaluation, ODDR&E(T&E), uses an inertial navigation system to provide accurate tracking of high-performance aircraft The system operates as an adjunct to the multilateration tracking system, RMS-2 A flight test in November 1973 demonstrated the potential capability of the SCORE system A test in December 1974 indicated that the accuracy of the RMS/SCORE system approached predictions, but further development of the system was needed A field acceptance test of three SCORE pods, conducted in June-July 1976, showed that tracks of pairs of pods on an aircraft differed by 10 to 15 ft in position, 5 to 10 ft/sec in velocity and 1 to 2 deg in attitude The RMS/SCORE Accuracy Test, initiated in the Summer of 1976, is designed to measure the accuracy of this system as a function of the vehicle-to-system geometry, hardware and software configuration, and the physical environment (Author)

A77-51189 Navigation checkpointing with forward-sensed, fixed-range terrain profiles G E Carlson, G L Bair, and C M Benoit (Missouri-Rolla, University, Rolla, Mo) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 81-88 Navy-supported research

A method for automatic identification of navigation checkpoints is presented It uses terrain elevation profiles sensed at a fixed range with a forward-looking, azimuth-scanning radar These profiles are compared with stored reference profiles to identify the aircraft position The comparison concept and system implementation are discussed The results of system analysis performed by digital simulation are shown These results establish the theoretical feasibility of the system and indicate system parameter selections, limits on allowable profile errors, and the effect of aircraft altitude errors Results are presented for a range of terrain roughnesses to indicate the effect of this parameter (Author)

A77-51190 Advanced terrain correlation techniques P R Hinrichs (E-Systems, Inc , Dallas, Tex) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 89-96

The requirements for an ideal positioning system are enumerated and compared with terrain correlation systems Models for terrain and performance characteristics are introduced Properly implemented, a terrain correlation system can be very accurate and tolerate large navigational uncertainties prior to the update Error estimates are made for state-of-the-art components and reference source data, and predictions using the performance models and these error characteristics indicate that accuracies rivaling optical systems can be achieved (Author)

A77-51192 Tactical and long-range navigation in the AN/ARN-101/V/ T E Perfitt and F E Pickel (Lear Siegler, Inc ,

Grand Rapids, Mich) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 116-121 USAF-supported research

The AN/ARN-101 provides a navigation subsystem with a high degree of accuracy, flexibility, and expansion capability which, in turn, is the basis for accurate reconnaissance and weapon delivery operation in the RF-4C and F-4E aircraft The navigation, position locating, and position updating capability utilizes a digital inertial measurement unit, Loran, fire-control radar, Pave Tack, TISEO, and optical sight interfaces A multisensor implementation of offset target location and coordinate computation is utilized to update the navigation position, and to provide information to the tactical problem The prime navigation mode is an integrated Loran-inertial implementation utilizing an 8-state Kalman filter and a secondary phase correction algorithm to minimize navigation errors associated with Loran Outputs are provided in latitude/longitude, Universal Transverse Mercator (UTM), and Loran Time Difference (TD) coordinates The computation subsystem was designed with spare memory and execution time to handle additional sensors as they are applied to the ARN-101 (Author)

A77-51195 Air Combat Maneuvering Range/Instrumentation 'ACMR/I' G W Eaton (Cubic Corp , San Diego, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 141-148

The instrumentation system described provides real-time attitude and position data on eight high-dynamic fighter aircraft and position data on 12 additional cooperative targets Position data is derived from multilateration range measurements using FM-CW phase-comparison techniques Attitude and acceleration data is obtained from a strap-down inertial system initialized by the ranging system Digital data is transmitted to and from the target by frequency shift keying of the ranging carrier A multiprocessor ground computer using Kalman filter techniques provides a total state vector for each participant at a rate of 10 per second The multiprocessor also provides real-time missile simulation for performance scoring The Display and Debriefing Subsystem provides real-time computer-drawn pseudo three-dimensional display of the aircraft, total replay capability, and control of the entire system from the operator's console (Author)

A77-51196 Precise positioning of sonobuoys using AME and DME techniques R W H Keller (Cubic Corp , San Diego, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 149-156

The Sonobuoy Reference System (SRS) described is a new technique in antisubmarine warfare This system, flown by the Navy in S-3A and P-3C aircraft, allows precise electronic location of enemy submarines Sonobuoys are dropped in the area of a suspected submarine, and SRS allows display of its location relative to the sonobuoys Based on phase-comparison techniques, the system determines the angles between aircraft and sonobuoys by measuring the phase difference between a signal arriving at two antennas Slant range is determined by measuring the phase delay of a signal transmitted from the aircraft through the sonobuoy and retransmitted back to the aircraft Self-calibration, data processing (including Kalman filtering), and other system applications are also described (Author)

A77-51197 Aircraft Space Position Measurement System - An application of precision DME E Herzberg (Cubic Corp , San Diego, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1 3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p. 157-163

The Aircraft Space Position Measurement System (ASPMS) is a USAF omnidirectional tracking system designed and produced for the 4950th Test Wing at Wright Patterson AFB, Ohio This system consists of two airborne interrogators, five transponders, a master site, and a ground relay station Rectangular and spherical coordinates of the aircraft are computed from multiple slant-range data furnished by distance-measuring equipment and a barometric altitude transducer Coordinates are provided in near real-time to the aircraft and to a laser tracking system for use in acquisition ASPMS has a range of 100 miles and a position-fixing accuracy of plus or minus 25 ft in the x- and y-directions, and plus or minus 50 ft in the z-direction (Author)

A77-51198 An application of Omega as a sensor R Brown and G Brohaugh (Northrop Corp , Electronics Div , Palos Verdes Peninsula, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 169-176

A hybrid navigation system, for use on the USAF E-3A Airborne Warning and Control System, is described The system consists of dual inertial navigation systems aided by both Doppler radar and Omega navigation equipment The primary objective is to provide attitude, heading, velocity, and position information with a very high probability of mission success Both bounded position accuracy (a one-mile standard deviation) and inflight alignment of the inertial navigators make Omega a logical choice as one of the prime sensor subsystems The system that resulted from this effort provides both ground and inflight alignment of both inertial navigation systems Inflight alignment has been achieved using Doppler radar and Omega together, Doppler radar alone, and Omega alone This paper discusses design and performance features of the system, addresses system-level considerations, and provides flight-test data (Author)

A77-51199 An integrated marine navigation system J M Nash (Orincon Corp , La Jolla, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 177-183 6 refs

Optimal integration of four marine navigation sensor subsystems is achieved using a seven-state, extended Kalman filter A surface ship's gyrocompass, electromagnetic speed (EM) log, Omega radio navigation receiver, and a Navy Navigation Satellite System (NNSS) receiver are used to obtain position and velocity measurements for input to a seagoing navigation system Linearized error models are developed for each sensor subsystem and used in a covariance analysis of the integrated system Maneuvers, failure modes, and potential computational simplifications are modeled and analyzed Error budget sensitivity analyses are performed to ascertain the time-varying effects of various error sources on system accuracy The result of the error modeling, covariance analyses and experiments with computational modifications is a best, suboptimal, filter design which is recommended for onboard multisensor integration of navigation sensors (Author)

A77-51200 Loran-C data acquisition and handling for improved accuracy D J Granato (Defense Mapping Agency, Hydrographic Center, Washington, D C) and B J Uttam (Analytic Sciences Corp , Reading, Mass) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 184-188 7 refs

The design of a Loran-C data handling system for navigation is presented, noting the force-fit algorithm, which has the potential to improve accuracy (dependent on wave propagation time) by reducing errors between theoretical and empirically-derived additional secondary phase (ASF) factors The primary elements of the Loran-C data acquisition system are described along with procedures for data handling, processing, and storage at a centralized facility The techniques are designed to generate improved ASF corrections, and thus improve general system accuracy S C S

A77-51201 **Clarinet Pilgrim - Communications using Loran-C** W N Dean (Magnavox Government and Industrial Electronics Co , Fort Wayne, Ind) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 190-195

The Clarinet Pilgrim system, presently operational in the Northwest Pacific Loran-C chain, is used to transmit communications using pulse position modulation of some of the pulses from each Loran station The position shifts are randomized to prevent timing errors A theoretical analysis predicts that the effects on navigation receivers, both linear and hard-limiting, should be negligible A series of controlled tests was made to determine the effects of modulation on hard-limiting receivers The results show the effects to be truly negligible (Author)

A77-51202 **The GPS Control Segment and its service to the GPS User** M J Hurley, D D Thornburg (General Dynamics Corp , Electronics Div , San Diego, Calif), and J L Kramer (General Dynamics Western Data Service Center, San Diego, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 196-202 DOD-sponsored research

Phase I of the GPS navigation satellite effort is to evaluate the performance of User receiving equipment Phase I is composed of six satellites, a ground Control Segment, and User equipment The purpose of this paper is to describe how the Control Segment supports the User equipment testing effort The Control Segment generates the data required by the User to obtain a navigation solution, uploads this data into the satellite processor for transmission to the User, and collects the satellite ranging data required to determine the satellite ephemeris and clock performance parameters The Control Segment software mechanization to perform these functions is a file-based, multi tasked architecture This architecture and its legacy to future phases of GPS are also described (Author)

A77-51203 **The Inverted Range GPS User test facility** R L Harrington and J T Dolloff (General Dynamics Corp , Electronics Div , San Diego, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 204-211

The Inverted Range will supply four ground-based simulated GPS satellite signals at Yuma Proving Ground for testing of GPS receivers The ground transmitters can operate independently or in synchronization with the satellites as they become available The four ground transmitters are remotely controlled by the Inverted Range Control Center, which is equipped with a GPS receiver for monitoring both ground transmitter and satellite signals The simulated satellite signals use four of the available 36 PRN codes to be used by GPS but differ from the satellites in that only the L1 signal is supplied The navigation message contents are necessarily different, although the word/subframe/frame lengths and parity scheme are the same Both code phase and frequency of the ground transmitter signals are controlled The code phase is controlled with a resolution of about 1 5 nanoseconds, and the ground transmitter signals are predicted to have an accuracy of a few nanoseconds The signals will be radiated with hemispherical coverage at a power level selectable between -30 and +30 dBm (Author)

A77-51204 **JTIDS - An overview of the system design and implementation** R Dell-Imagine (Hughes Aircraft Co , Ground Systems Group, Fullerton, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 212 215

The Joint Tactical Information Distribution System (JTIDS) is a time-division multiple access communications system designed to operate in the 960-1215 MHz band of the Tactical Air Navigation System (TACAN) and provide a secure antijam data link to operate in the tactical environment of the 1980's This paper summarizes the operation of JTIDS and the design of JTIDS terminals by Hughes Ground Systems under subcontract to Boeing for its E-3A program The network architecture, waveform characteristics, coding, and network synchronization methods are examined A summary of TACAN compatibility analyses and tests is given Finally, the partitioning of the E-3A hardware is described (Author)

A77-51205 **Principles, simulation results and interoperability of JTIDS relative navigation** W R Fried (Hughes Aircraft Co , Fullerton, Calif) In Position Location and Navigation Symposium, San Diego, Calif , November 1-3, 1976, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1976, p 216-222

The time-synchronous operation and high accuracy time-of-arrival measurement capability of JTIDS terminals makes possible a high performance relative navigation (RELNAV) capability through addition of only a software module to the JTIDS communication terminal computer program Each member of a JTIDS community determines his own position, velocity and time bias through sequential passive time-of-arrival measurements on the signals received from the other members in the net, using appropriate source selection criteria, a recursive (e g , Kalman) filter mechanization and extrapolation with dead reckoning data Infrequent active round-trip-timing is used by some units to maintain very high time quality The derived navigational information is either with respect to a relative grid, whose origin and direction are arbitrarily established by one member, or with respect to absolute, geographic coordinates Computer simulation results have demonstrated the high accuracy performance capability of the RELNAV concept for a variety of mission scenarios (Author)

A77-51261 * **Proving the correctness of a flight-director program for an airborne minicomputer** W D Maurer (George Washington University, Washington, D C) *(Association for Computing Machinery, Interface Meeting on Programming Systems in the Small Processor Environment, New Orleans, La , Mar 4-6, 1976) ACM SIGPLAN Notices,* vol 11, Apr 1, 1976, p 103-108 NSF Grant No DCR 73-03431-A01, Grant No NsG 1170

Program verification procedures are described and used to determine the correctness of a program written for an airborne computer The basic method relies on the inductive assertion method of Floyd (1967), modified and extended for application to a machine-language situation Correctness considerations in the flight director program include self-modification, system correctness, executable instructions, overflow, approximate calculations with fractional quantities, and fixed point scaling An example proof of correctness, which proceeds by proving the correctness of a certain subroutine, is provided M L

A77-51276 # **Electronic systems for air traffic control (Radiotekhnicheskie sredstva upravleniia vozdushnym dvizheniem)** V A Boldin *Itogi Nauki i Tekhniki, Seriia Radiotekhnika,* vol 10, no 1, 1976, p 5-103 36 refs In Russian

Various methods, employing electronic systems for air traffic control, are described, including Tacan, Loran, DF, VOR, ILS, MLS, and DABS Onboard systems for collision avoidance are presented (noting the criteria used for their design and testing) such as EROS II, AVOIDS, and SECANT Landing systems are discussed including those using amplitude scanning of antenna radiation patterns, systems employing the Doppler effect, and a comparison of systems using the Doppler effect, amplitude scanning, and a method of active interferometry S C S

A77-51277 # **Radar systems with phased-array antennas (Radiolokatsionnye sistemy s fazirovannymi antennymi reshetkami)** N T Vasilenko *Itogi Nauki i Tekhniki, Seriia Radiotekhnika,* vol 10, no 1, 1976, p 104-223 59 refs In Russian

Design principles for radar systems with phased-array antennas are described, including electronic beam control A classification

table of types of phased-array antennas is presented, noting the advantages and deficiencies of each Noise immunity of radar systems with phased-array antennas is discussed along with the criteria for its evaluation Techniques for sidelobe reduction are outlined, and descriptions of adaptive radar stations and radar stations using matched systems are included Suggestions are given for using radar systems with phased-array antennas for ground-based, shipboard, and airborne functions S C S

A77-51351 Automatic systems check-out *Aviation Engineering and Maintenance,* vol 1, Sept 1977, p 22-24, 39, 40

Components of the USAF Central Integrated Test (CITS) automatic built-in testing system are described in detail The CITS control and display panel is reproduced, and test display modes are listed, with identification codes CITS software options are enumerated in brief Descriptions are provided of the data bus, plug-in interface unit, data acquisition units (strategically located through the aircraft), computer-controlled airborne strip printer (furnishing hard copy on failures and fault isolation data to aid maintenance), and maintenance recorder (writing logistics information and ground analysis of difficult failures onto magnetic tape) The CITS system was designed for a B-1 prototype R D V

A77-51352 CF6 engine designed for maintenance *Aviation Engineering and Maintenance,* vol 1, Sept 1977, p 25-27, 48

Redesign of the CF6 bypass turbofan engine family and engine components for maintainability is described Improved maintainability is manifested in three areas enhanced inspection accessibility, easy rapid removal and replacement of engine parts, and modular construction of basic components Data on shop visit rates, inflight shutdown rates, and unscheduled removal rates for the CF6 and comparable engines are provided Fan, high-pressure compressor, low-pressure turbine, combustor/high-pressure turbine, and gearbox are individually replaceable modules Transportability of the entire engine assembly and of modular parts is described Inspection ports for borescopes and their use are discussed R D V

A77-51353 Airframe composite materials B Walsh *Aviation Engineering and Maintenance,* vol 1, Sept 1977, p 37, 38

Advantages of composite materials for airframe parts fabrication, types of composites and their salient properties, composites development and applications programs sponsored by USAF, US Navy, and NASA, and barriers to acceptance of composites in the industry are discussed briefly To date, use of composites has become common only in secondary structures (spoilers, fairing panels, control surfaces) and some medium primary structures (horizontal tail in B-737, vertical fin in DC-10 and L-1011) Weight savings and fuel savings with no loss in strength or service life, and lower costs with increasing acceptance and production and rising overall materials costs, are cited R D V

A77-51354 Eight-channel resolver simplifies digital flight controls J Munn (Micro Networks Corp, Worcester, Mass) *Aviation Engineering and Maintenance,* vol 1, Sept 1977, p 41-43, 63

A compact eight-channel resolver-to-digital converter (R/DC) is presented for use in digitally adaptive flight control systems Eight resolver channels can be processed sequentially on a single 6 by 9 in module, for improved continuous automatic monitoring and correction of slight changes in attitude, pitch, yaw, and improved stability and compensation of aircraft with smaller stabilizers and increased wing area A combination of highly stable thin film resistors, dual-in-line hybrid circuits, and ICs incorporating microprocessor and memory in a compact package offer cost, space, and accuracy advantages, with elimination of staleness error Operating principles of the R/DCs are discussed R D V

A77-51460 A mathematical model of transcontinental balloon C D La Padula and C F Polcaro (CNR, Laboratorio di Astrofisica Spaziale, Frascati, Italy) *International Astronautical Federation, International Astronautical Congress, 28th, Prague, Czechoslovakia, Sept 25-Oct 1, 1977, Paper 77-167* 22 p 6 refs

The general features of a mathematical model of intercontinental stratospheric balloon flight that takes into consideration the sunrise-sunset effect, outgassing, and balloon pressurization, are described The computer program is based on both adiabatic formulas and step-by-step temperature variations A ballast release logic optimized for best possible altitude stabilization and minimum ballast consumption was verified on model runs P T H

A77-51600 Computer studies of swirl flows in Carnot diffusors (Rechnerische Untersuchungen von Drallstromungen in Carnotdiffusoren) M Acrivellis (Karlsruhe, Universitat, Karlsruhe, West Germany) *Forschung im Ingenieurwesen,* vol 43, no 5, 1977, p 159-163 5 refs. In German

The calculation of the static pressure rise and the stagnation pressure drop for single-stage Carnot diffusors with swirl flow is carried out with the aid of a computational modes based on measurement results, and calculated values are compared with experiment The computed velocity trend and static pressure trend are in agreement with the experimentally determined ones, but the measured stagnation pressure is well below the calculated one The reason for this is seen mainly in the appearance of vortex instabilities in the boundary layer of the swirl flow P T H

A77-51608 # Conditions of physical validity in the linear aerodynamics of supersonic jets (Conditii de validitate fizica in aerodinamica liniara a jeturilor supersonice) C Iacob (Bucuresti, Universitatea, Bucharest, Rumania) *Studii si Cercetari Matematice,* vol 29, Sept -Oct 1977, p 507-519 5 refs In Rumanian

The theory of plane supersonic jets expanding in the atmosphere has been recently studied (Jacob, 1975) and an extension of the Prandtl formula has been obtained The formulae connect the length of the first wave to the mean diameter of the jet function of the pressure at the nozzle In the present paper the physical validity conditions of these formulae have been analyzed and numerical results are presented J M B

A77-51610 # Queues with delayed, probabilistic feedback as a model of air traffic control communications W W Bundy and W C Giffin (Ohio State University, Columbus, Ohio) *Operations Research Society of America and Institute of Management Sciences, Joint National Meeting, Miami, Fla , Nov 3-5, 1976, Paper* 23 p 8 refs

The availability of aids to navigation and air traffic control facilities is one of the factors which determine the ultimate capacity of an airfield An investigation is conducted of the air traffic controller availability to pilots who need to engage in voice communications with the controller The investigation makes use of a model for the description of the communication network and the measurement of its performance The feedback model employed is examined The model utilizes the numerical techniques for solving finite systems of linear differential equations with constant coefficients first proposed by Koopman (1972) Attention is given to approaches for modeling the probability of feedback, the definition of the probability state vector, the queue statistics calculated from the numerically determined time-varying probability distribution, and the results of a statistical analysis of voice communications G R

A77-51613 # Estimation of helicopter performance by an extended energy method improved by flight tests K Sanders (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Flugmechanik, Braunschweig, West Germany) *Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 2nd, Buckeburg, West Germany, Sept 20-22, 1976, Paper* 13 p. 8 refs

This paper presents a useful method for obtaining heclopter performance data Only minimal flight test data is required and the method does not require excessive computer time The estimation of

helicopter performance by the energy method yields good results for medium forward speeds The energy-method has been extended to also include hovering, low speed, and high speed flight It was found that only a small number of flight test data points are needed to obtain the required correction factors These factors cover effects which are not considered in the simple downwash model, take into account ground effect influences, and correct for power losses caused by compressibility effects Results computed using the expanded method were compared with flight test data for five different helicopters Calculated results agreed closely with experimental results when flight test data of sufficient accuracy was used (Author)

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STAR ENTRIES

N77-32079*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

DETERMINING THE LIFT AND DRAG DISTRIBUTIONS ON A THREE-DIMENSIONAL AIRFOIL FROM FLOW-FIELD VELOCITY SURVEYS

Kenneth L Orloff May 1977 75 p

(NASA-TM-73247 A-7062) Avail NTIS HC A04/MF A01 CSCL 01A

The application of the incompressible momentum integral equation to a three-dimensional airfoil was reviewed to interpret the resulting equations in a way that suggests a reasonable experimental technique for determining the spanwise distributions of lift and drag Consideration was given to constraints that must be placed on the character of the vortex wake structure shed by the wing to provide the familiar relationship between lift and bound vorticity It is shown that the induced drag distribution is not directly measurable, but can be obtained via the lift distribution approximately for a deflected wake and exactly for a planar wake Moreover it is shown that it is only necessary to survey a short distance above and below the wing trailing edge Examples are presented for several typical loading distributions and the results of a numerical simulation of the suggested experiment are discussed Author

N77-32080*# National Aeronautics and Space Administration Hugh L Dryden Flight Research Center, Edwards Calif

BUFFET CHARACTERISTICS OF THE F-8 SUPERCRITICAL WING AIRPLANE

V Michael DeAngelis and Richard C Monaghan Sep 1977 30 p refs

(NASA-TM-56049 H-945) Avail NTIS HC A03/MF A01 CSCL 01A

The buffet characteristics of the F-8 supercritical wing airplane were investigated Wing structural response was used to determine the buffet characteristics of the wing and these characteristics are compared with wind tunnel model data and the wing flow characteristics at transonic speeds The wingtip accelerometer was used to determine the buffet onset boundary and to measure the buffet intensity characteristics of the airplane The effects of moderate trailing edge flap deflections on the buffet onset boundary are presented The supercritical wing flow characteristics were determined from wind tunnel and flight static pressure measurements and from a dynamic pressure sensor mounted on the flight test airplane in the vicinity of the shock wave that formed on the upper surface of the wing at transonic speeds The comparison of the airplane s structural response data to the supercritical flow characteristics includes the effects of a leading edge vortex generator Author

N77-32081*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va

AERODYNAMIC CHARACTERISTICS AT MACH NUMBERS FROM 0 6 TO 2 16 OF A SUPERSONIC CRUISE FIGHTER CONFIGURATION WITH A DESIGN MACH NUMBER OF 1 8

Barrett L Shrout Washington Sep 1977 79 p refs

(NASA-TM-X-3559 L-11604) Avail NTIS HC A05/MF A01 CSCL 01A

An investigation was made in the Langley 8-foot transonic tunnel and the Langley Unitary Plan wind tunnel over a Mach number range of 0 6 to 2 16 to determine the static longitudinal and lateral aerodynamic characteristics of a model of a supersonic-cruise fighter The configuration which is designed for efficient cruise at Mach number 1 8 is a twin-engine tailless arrow-wing concept with a single rectangular inlet beneath the fuselage and outboard vertical tails and ventral fins It had untrimmed values of lift-drage ratio ranging from 10 at subsonic speeds to 6 4 at the design Mach number The configuration was statically stable both longitudinally and laterally Author

N77-32082*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio

COLD-AIR PERFORMANCE OF A 12 766-CENTIMETER-TIP-DIAMETER AXIAL-FLOW COOLED TURBINE 3 EFFECT OF ROTOR TIP CLEARANCE ON OVERALL PERFORMANCE OF A SOLID BLADE CONFIGURATION

Jeffrey Haas (Army Air Mobility Research and Development Lab Cleveland Ohio) and Milton G Kofskey Sep 1977 24 p refs

(NASA-TP-1032 E-9181) Avail NTIS HC A02/MF A01 CSCL 01A

Two tip clearance configurations one with a recess in the casing and the other with a reduced rotor blade height were investigated at design equivalent speed over a range of tip clearance from about 2 0 to 5 0 percent of the stator blade height The optimum configuration with a recess in the casing was the one where the rotor tip diameter was equal to the stator tip diameter (zero blade extension) For this configuration there was an approximate 1 5 percent decrease in total efficiency for an increase in tip clearance of 1 percent of stator blade height For the reduced blade height configurations there was an approximate 2 0 percent decrease in total efficiency for an increase in tip clearance of 1 percent of stator blade height Author

N77-32083*# National Aeronautics and Space Administration Langley Research Center Langley Station Va

EFFECT OF ROTOR WAKE ON AERODYNAMIC CHARACTERISTICS OF A 1/6 SCALE MODEL OF THE ROTOR SYSTEMS RESEARCH AIRCRAFT

Raymond E Mineck (US Army Air Mobility Research and Development Lab Langley Va) Washington Sep 1977 120 p refs

(DA Proj 1L1-61102-AH-45)

(NASA-TM-X-3548 L-11515) Avail NTIS HC A06/MF A01 CSCL 01A

Tests were conducted in the Langley V/STOL tunnel to determine the effect of the main-rotor wake on the aerodynamic characteristics of the rotor systems research aircraft A 1/6-scale model with a 4-blade articulated rotor was used to determine the effect of the rotor wake for the compound configuration Data were obtained over a range of angles of attack, angles of sideslip, auxiliary engine thrusts rotor collective pitch angles and rotor tip-path plane angles for several main-rotor advance ratios Separate results are presented for the forces and moments on the airframe the wing and the tail An analysis of the test data indicates significant changes in the aerodynamic characteristics The rotor wake increases the longitudinal static stability the effective dihedral, and the lateral static stability of the airframe The rotor induces a downwash on the wing This downwash decreases the wing lift and increases the drag The asymmetrical rotor wake induces a differential lift across the wing and a subsequent rolling moment These rotor induced effects on the wing become smaller with increasing forward speed Author

N77-32084# Naval Postgraduate School Monterey Calif

DATA REDUCTION FOR THE UNSTEADY AERODYNAMICS ON A CIRCULATION CONTROL AIRFOIL M S Thesis

Mar 1977 63 p refs

(AD-A041153) Avail NTIS HC A04/MF A01 CSCL 20/4

Calculating the lift drag and pitching moment coefficients for an airfoil from the static pressure distribution obtained from wind tunnel tests is a routine task when steady flow is considered but it is much more complicated when the airfoil is operating in

an unsteady flow field, similar to that experienced by a helicopter rotor blade, produced by an oscillating wind tunnel A data reduction routine capable of condensing the large numbers of data associated with the unsteady investigation, as well as a numerical integration algorithm for the unsteady aerodynamic coefficients, were developed, however, no unsteady data were collected due to hardware failures The ability of the program was demonstrated on previously obtained steady and quasi-steady data and sample results were presented Author (GRA)

N77-32085# Armament Development and Test Center, Eglin AFB, Fla

TRANSONIC PRESSURE DISTRIBUTION ON AN AIRCRAFT WING MODEL DURING ROCKET SLED RUNS Final Report

Hans Rasmussen Mar 1977 73 p refs
(AD-A041633, ADTC-TR-77-34) Avail NTIS HC A04/MF A01 CSCL 20/4

Hardware and techniques are described which were used in a series of rocket sled runs aimed at measuring aerodynamic data in the transonic speed regime during rocket sled runs During these tests surface pressure distribution was measured on an aircraft wing model mounted in vertical position on a rocket sled at Mach numbers between zero and Mach 0 95 and at Reynolds numbers (based on cord length) up to 23 millions The data were collected while sweeping the entire Mach number range both during acceleration and during deceleration Selected data obtained in this test series are presented and compared with wind tunnel and flight test results The influence of time delay in the pressure tubing is discussed and methods for compensating for this effect are presented Author (GRA)

N77-32090# Bolt, Beranek and Newman, Inc , Cambridge Mass

A GUIDE FOR ESTIMATION OF AEROACOUSTIC LOADS ON FLIGHT VEHICLE SURFACES, VOLUME 1 Final Report, Jan 1975 - Jul 1976

Eric E Ungar John F Wilby, Donald B Bliss B Pinkel and A Galaitsis Wright-Patterson AFB, Ohio AFFDL Feb 1977 207 p refs
(Contract F33615-75-C-3017)
(AD-A041198 BBN-3215-Vol-1, AFFDL-TR 76-01-Vol-1) Avail NTIS HC A10/MF A01 CSCL 20/1

A compilation is presented of the best available methods for estimating the magnitudes, spectra and correlations of pressures that act on the surfaces of flight vehicles due to propulsion and powered lift systems, surface flows and armament Author (GRA)

N77-32091# Advisory Group for Aerospace Research and Development Paris (France)

SPECIAL COURSE ON CONCEPTS FOR DRAG REDUCTION

Jun 1977 294 p Presented at an AGARD Special Course at the von Karman Inst Rhode-St-Genese, Belgium, 28 Mar 1 Apr 1977
(AGARD-R-654 ISBN-92-835-1247-2) Avail NTIS HC A13/MF A01

The results of aerodynamic research and development in aircraft design to reduce drag, boundary layer control, and optimization of gas turbine intake system are evaluated in relation with fuel consumption

N77-32092*# National Aeronautics and Space Administration Langley Research Center Langley Station Va

AN OVERVIEW OF CONCEPTS FOR AIRCRAFT DRAG REDUCTIONS

Jerry N Hefner and Dennis M Bushnell *In* AGARD Spec Course on Concepts for Drag Reduction Jun 1977 30 p refs

Avail NTIS HC A13/MF A01 CSCL 01A

A current overview of aerodynamic drag reduction concepts which have potential for reducing aircraft fuel consumption is presented The discussion shows where the greatest percentages of aircraft fuel is burned and what areas have the greatest potential for fuel conservation The paper deals with aerodynamic improvements and touches only briefly on structural and propulsion improvements Concepts for reducing pressure drag (i e roughness wave interference and separation drag) drag due to lift/induced drag and skin-friction drag at subsonic and supersonic speeds are emphasized Author

N77-32093*# National Aeronautics and Space Administration Langley Research Center Langley Station Va

METHODS FOR REDUCING SUBSONIC DRAG DUE TO LIFT

R T Whitcomb *In* AGARD Spec Course on Concepts for Drag Reduction Jun 1977 17 p refs

Avail NTIS HC A13/MF A01 CSCL 01A

The results of repeat experimental research on methods for reducing subsonic drag due to lift are discussed The NASA supercritical airfoils and their application to structurally practical wings with increased aspect radio are described A design approach and experimental results for wing-tip-mounted winglets are presented Several methods for utilizing the thrust of jet engines to provide reductions in the drag due to lift are also discussed Author

N77-32101# DOD Aircraft Ground Fire Suppression and Rescue Office, Wright-Patterson AFB, Ohio

DESIGN OF A CASCADE FIRE APPARATUS FOR TESTING COUNTERMEASURE EFFECTIVENESS Final Report, Jan - Jun. 1976

S Wiersma R S Alger, R G McKee, and W H Johnson Jun 1976 51 p refs
(AD-A043176, DOD-AGFSRS-76-7) Avail NTIS HC A04/MF A01 CSCL 13/12

A cascade fire apparatus was designed to be used in the evaluation of agent effectiveness and application techniques in suppressing accidental aircraft ground fires involving fuels which are cascading, spraying, or pouring The apparatus provides for (1) a controllable burning rate (2) a reproducible fire, (3) a flame geometry that minimizes wind effects, and (4) an adjustable size by virtue of its modular nature One of the two fuel supply nozzling options yields a smokeless fire, however the other option has better fire characteristics for evaluating some of the countermeasures Suppression tests were conducted using PKP and Monnex dry chemical agents and gaseous Halon 1211 It was not possible to compare the effectiveness of Halon 1211 and the powder agents because of the different application rates and capacities of the extinguishers tested and therefore the different required fire size The apparatus appeared to be well suited for evaluation of agent effectiveness against the kinematic fires and also for training firemen in fighting these fires Author (GRA)

N77-32102# National Transportation Safety Board Washington, D C Bureau of Technology

BRIEFS OF ACCIDENTS INVOLVING AIR TAXI OPERATIONS, US GENERAL AVIATION, 1975

1975 130 p
(PB-267653/4, NTSB-AMM-77-10) Avail NTIS HC A07/MF A01 CSCL 01B

Forty-three commuter air carrier and 157 on-demand air taxi accident briefs are reviewed The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident Additional statistical information on all air taxi accidents is tabulated by type of accident phase of operation, injury index aircraft damage, pilot certificate, injuries and causal/factor(s) GRA

N77-32103 Texas Univ , Austin

GLOBAL POSITIONING SYSTEM NAVIGATION ALGORITHMS Ph D. Thesis

Leonard Richard Kruczynski 1976 327 p
Avail Univ Microfilms Order No 77-11544

The passive-ranging concept of the system and the various hardware software and environmental factors which determine

system accuracy were examined The simulation of an aircraft flight with satellite range and range-rate measurements and with barometric altimeter measurements is used to numerically evaluate navigation algorithms The results show that accuracy is strongly dependent on user-satellite geometry An exponentially correlated random acceleration filter model for the aircraft, combined with measurement bias models, was incorporated into an extended Kalman filter Numerical results show that, for the basic filter model, filters which maintain good accuracy during the maneuvering phases of flight have poor performance during cruising flight and conversely, filters which perform well during cruise, have degraded accuracy during maneuvers Dissert Abstr

N77-32104*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

MULTIPLE CURVED DESCENDING APPROACHES AND THE AIR TRAFFIC CONTROL PROBLEM

Sandra G Hart (San Jose State Univ , Calif), Duncan McPherson (San Jose State Univ , Calif), John Kreifeldt (Tufts Univ Medford, Mass), and Thomas E Wemple Aug 1977 20 p refs (Grant NGL-05-046-002)

(NASA-TM-78430, A-7151) Avail NTIS HC A02/MF A01 CSCL 17G

A terminal area air traffic control simulation was designed to study ways of accommodating increased air traffic density The concepts that were investigated assumed the availability of the microwave landing system and data link and included (1) multiple curved descending final approaches, (2) parallel runways certified for independent and simultaneous operation under IFR conditions, (3) closer spacing between successive aircraft, and (4) a distributed management system between the air and ground Three groups each consisting of three pilots and two air traffic controllers flew a combined total of 350 approaches Piloted simulators were supplied with computer generated traffic situation displays and flight instruments The controllers were supplied with a terminal area map and digital status information Pilots and controllers also reported that the distributed management procedure was somewhat more safe and orderly than the centralized management procedure Flying precision increased as the amount of turn required to intersect the outer mark decreased Pilots reported that they preferred the alternative of multiple curved descending approaches with wider spacing between aircraft to closer spacing on single, straight in finals while controllers preferred the latter option Both pilots and controllers felt that parallel runways are an acceptable way to accommodate increased traffic density safely and expeditiously Author

N77-32105# Technische Universitaet, Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung

CONTRIBUTIONS TO THE EVALUATION OF THE GERMAN PROPOSAL DLS FOR A NEW MICROWAVE LANDING SYSTEM, PART 1 [BEITRAEGE ZUR ERPROBUNG DES DEUTSCHEN VORSCHLAGES DLS FUER EIN NEUES MIKROWELLEN-LANDESYSTEM, 1 TEIL]

Sep 1976 91 p refs Partly in GERMAN and ENGLISH 2 Vol

(TUBS/SFB58/M1-Pt-1) Avail NTIS HC A05/MF A01

Research projects in connection with the development and evaluation of the German proposal DLS (Distance measuring equipment-based Landing System) are presented Topics include multipath propagation, systems capacity, and anthropotechnical aspects

N77-32106# Technische Universitaet, Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung

SIMULATION OF THE MULTIPATH PROPAGATION OF DLS [SIMULATION DER MEHRWEGEAUSBREITUNG BEIM DLS]

H Ecklundt *In its* Contrib to the Evaluation of the Ger Proposal DLS for a New Microwave Landing System, Pt 1 Sep 1976 p 6-12 refs In GERMAN

Avail NTIS HC A05/MF A01

Multipath propagation aspects of the German proposal for DLS (Distance measuring equipment-based Landing System), i e , ground reflection building reflection aircraft reflection, diffuse reflection, and hump deviation were simulated As a basis for comparison, the MIT Lincoln Laboratory multipath simulation computer program was used The development of the program s multipath driver with MIT subroutines and model driver with model subroutines is described ESA

N77-32107# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung

MEASUREMENT OF THE MULTIPATH PROPAGATION AT THE BRUNSWICK TEST AIRPORT [MESSUNGEN DER MEHRWEGEAUSBREITUNG AUF DEM TESTFLUGHAFEN BRAUNSCHWEIG]

Peter Form and Springer *In its* Contrib to the Evaluation of the Ger Proposal DLS for a New Microwave Landing System, Pt 1 Sep 1976 p 13-27 In GERMAN

Avail NTIS HC A05/MF A01

A multipath instrument landing system was tested at Brunswick airport, Germany The Doppler shift between direct signal and reflected (building) system was used to separate the signals The tests were performed with a Piaggio aircraft flying at 10 m altitude The Doppler shifts of the direct and reflected signal (1011 MHz) were calculated Evaluation of the test data shows the technique to be promising ESA

N77-32108# Technische Universitaet, Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung

THE BRUNSWICK DLS TEST AIRPORT AREA - A NON CLEAN ENVIRONMENT

Peter Form Springer, and H Ecklundt *In its* Contrib to the Evaluation of the Ger Proposal DLS for a New Microwave Landing System, Pt 1 Sep 1976 p 28-37 Presented at the 6th AWOP Working Group A Meeting, The Hague 5-16 Jul 1976

Avail NTIS HC A05/MF A01

DLS-independent multipath measurements and multipath environment simulation of the Brunswick test airport were made The results show the rather strong multipath propagation conditions under which the DLS microwave landing system is being tested ESA

N77-32110 Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung

INFLUENCE OF THE MULTIPATH PROPAGATION ON THE DISTANCE MEASURING PART OF DLS [EINFLUSS DER MEHRWEGEAUSBREITUNG AUF DEN ENTFERNUNGSMESSTEIL DES DLS]

Busch *In its Contrib to the Evaluation of the Ger Proposal* DLS for a New Microwave Landing System Pt 1 Sep 1976 p 77-80 In GERMAN

Avail NTIS HC A05/MF A01

The influence of the multipath propagation on the distance measuring component of DLS was investigated by computer simulation The simulation program consisted of three phases calculation of the demodulated signal calculation of the time failures and reconstruction of the evaluation algorithm of the DLS distance measuring component Results of the simulation programs show that for a disturbed demodulated signal (DME-impulse) the signal curve remains Gaussian ESA

N77-32111# Technische Universitaet, Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung

PRESENTATION OF DLS INFORMATION

R Beyer *In its* Contrib to the Evaluation of the Ger Proposal DLS for a New Microwave Landing System, Pt 1 Sep 1976 p 81-84

Avail NTIS HC A05/MF A01

Displays of DLS information are discussed taking the advantages of DLS more flexible approach profiles new piloting

techniques and as a consequence advanced cockpit instrumentation into account It is concluded that the conventional cockpit instruments generally are adequate for the conventional approach with DLS and that DLS simplifies the design of flight dependent circuits (e g gain programmers) needed to process relative position information by providing absolute position information ESA

N77-32112# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
CONTRIBUTIONS TO THE EVALUATION OF THE GERMAN PROPOSAL DLS FOR A NEW MICROWAVE LANDING SYSTEM, PART 2 [BEITRAEGE ZUR ERPROBUNG DES DEUTSCHEN VORSCHLAGES DLS FUER EIN NEUES MIKROWELLENLANDESYSTEM, 2 TEIL]
Mar 1977 79 p refs Partly in GERMAN and partly in ENGLISH 2 Vol
(TUBS/SFB58/M2-Pt-2) Avail NTIS HC A05/MF A01

Research projects in connection with the development and evaluation of the German proposal DLS (Distance measuring equipment-based Landing System) are presented Topics include multipath propagation simulation, adjustable null-steering in elevation measurement improvements to the DLS system multipath immunity in mountainous sites and Salzburg scenario for multipath simulation tests

N77-32116# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
MULTIPATH IMMUNITY OF MLS IN MOUNTAINOUS SITES
Peter Form *In its* Contrib to the Evaluation of the Ger Proposal DLS for a New Microwave Landing System Pt 2 Mar 1977 p 55-66 refs Presented at the 7th AWOP Group A Meeting, London, Nov 1976

Avail NTIS HC A05/MF A01

The usability of microwave landing systems in mountainous regions is discussed Some examples of operational sites partly surrounded by mountains requiring curved approach or missed approach procedures are given Salzburg Airport and Hong Kong International Airport The immunity of DLS (Distance measuring equipment-based Landing System) in such environments a result of the pulse transmission, is described In addition to narrow angle focusing antennas, the used pulse technique generates elliptical characteristics in space which limits the space for transmission and eliminates multipath sources ESA

N77-32118# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
CIVIL TRANSPORT AIRCRAFT SHORT RANGE ALL-WEATHER FLIGHT [ALLWETTERFLUG ZIVILER TRANSPORTFLUGZEUGE IM NAHBEREICH]
Sep 1976 82 p refs In GERMAN
(TUBS/SFB58/FB1976) Avail NTIS HC A05/MF A01

Topics dealt with include flight path and aircraft position control, navigation and security systems instrumentation and human factors engineering

N77-32119# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
INTEGRATED PATH GUIDANCE SYSTEM FOR UNCONVENTIONAL APPROACH PROCEDURES [INTEGRIERTES BAHNFUEHRUNGSSYSTEM FUER UNKONVENTIONELLE ANFLUGVERFAHREN]
K H Doetsch and R Brockhaus *In its* Civil Transport Aircraft Short Range All-Weather Flight Sep 1976 p 7-28 refs In GERMAN
Avail NTIS HC A05/MF A01

Topics discussed include the hybrid computer system the simulation program, simulator extensions test evaluation, simulator tests, optimization of the multiparameter system, and application of characteristic frequency drift curves for the investigation of the breakdown security of flight control systems ESA

N77-32121# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
FLIGHT MECHANICAL PROBLEMS IN CONNECTION WITH THE INTERCEPTION PROCESS [FLUGMECHANISCHE PROBLEME BEIM ABFANGVORGANG]
K Wilhelm *In its* Civil Transport Aircraft Short Range All-Weather Flight Sep 1976 p 33-35 In GERMAN

Avail NTIS HC A05/MF A01

The influence of wind shearing on the flight path of an aircraft was investigated using hybrid computer EAI Pacer 600 simulation on the one hand and mathematical modeling on the other hand A program to optimize the interception and overshooting process by means of a digital computer program was initiated ESA

N77-32123# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
RECOGNITION AND ELIMINATION OF INTERFERENCE DISTURBANCES BY MODIFICATION OF THE RADIO FIELD OF LANDING SYSTEMS WITH SPATIAL MODULATION DEGREE DIAGRAMS [ERKENNUNG UND BESEITIGUNG VON INTERFERENZSTOERUNGEN DURCH MODIFIKATIONEN DES FUNKFELDES VON LANDESYSTEMEN MIT RAEUMLICHEN MODULATIONSGRADDIAGRAMMEN]
Westphal *In its* Civil Transport Aircraft Short Range All-Weather Flight Sep 1976 p 50-54 In GERMAN

Avail NTIS HC A05/MF A01

The influence of interference disturbed guidance signals on the behavior of a generalized airplane model in the approach phase was studied By means of a small tabletop calculator EAI-TR 10 with a capacity of 20 summing amplifiers 20 coefficient potentiometers, 12 integrating networks and a multiplier the approach of a Boeing 707-312 without autopilot was simulated It is shown that the simulation system has similar accuracies in the flight dynamics as the real approach system ESA

N77-32129# Martin Marietta Aerospace Denver Colo Denver Div
MICRON RELIABILITY ANALYSES Final Technical Report, Apr 1974 - Apr 1977
Richard W Burrows and Ray A Holtz Jun 1977 168 p
(Contract F33615-74-C-1107)
(AD-A042987 MCR-74-164 AFAL-TR-77-62) Avail NTIS HC A08/MF A01 CSCL 17/7

The purpose of the MICRON Reliability Analysis Program was for Martin Marietta Corporation (MMC) to assist the Air Force Avionics Laboratory to achieve a MICRON Inertial Navigation System that would exhibit a high reliability and provide a significantly reduced cost-of-ownership The approach used by MMC to help attain the specified program goals included, but was not limited to preparing a reliability program plan and reliability test plan, performing independent reliability analyses and assessments, preparing design guidelines, performing trade off studies developing reliability models supplying data, and monitoring testing GRA

N77-32131*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
VARIATION OF PITCHING MOMENT WITH ENGINE THRUST FOR A TWIN-ENGINE COMMERCIAL JET AIRCRAFT
Robert E Shanks Washington Sep 1977 15 p refs
(NASA-TM-X-3569 L-10984) Avail NTIS HC A02/MF A01 CSCL 01C

Flight tests were made to determine the effect of engine net thrust on airplane pitching moment for a twin-engine commercial jet transport in the approach climbout and descent and cruise configurations The results indicate that for all the conditions analyzed, the pitching moment due to thrust is somewhat higher than that estimated from the product of net thrust and its moment arm (perpendicular distance from thrust axis to the airplane center of gravity) The differences are attributed

to additional moments produced by nacelle normal force, jet-induced downwash and interaction between wing flow and engine nacelle flow Author

N77-32132# Coast Guard Washington D C
WIDE AREA ILLUMINATOR DEVELOPMENT FOR US COAST GUARD HH-3F HELICOPTER Final Report, Jul 1975 - Jan 1977
James E Perry, Thomas Cassidy, Clifton S Fox and Gertrude H Kornfeld Feb 1977 81 p Prepared by Army Night Vision Lab Fort Belvoir Va
(AD-A041425 USCG-D-30-77) Avail NTIS HC A05/MF A01 CSCL 13/1

A program to define and design a wide area illuminator to be used on the United States Coast Guard HH-3F search and rescue helicopters is described An explanation of the Night Vision Laboratory Computer search model and how it was used to select the optimum light source for the application is given Finally the completed purchase description and the test plan for use in evaluating the hardware when developed is presented It is anticipated that the first of the illuminators will be available for testing on aircraft during 1978 Author (GRA)

N77-32136# Kaman Aerospace Corp , Bloomfield, Conn
HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM Final Report, May 1974 - Feb 1977
Michael A Bowes Nicholas Giansante, Robert B Bossler, Jr and Alex Berman Jun 1977 156 p refs
(Contract DAAJ02-74-C-0039 DA Proj 1G2-62207-AH-89)
(AD-A042457 R-1495, USAAMRDL-TR-77-14) Avail NTIS HC A08/MF A01 CSCL 01/3

A combined analytical and test program has been performed to develop a method for analytically determining the vibration and noise characteristics of a helicopter transmission This effort included formulation of the necessary analytical method, validation of this method through direct comparison with test data, and use of the method to predict the effects of various transmission design changes The analytical method formulated in this program makes use of available techniques for predicting gear-mesh-induced excitations These techniques have been expanded to include a more rigorous treatment of spiral bevel and helical gear induced mesh excitations Response of the dynamic system is predicted using a coupled torsion and bending analysis of the gearshafts, and includes the effects of bearing and case dynamics Predicted case surface response is used directly to calculate radiated sound power GRA

N77-32140# California Univ Los Angeles Dept of Mechanics and Structures
AN OPTIMALITY CRITERIA APPROACH TO THE MINIMUM WEIGHT DESIGN OF AIRCRAFT STRUCTURES Interim Report, 1 Mar 1976 - 1 Mar 1977
M W Dobbs and R B Nelson Mar 1977 96 p refs
(Grant AF-AFOSR-2640-74)
(AD-A042759, UCLA-ENG-7731 AFOSR-77-0844TR) Avail NTIS HC A05/MF A01 CSCL 01/3

The research presented in this report is both a continuation and an extension of the optimality criteria approach to structural optimization reported in AFOSR-TR-75-1431 In the present study the optimality criteria method is extended to provide a capability for the automated minimum weight design of elastic redundant structures composed of one- and two-dimensional structural elements and subjected to multiple independent static loading conditions The design variables are taken to be the thicknesses of the structural elements These variables are constrained to be between specified maximum and minimum values as are the internal stresses in each element and the nodal displacements of the structure Results are presented to indicate both the excellent performance of the optimality criteria method and the wide range of structures which can be designed using the algorithm Finally, the algorithm is extended to include the new (to automated design) and very important requirement that structural integrity under the applied loads be maintained given the presence of existing structural fatigue cracks This requirement, which is cast in an energy format and incorporated in the design algorithm as an inequality constraint is shown to have a dominant effect in the design of safe minimum weight aircraft structures Author (GRA)

N77-32141# Defense Systems Management School, Fort Belvoir, Va
LIFE CYCLE COST REDUCTION TECHNIQUES ASSOCIATED WITH ADVANCED MEDIUM STOL TRANSPORT (AMST)
David R Forville May 1977 35 p refs
(AD-A042880) Avail NTIS HC A03/MF A01 CSCL 01/3

The report considers what factors have to be conceived developed, and evaluated in designing a transport aircraft system for introduction in the 1980 s The basic considerations are cost and the attempts made to reduce cost throughout the life cycle of the system AMST currently in the validation phase of its life cycle, is evaluated The parameters considered for cost reduction are range/payload cargo compartment size, operational field length, engine availability and crew size These tradeoffs are considered in arriving at a DTC goal The LCC reduction possibilities are considered separately The new concept of design to life cycle cost (DTLCC) is evaluated as a combination of DTC goals and LCC goals The Cost Analysis Cost Estimating (CACE) model is used as the evaluator of operating and support costs for the DTCC plan The results proved to be an overview of concepts versus hard facts because of the sensitive nature resulting from the upcoming source selection Author (GRA)

N77-32143# Bell Helicopter Co Fort Worth, Tex
ROTORCRAFT FLIGHT SIMULATION WITH COUPLED ROTOR AEROELASTIC STABILITY ANALYSIS VOLUME 3 PROGRAMMER'S MANUAL Final Technical Report
P Y Hsieh May 1977 84 p
(Contract DAAJ02-75-C-0025 DA Proj 1F2-62209-AH-76)
(AD-A042907 FTR699-099-022-Vol-3 USAAMRDL-TR-76-41C) Avail NTIS HC A05/MF A01 CSCL 09/2

This report consists of three volumes and documents the current version in the C81 family of rotorcraft flight simulation programs developed by Bell Helicopter Textron This current version of the digital computer program is referred to as AGAJ76 The accompanying program for calculating fully-coupled rotor blade mode shapes is called DN9100 Volume III, the Programmers Manual includes a catalog of subroutines and a discussion of programming considerations GRA

N77-32145# Texas Instruments Inc Dallas Equipment Group
SYSTEM AVIONIC ARCHITECTURES FOR RPVs Final Technical Report, 2 Feb - 2 Aug 1976
R Allen, L Chamberlin J Early J Graham, W Grimes E Karintis A Minnick and T Shipchandler Wright-Patterson AFB Ohio AFAL Apr 1977 203 p refs
(Contract F33615-76-C-1215)
(AD-A041502, AFAL-TR-76-245) Avail NTIS HC A10/MF A01 CSCL 01/3

Results are presented from a 6-month study to design an avionic digital processing system for the multi-mission Advanced Remotely Piloted Vehicle (ARPV) application The recommended approach is a microprocessor-based design consisting of a distributed processing network with modular processor/memory elements (PEs) interconnected via a MIL-STD-1553A data bus The objective was to design a digital processing system providing not only adequate performance for the anticipated ARPV missions but also the lowest possible life cycle cost (LCC) Three different processing systems were designed to meet performance requirements for specific postulated ARPV missions The total LCC for each candidate system was then estimated using a postulated 10-year life-cycle scenario The optimum design was selected on the basis of minimum LCC In addition to the minimum

LCC the recommended system also provides the best performance in terms of flight-critical reliability The extensive use of standard modules throughout the distributed network provides flexible system performance by allowing throughput capacity and/or memory capacity to be increased readily as processing requirements demand The use of standard modules is also important in achieving a low LCC Results from this study in particular the modular design of the basic PE are applicable not only to the ARPV problem but other Air Force avionic processing applications as well Author (GRA)

N77-32146# RAND Corp , Santa Monica Calif
AVIONICS DATA FOR COST ESTIMATING
Bruce E Armstrong Mar 1977 20 p Presented at the 1976 DoD Cost Analysis Symp Airlie, Va 14-17 Nov 1976
(AD-A043265, P-5745-1) Avail NTIS HC A02/MF A01 CSCL 01/3

Avionics cost has been a continuing problem to the defense cost analyst The various services and the Office of the Secretary of Defense (OSD) have sponsored numerous avionics data collection efforts as well as funding various companies to develop cost models and cost estimating relationships To mention a few both the Air Force and the Navy and research firms such as General Research Corporation (GRC), Research Management Corporation (RMC), and Institute for Defense Analyses (IDA) have all been involved at one time or another with efforts to develop the avionics cost estimation methods and a supporting data bank The reason for this level of effort is that the costs of avionics account for nearly 30 percent of the total costs of fighter aircraft and a significant amount in most other aircraft types Yet because of rapid technological change typically small production runs and poor historical cost information reliable prediction of avionics costs has been impeded This paper discusses a recent Rand study sponsored by OSD/Director of Planning and Evaluation (DP and E) which had the objective of creating an avionics data base for tactical aircraft GRA

N77-32147# Illinois Univ Urbana-Champaign Coordinated Science Lab
ON THE IMPORTANCE OF PROGRAM INTELLIGENCE TO ADVANCED AUTOMATION IN FLIGHT OPERATIONS Final Report, 23 Jul 1973 - 22 May 1976
Robert T Chien Wright-Patterson AFB Ohio Apr 1977 51 p refs
(Contract F33615-73-C-1238)
(AD-A042915 AFAL-TR-77-20) Avail NTIS HC A04/MF A01 CSCL 01/4

In today's sophisticated aircraft much emphasis has been placed on the acquiring of and the displaying to the pilot an ever increasing amount of information obtained during flight missions This has resulted in increased workloads for the pilot which force him to evaluate highly complex sets of input data to decide upon courses of action and then to implement those actions in minimal times Such a situation is seen as undesirable because it increases the pilot s chances for making errors which consequently lowers the probability of mission success In order to continuously provide low workloads and hence more safety for the pilot his crew and the aircraft itself, the Coordinated Science Laboratory has developed a system which relieves the pilot of having to deal with many situations which would detract from his overall mission goals This intelligent computer-aided decision making system (CADM) works cooperatively with the pilot in order to ensure the safety of the aircraft and its crew thereby allowing the accomplishment of successful missions GRA

N77-32148* National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
PLATFORM FOR A SWING ROOT TURBOMACHINERY BLADE Patent
Richard Ravenhall inventor (to NASA) (GE Cincinnati) Issued 30 Aug 1977 5 p Filed 3 Feb 1976 Sponsored by NASA
(NASA-Case-LEW-12312-1 US-Patent-4 045 149
US-Patent-Appl-SN-654787 US-Patent-Class-416-135
US-Patent-Class-416-190 US-Patent-Class-416-193A
US-Patent Class 416-241A) Avail US Patent Office CSCL 21E

A rotor apparatus comprising a blade having a root adapted to swing laterally within a supporting spindle under impact loading is provided with a flow path defining platform The platform comprises an inner shroud extending generally laterally of the blade airfoil portion and adapted to swing laterally In one embodiment wherein the blade primarily comprises a laminate of composite filament plies, the inner shroud is bonded to the laminate An outer shroud fixed with respect to the supporting spindle, forms a lateral extension of the inner shroud with the blade in its normal operating position The inner and outer shrouds are provided with a pair of complementary adjacent surfaces contoured to pass in relatively close-fitting relationships to each other when the blade swings under impact loadings
Official Gazette of the U S Patent Office

N77-32154*# National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
EFFECT OF SLOTTED CASING TREATMENT WITH CHANGE IN REYNOLDS NUMBER INDEX ON PERFORMANCE OF A JET ENGINE
John E Moss Jr and Willis M Braithwaite Sep 1977 19 p refs
(NASA-TP-1058 E-9185) Avail NTIS HC A02/MF A01 CSCL 21E

A tip-treated J85-13 engine was tested at Reynolds number indices (RNI) of 0 3 and 0 7 with a clean inlet for 80 and 100-percent corrected engine speeds This engine was equipped with a compressor case which allowed changes to the case wall over the rotor tips of six of its eight stages For all tests the principal effects were (1) with tip treatment a stall pressure ratio loss of 6 percent at 100 percent corrected engine speeds for both the 0 3 and 0 7 RNI and (2) with and without tip treatment decreasing the RNI from 0 7 to 0 3 decreased the stall pressure ratio 3 8 percent for 100 percent corrected engine speed and 2 8 percent for 80-percent corrected engine speed Author

N77-32156*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
INTERACTION OF ROTOR TIP FLOW IRREGULARITIES WITH STATOR VANES AS A NOISE SOURCE
James H Dittmar Oct 1977 14 p refs Presented at the 4th Aeroacoustics Conf Atlanta 3-5 Oct 1977 sponsored by AIAA
(NASA-TM-73706) Avail NTIS HC A02/MF A01 CSCL 21E

The role of the interaction of rotor tip flow irregularities (vortices and velocity defects) with downstream stator vanes is discussed as a possible fan noise mechanism This is accomplished by (1) indicating some of the methods of formation of these flow irregularities (2) observing how they would behave with respect to known noise behavior and (3) attempting to compare the strength of the rotor tip flow irregularity mechanism with the strength of the more common rotor wake stator mechanism The rotor tip flow irregularity-stator interaction is indicated as being a probable inflight noise source Author

N77-32157*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
EFFECTS OF SIMULATED FLIGHT ON FAN NOISE SUPPRESSION
Marcus F Heidmann and Donald A Dietrich Oct 1977 34 p refs Presented at 4th Aeroacoustics Conf Atlanta 3-5 Oct 1977 sponsored by AIAA
(NASA-TM 73708 E-9247) Avail NTIS HC A03/MF A01 CSCL 21E

Attenuation properties of three treated fan inlets were evaluated Tunnel flow simulated the inflow clean up effect on source noise observed in flight and allowed observation of the blade passage frequency tone cut-off phenomenon Acoustic data consisted of isolated inlet noise measured in the far field at two fixed positions and with traverses at four frequencies Attenuation and source noise properties with and without flight simulation are compared and discussed Averaged attenuation properties showed relative agreement of the inlets with their

design intent however tunnel flow significantly affected the attenuation spectra Author

N77-32158*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
ACOUSTIC PERFORMANCE OF INLET MULTIPLE-PURE-TONE SUPPRESSORS INSTALLED ON NASA QUIET ENGINE C
Harry E Bloomer John W Schaefer Edward J Rice and Charles E Feiler Oct 1977 16 p refs Presented at 4th Aeroacoustics Conf Atlanta 3-5 Oct 1977 sponsored by AIAA
(NASA-TM-73713) Avail NTIS HC A02/MF A01 CSCL 21E

The length of multiple-pure-tone (MPT) treatment required to reasonably suppress the MPT s produced by a supersonic tip speed fan was defined Other suppression broadband and blade passing frequency which might be accomplished were also determined The experimental results are presented in terms of both far-field and duct acoustic data Author

N77-32159*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
SUMMARY OF FORWARD VELOCITY EFFECTS ON FAN NOISE
Charles E Feiler and John F Groeneweg Oct 1977 16 p refs Presented at 4th Aeroacoustics Conf Atlanta, 3-5 Oct 1977 sponsored by AIAA
(NASA-TM-73722 E-9209) Avail NTIS HC A02/MF A01 CSCL 20A

Available experimental data comparing the in-flight and static behavior of fan noise are reviewed These results are then compared with recent data obtained for a fan stage tested with forward velocity in a low speed wind tunnel Tentative conclusions are presented about the significance and nature of the changes in noise observed when a forward velocity is imposed Finally the implications of the emerging picture of in-flight fan source noise for suppressor design are discussed Author

N77-32162# Avco Lycoming Engine Group Stratford Conn
INVESTIGATION OF FACTORS CONTROLLING ENGINE SCHEDULED OVERHAUL T53/T55
Paul A King and Robert L Givens May 1977 182 p refs (Contract DAAJ02-75-C-0018)
(AD-A042190 LYC-76-42 USAAMRDL-TR-77-9) Avail NTIS HC A09/MF A01 CSCL 05/1

This report presents an analysis of the factors responsible for the return of helicopter turbine engines to depot Engine component causes are detailed from the larger set of total system caused returns The derived data are used to identify significant parameters which can allow the design of high initial time between-overhauls with an optimum growth rate Models and examples of the design approach are presented with emphasis on reliability and maintainability support The report is concluded with a qualitative analysis of advanced component system concepts and their probable effect on TBO interval and safety/mission reliability Author (GRA)

N77-32163# Air Force Aero Propulsion Lab Wright-Patterson AFB Ohio
A REVIEW OF TURBOPROPULSION COMBUSTION PART 1 FUNDAMENTALS OF COMBUSTION PART 2 TURBOPROPULSION COMBUSTION TECHNOLOGY Summary Report, Mar 1975 - Dec 1976
William S Blazowski and Robert E Henderson Jun 1977 60 p refs
(AD-A043C22 AFAPL-TR-77-41) Avail NTIS HC A04/MF A01 CSCL 21/2

This report constitutes a reprint of two chapters on turbopropulsion combustion expressly prepared as part of a Propulsion Text Book entitled A Comprehensive Study of Aircraft Gas Turbine Engines, edited by G C Oates A variety of subjects are reviewed ranging from fundamental chemistry thermodynamics and gas dynamics of combustion to jet engine combustor design factors performance characteristics and engineering/analysis tools In addition the impact of environmental controls and regulations is discussed and the effects alternate and/or non-spec fuels may have on combustion system performance are examined Each chapter includes an extensive reference list of related topics many of which expand further on key points discussed GRA

N77-32164# Politecnico di Torino (Italy) Ist di Macchine e Motori per Aeromobili
PRELIMINARY INVESTIGATIONS OF THE UNSTEADY FLOW IN TURBOJET ENGINES DURING TRANSIENTS
Maurizio Pandolfi and Luca Zannetti Mar 1976 23 p refs (Contract CNR-75-00353 07-115 6799)
(Publ-PP-174) Avail NTIS HC A02/MF A01

The problem of predicting the performance of turbojet engines during transients is discussed Some results of computations about typical fast transients which may take place in turbojet engines are presented The methodology is based on advanced numerical techniques successfully developed for unsteady gasdynamics problems, regarding the computational point of view and on classical concepts widely used in turbomachine studies regarding the modelling of the actual machine The main limitations are related to the modelling of transonic or supersonic flow at the bladings which accrues at larger rotational speed ESA

N77-32173# Human Engineering Labs Aberdeen Proving Ground Md
COMPUTER-GENERATED DISPLAYS ADDED TO HEL HELICOPTER OPERATIONAL TRAINER Final Report
Gordon L Herald May 1977 28 p
(AD A043267 HEL-TM-18-77) Avail NTIS HC A03/MF A01 CSCL 05/9

A Singer-Link Helicopter Operational Trainer has been interfaced with the U S Army Human Engineering Laboratory s Command Control Simulator computer to provide the helicopter trainer with real-time computer generated cathode ray-tube imaging displays This report discusses the equipment configuration data collection displays and the hardware and software problems associated with this development Author (GRA)

N77-32240# Rocket Propulsion Establishment, Westcott (England)
THE EFFECT OF SIMULATED AERODYNAMIC HEATING ON THE STRENGTH OF THREE ROCKET MOTOR CASE STEELS
G R Ramsden and D A R Herrick Jun 1976 24 p refs (RPE-TR-45, BR55715) Avail NTIS HC A02/MF A01

The effect of simulated aerodynamic heating on the strength of three high strength steels used in rocket motor cases was investigated Low-alloy steel RS 131 (1 % Cr-Mo) and 18 % Ni maraging steels DTD 5212 and RPE 1090 (G 125) were tested at temperatures up to 700 C attained in 5 sec The results show that the reduction in short term strength of these metals at elevated temperatures is not so great as to preclude their use in Mach 3 missiles and in some types of Mach 4 missiles Author (ESA)

N77-32280* National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
NICKEL BASE ALLOY Patent
John C Freche and William J Waters inventors (to NASA) Issued 6 Sep 1977 3 p Filed 30 Dec 1975 Supersedes N76-14247 (14 - 05 p 0557)
(NASA Case-LEW-12270 1 US-Patent-4 046 560
US-Patent-Appl-SN-645507 US-Patent-Class-75-170
US-Patent-Class-148-32 5) Avail US Patent Office CSCL 11F

A nickel base superalloy for use at temperatures of 2000 F (1095 C) to 2200 F (1205 C) was developed for use as stator vane material in advanced gas turbine engines The alloy has a nominal composition in weight percent of 16 tungsten 7 aluminum 1 molybdenum 2 columbium 0 3 zirconium 0 2 carbon and the balance nickel Official Gazette of the U S Patent Office

N77-32474# Royal Aircraft Establishment Farnborough (England)
A PRECISION VOLTAGE REFERENCE UNIT FOR CALIBRATING AIRBORNE DATA ACQUISITION SYSTEMS
D Thomas Dec 1976 31 p refs
(RAE-TR-76164 BR56069) Avail NTIS HC A03/MF A01

A precision voltage reference unit is described which enables the accuracy and precision of flight data acquisition systems to be measured under operational conditions Two versions were designed having outputs of 8 mV and 4 V which simulate 80% of the full scale output respectively of low level (10 mV) and high level (5 V) transducer outputs and a range of source impedances is also simulated The voltage stability of the units is better than 0 01% for the high level version and 0 1% for the low level version over the temperature range -40 to +80 C The design is such that the magnitude of a number of error sources (e g common mode voltages system input impedances and offset voltages and currents) can be determined
Author (ESA)

N77-32524# Scope Electronics Inc Reston Va
VOICE CONTROL SYSTEMS FOR AIRBORNE ENVIRONMENTS Final Technical Report, 5 Jan 1976 - 4 Jan 1977
Hill Montague Griffiss AFB N Y RADC Jun 1977 93 p
(Contract F30602-76-C-0127)
(AD-A043252 Rept-6205-0377 RADC-TR-77-189) Avail NTIS HC A05/MF A01 CSCL 01/3

The effects of g-force stress on human voice patterns were investigated with the objective of finding means for making isolated word recognition word devices work in the fighter aircraft cockpit environment Data were taken in a human centrifuge with SCOPE Electronics Inc s Voice Data Entry System (VDETS) used to prompt and pace the subjects Data were subsequently digitized and stored for analysis and recognition experiments using the VDETS algorithm with a number of variations Recognition performance on the centrifuge data was initially poor Means were found for improving it substantially through modifications to the VDETS algorithm and through preprocessing techniques VDETS modifications included increased coding resolution improved segmentation techniques and provision for multimode training Breathing noise elimination and inverse filtering preprocessing routines were effective Variations in spectral characteristics with g-force stress were found but no consistent pattern was discerned The effectiveness of the inverse filtering led to the conclusion that the major problem was the face mask worn by the subjects, causing a variable element in the acoustic transmission path Additional work will be required to eliminate face mask effects
Author (GRA)

N77-32573# Defense Systems Management School Fort Belvoir Va
A NEW LOOK IN RELIABILITY F-18 OPERATIONAL MISSION ENVIRONMENT
Douglas P Dunbar Jr May 1977 40 p refs
(AD-A042781) Avail NTIS HC A03/MF A01 CSCL 17/8

This study project examines the F-18 program s development of an expected operational mission environment (OME) of the airplane to tailor existing specifications for design and test requirements of systems and equipment Based on F-18 contractor studies and reports plus interviews of contractor and Navy Project Management Office personnel discussion is presented treating establishment of mission profiles/environments expected reliability improvements and life cycle cost savings Study results indicate that use of the OME concept will significantly increase F-18 operational reliability as compared to existing carrier-based aircraft Analysis also indicates that a 'front end investment cost of approximately three million dollars for OME design and test of selected mission critical equipment will result in a savings of over 100 million dollars in operating and support costs through manpower spares and rework reductions Recommendations include establishment of a requirement for and standard methodology of developing mission profiles early in the acquisition cycle of future systems The expected operational environment derived from these profiles should then form the baseline for design and test requirements of system and equipment
Author (GRA)

N77-32850# National Gas Turbine Establishment Pyestock (England)
THE EFFECT OF FLIGHT ON THE NOISE OF SUBSONIC JETS
B J Cocking Oct 1976 37 p refs Presented at the 3d Aero-Acoust Specialists Conf Palo Alto Calif Jul 1976
(NGTE-R-343 BR55165) Avail NTIS HC A03/MF A01

The noise of a single-stream circular jet and a coaxial jet with coplanar nozzles of 2 5 area ratio has been measured under simulated flight conditions in the RAE 24 ft wind tunnel The majority of tests were conducted with the single-stream jet and primary section of the coaxial jet at a nominal temperature of 880 K The data were used to quantify the effect of jet temperature and were combined with measurements from an earlier test series to establish a prediction method for the effect of flight on the noise of single-stream subsonic jets This method is based on jet noise theory modified by experimentally derived constants For coaxial jets it is concluded that the noise reductions which are independent of the secondary stream velocity are predicted to an acceptable degree by the method suggested for unheated single-stream jets The prediction methods are suitable for both OASPLs and spectra
Author (ESA)

N77-32871# Naval Air Development Center Warminster Pa Crew Systems Dept
PREDICTION OF AIRBORNE TARGET DETECTION
Gloria Twine Chisum 3 Jun 1977 27 p refs
(AD-A041428, NADC-77102-40) Avail NTIS HC A03/MF A01 CSCL 17/8

The visibility of a uniformly luminous object depends on the apparent contrast between the object and its background the angular subtense of the object the contrast threshold of the observer at the level of luminance to which the eyes are adapted, the conditions and technique of observing and the shape of the object Techniques for combining the influence of the various factors have been applied to the problem of predicting airborne target detectability Recommendations for achieving the desired detectability are made
Author (GRA)

N77-33040*# Academy of Sciences (USSR) Moscow National Committee for the History of Science and Technology
ON THE WORKS OF S S NEZHDANOVSKY IN THE FIELD OF FLIGHT BASED ON REACTIVE PRINCIPLES, 1880 - 1895 **c12**
V N Sokolsky *In* NASA Washington Essays on the History of Rocketry and Astronautics Vol 1 Sep 1977 p 125-139 refs
Avail NTIS MF A01 SOD HC CSCL 22A

The work of a Soviet scientist and inventor of the 19th century S S Nezhdanovsky is discussed Investigations in the field of aircraft science and technology are emphasized in relation to Nezhdanovsky s studies of using the jet principle in solving the problem of human flight Nezhdanovsky dealt with calculations of the speed at which combustion products flow and considered such problems as fuel feeding into the combustion chamber by means of pumps and the use of one of the fuel components for cooling the walls of the combustion chamber
B L P

N77-33100*# Aerophysics Research Corp , Bellevue, Wash
NSEG A SEGMENTED MISSION ANALYSIS PROGRAM FOR LOW AND HIGH SPEED AIRCRAFT VOLUME 2: PROGRAM USERS MANUAL
D S Hague and H L Rozendaal Washington NASA Sep 1977 175 p
(Contract NAS1-13599)
(NASA-CR-2808) Avail NTIS HC A08/MF A01 CSCL 09B

A rapid mission analysis code based on the use of approximate flight path equations of motion is described Equation form varies

with the segment type, for example accelerations, climbs, cruises, descents, and decelerations Realistic and detailed vehicle characteristics are specified in tabular form In addition to its mission performance calculation capabilities, the code also contains extensive flight envelop performance mapping capabilities Approximate take off and landing analyses can be performed At high speeds centrifugal lift effects are taken into account Extensive turbojet and ramjet engine scaling procedures are incorporated in the code Author

N77-33101# Boeing Vertol Co , Philadelphia, Pa
PRODUCT IMPROVEMENT PROGRAM EVALUATION Final Report, 17 May 1976 - 17 Feb 1977
Stephen J Blewitt Jun 1977 118 p refs
(DA Proj 1F2-62209-AH-76)
(AD-A042134 D210-11146-2 USAAMRDL-TR-77-17) Avail NTIS HC A06/MF A01 CSCL 01/3

This report presents the results of a study to develop an analysis technique for evaluating the cost and operational effectiveness of potential aircraft modifications that affect reliability and maintainability Author (GRA)

N77-33102*# Virginia Polytechnic Inst and State Univ , Blacksburg Dept of Engineering Science and Mechanics
THREE DIMENSIONAL STEADY AND UNSTEADY ASYMMETRIC FLOW PAST WINGS OF ARBITRARY PLANFORMS
O A Kandil E H Atta and A H Nayfeh Sep 1977 33 p refs
(Grant NGR-47-004-090)
(NASA-CR-145235) Avail NTIS HC A03/MF A01 CSCL 01A

The nonlinear discrete vortex method was extended to treat the problem of asymmetric flows past a wing with leading-edge separation including steady and unsteady flows The problem was formulated in terms of a body-fixed frame of reference, and the nonlinear discrete vortex method was modified accordingly Only examples of flows past delta wings are presented Comparison of these results with experimental results for a delta wing undergoing a steady rolling motion at zero angle of attack demonstrates the superiority of the present method in obtaining highly accurate loads Numerical results for yawed wings at large angles of attack are also presented In all cases, total load coefficients, pressure distributions and shapes of the free-vortex sheets are shown Author

N77-33103*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
PRESSURE DISTRIBUTIONS ON A 1- BY 3-METER SEMISPAN WING WITH A NONSTREAMWISE TIP IN SUBSONIC FLOW
Long P Yip and Gary L Shubert (Joint Inst for Advan of Flight Sci , Hampton, Va) Aug 1977 205 p refs
(NASA-TM-72755) Avail NTIS HC A10/MF A01 CSCL 01A

Pressure distributions on a 1- by 3-meter semispan wing with a tip that is streamwise at 0 deg sweep are presented The tip becomes nonstreamwise as the wing is swept At 0 deg sweep angle, the semispan wing has a taper ratio of 1 0 and NACA 0012 airfoil section contours The test was conducted in the Langley V/STOL tunnel at a freestream dynamic pressure of 2 46 kPa Pressure distributions are presented for sweep angles of 10, 20, 30, and 40 with an angle of attack range from -6 deg to 20 deg The data are presented without analysis or discussion Author

N77-33104*# Kansas Univ , Lawrence
FLIGHT EVALUATION OF AN ADVANCED TECHNOLOGY LIGHT TWIN-ENGINE AIRPLANE (ATLIT)
Bruce J Holmes Washington NASA Jul 1977 286 p refs
(Grant NGR-17-002-072)
(NASA-CR-2832) Avail NTIS HC A13/MF A01 CSCL 01A

Project organization and execution, airplane description and performance predictions, and the results of the flight evaluation of an advanced technology light twin engine airplane (ATLIT) are presented The ATLIT is a Piper PA-34-200 Seneca I modified by the installation of new wings incorporating the GA(W)-1 (Whitcomb) airfoil, reduced wing area, roll control spoilers, and full span Fowler flaps The conclusions for the ATLIT evaluation are based on complete stall and roll flight test results and partial performance test results The Stalling and rolling characteristics met design expectations Climb performance was penalized by extensive flow separation in the region of the wing body juncture Cruise performance was found to be penalized by a large value of zero lift drag Calculations showed that, with proper attention to construction details, the improvements in span efficiency and zero lift drag would permit the realization of the predicted increases in cruising and maximum rate of climb performance Author

N77-33105*# Aeronautical Research Associates of Princeton, Inc , N J
VORTEX INTERACTIONS AND DECAY IN AIRCRAFT WAKES Final Report
Alan J Bilanin Milton E Teske, Coleman DuPDonaldson and Guy G Williamson Washington NASA Sep 1977 121 p refs
(Contract NAS1-13939)
(NASA-CR-2870) Avail NTIS HC A06/MF A01 CSCL 20D

The dynamic interaction of aircraft wake vortices was investigated using both inviscid and viscous models For the viscous model, a computer code was developed using a second-order closure model of turbulent transport The phenomenon of vortex merging which results in the rapid aging of a vortex wake was examined in detail It was shown that the redistribution of vorticity during merging results from both convective and diffusive mechanisms Author

N77-33107*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
NONLINEAR AEROELASTIC EQUATIONS FOR COMBINED FLAPWISE BENDING, CHORDWISE BENDING, TORSION, AND EXTENSION OF TWISTED NONUNIFORM ROTOR BLADES IN FORWARD FLIGHT
Krishna Rao V Kaza and Raymond G Kvaternik (NASA Langley Res Center) Aug 1977 111 p refs
(NASA-TM-74059) Avail NTIS HC A06/MF A01 CSCL 01A

Second-degree nonlinear aeroelastic equations were developed using Hamilton s principle The implications of the slender beam approximation as applied to the derivation of the second-degree nonlinear equations of motion are discussed and a mathematical ordering scheme which is compatible with the assumption of a slender beam is introduced The blade aerodynamic loading was obtained from strip theory based on a quasi-steady approximation of two dimensional, incompressible unsteady airfoil theory The equations were compared with several of those existing in the literature and the results are discussed Author

N77-33108*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
SUBSONIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS AND ENGINE PRESSURE DISTRIBUTIONS FOR AN AIRCRAFT WITH AN INTEGRATED SCRAMJET DESIGNED FOR MACH 6 CRUISE
Jarrett K Huffman, Charles H Fox, Jr , and Patrick J Johnston Aug 1977 400 p refs
(NASA-TM-X-73911) Avail NTIS HC A17/MF A01 CSCL 01A

A 1/10-scale model of a proposed hypersonic aircraft with an integrated scramjet was tested The investigation took place over a Mach number range from 0 2 to 0 7 and an angle of attack range from 2 deg to approximately 17 deg at a sideslip angle of 0 deg The primary configuration variables studied were engine location, internal engine geometry and external engine geometry The results are presented without analysis Author

N77-33112*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
THEORETICAL PARAMETRIC STUDY OF THE RELATIVE ADVANTAGES OF WINGLETS AND WING-TIP EXTENSIONS

Harry H Heyson, Gregory D Riebe and Cynthia L Fulton Sep 1977 75 p refs
(NASA-TP-1020 L-11679) Avail NTIS HC A04/MF A01 CSCL 01A

It was found that for identical increases in bending moment a winglet provides a greater gain in induced efficiency than a tip extension Winglet toe in angle allows design trades between efficiency and root moment A winglet showed the greatest benefit when the wing loads were heavy near the tip Washout diminished the benefit of either tip modification and the gain in induced efficiency became a function of lift coefficient heavy wing loadings obtained the greatest benefit from a winglet, and low speed performance was enhanced even more than cruise performance Both induced efficiency and bending moment increased with winglet length and outward cant The benefit of a winglet relative to a tip extension was greatest for a nearly vertical winglet Root bending moment was proportional to the minimum weight of bending material required in the wing it is a valid index of the impact of tip modifications on a new wing design Author

N77-33114*# Douglas Aircraft Co Inc Long Beach, Calif
WIND TUNNEL AND ANALYTICAL INVESTIGATION OF OVER-THE WING PROPULSION/AIR FRAME INTERFERENCES FOR A SHORT-HAUL AIRCRAFT AT MACH NUMBERS FROM 0 6 TO 0 78 Final Report
O D Wells M L Lopez H R Welge P A Henne, and A E Sewell Washington NASA Sep 1977 244 p refs
(Contract NAS3-18284)
(NASA-CR-2905, MDC-J7601) Avail NTIS HC A11/MF A01 CSCL 01A

Results of analytical calculations and wind tunnel tests at cruise speeds of a representative four engine short haul aircraft employing upper surface blowing (USB) with a supercritical wing are discussed Wind tunnel tests covered a range of Mach number M from 0 6 to 0 78 Tests explored the use of three USB nozzle configurations Results are shown for the isolated wing body and for each of the three nozzle types installed Experimental results indicate that a low angle nacelle and streamline contoured nacelle yielded the same interference drag at the design Mach number A high angle powered lift nacelle had higher interference drag primarily because of nacelle boattail low pressures and flow separation Results of varying the spacing between the nacelles and the use of trailing edge flap deflections wing upper surface contouring and a convergent-divergent nozzle to reduce potential adverse jet effects were also discussed Analytical comparisons with experimental data made for selected cases indicate favorable agreement Author

N77-33115*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
TRANSONIC WIND-TUNNEL INVESTIGATION OF THE MANEUVER POTENTIAL OF THE NASA SUPERCRITICAL WING CONCEPT, PHASE 1
James B Hallissy and Theodore G Ayers Washington Sep 1977 295 p refs
(NASA-TM-X-3534 L-11064) Avail NTIS HC A13/MF A01 CSCL 01A

An investigation was conducted in the NASA Langley 8-foot transonic pressure tunnel at Mach numbers from 0 60 to 0 975 with a variable-wing sweep airplane model in order to evaluate a series of wings designed to demonstrate the maneuver potential of the supercritical airfoil concept Both conventional and supercritical wing designs for several planform configurations were investigated with wing sweep angles from 16 0 deg to 72 5 deg depending on Mach number and wing configuration The supercritical wing configuration showed significant improvement over the conventional configurations in drag-divergence Mach number and in drag level at transonic maneuver conditions Author

N77-33116*# National Aeronautics and Space Administration Langley Research Center Langley Station Va
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERCRITICAL-WING TRANSPORT MODEL WITH TRAILING EDGE CONTROLS
Michael J Mann and Richard A Langhans Washington Oct 1977 336 p refs
(NASA-TM-X-3431 L-10871) Avail NTIS HC A15/MF A01 CSCL 01A

The effects of wing trailing-edge control surfaces on the static transonic aerodynamic characteristics of a transport configuration with a supercritical wing were studied The configuration was tested with both an area-ruled fuselage and a cylindrical fuselage The Mach number range was from 0 80 to 0 96 and the angle of attack range was from -1 deg to 12 deg The Reynolds number was 1 580 000 based on the mean aerodynamic chord Tabular data are presented Author

N77-33117*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERCRITICAL-WING TRANSPORT MODEL WITH TRAILING-EDGE CONTROLS, SUPPLEMENT, PART 1
Michael J Mann and Richard A Langhans Washington Oct 1977 493 p
(NASA-TM-X-3431-Pt-1) Avail NTIS HC A21/MF A01 CSCL 01A

For abstract see N77-33116

N77-33118 *# National Aeronautics and Space Administration Langley Research Center Langley Station Va
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERCRITICAL WING TRANSPORT MODEL WITH TRAILING-EDGE CONTROLS
Michael J Mann and Richard A Langhans Washington Oct 1977 480 p
(NASA-TM-X-3431-Pt-2) Avail NTIS HC A21/MF A01 CSCL 01A

For abstract see N77-33116

N77-33119*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERCRITICAL-WING TRANSPORT MODEL WITH TRAILING EDGE CONTROLS
Michael J Mann and Richard A Langhans Washington Oct 1977 498 p
(NASA-TM-X-3431-Pt-3) Avail NTIS HC A21/MF A01 CSCL 01A

For abstract, see N77-33116

N77-33120*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A SUPERCRITICAL-WING TRANSPORT MODEL WITH TRAILING-EDGE CONTROLS
Michael J Mann and Richard A Langhans Washington Oct 1977 476 p
(NASA-TM-X-3431-Pt-4) Avail NTIS HC A21/MF A01 CSCL 01A

For abstract see N77-33116

N77-33121*# Textron Bell Aerospace Co Buffalo N Y Niagara Frontier Operations
UNSTEADY SUPERSONIC AERODYNAMIC THEORY FOR INTERFERING SURFACES BY THE METHOD OF POTENTIAL GRADIENT Final Report
William P Jones (Tex A&M Univ College Station) and Kari Arppa Washington NASA Oct 1977 38 p refs
(Contract NAS1-13986)
(NASA-CR-2898) Avail NTIS HC A03/MF A01 CSCL 01A

A generalized solution of the hyperbolic wave equation was further developed to relate the velocity components at a field point to the potential gradient distribution in the dependence domain Singular integrals were evaluated in closed form with numerical integration methods for more complex but analytic functions Idealization of the lifting surfaces by trapezoidal elements with two sides parallel to the streamlines is computationally efficient Streamwise integrals were performed analytically and spanwise integrals were neccessary only on

element leading and trailing sides All integrands vanish on the Mach cone Pressure distribution on a double delta wing and generalized aerodynamic coefficients for three AGARD planforms were calculated and compared with available results Author

N77-33122# Naval Postgraduate School Monterey Calif
INITIAL UNSTEADY AERODYNAMIC MEASUREMENTS OF A CIRCULATION CONTROLLED AIRFOIL AND AN OSCILLATING FLOW WIND TUNNEL M S Thesis
Emmett John Lancaster Jun 1977 74 p refs
(AD-A042102) Avail NTIS HC A03/MF A01 CSCL 20/4

Steady state results of lift developed by varying the momentum blowing coefficient C sub mu upon a refurbished Circulation Control Rotor (CCR) airfoil section were favorable This thesis was an experimental investigation to quantitatively evaluate whether the steady state results could be applied by a quasi-steady assumption when a harmonic perturbation of C sub mu was superimposed upon the steady value Results suggested an attenuation in the dynamic transfer function of dC sub P/d C sub mu as the oscillating blowing frequency was increased Initial measurements indicated that the RMS C sub P perturbation was an order of magnitude greater than the normalized RMS velocity perturbation To further clarify this situation investigations were conducted to establish a dynamic frequency response calibration of the wind tunnel Results confirmed the order of magnitude difference between the RMS C sub P and normalized RMS velocity perturbations, indicating that the tunnel flow environment was governed by Euler s equation in its complete form rather than with the simplifications which lead to the quasi-steady small perturbation theory GRA

N77-33124# Naval Postgraduate School, Monterey, Calif
AN ANALYSIS OF PERSONNEL PARACHUTES FOR USE BY MARINE CORPS FORCE RECONNAISSANCE UNITS M S Thesis
Robert Joseph McLaughlin Mar 1977 125 p refs
(AD-A041151) Avail NTIS HC A06/MF A01 CSCL 01/3

There is an opportunity for the Marine Corps to adopt a free-fall parachute, especially for Force Reconnaissance units, where the emphasis is on achieving an assigned mission for the Force Commander The subject of this thesis is to explore the field of free-fall and high-glide parachutes currently in use within the military establishment and the civilian community and to develop a model for selecting the most cost-effective free-fall parachute for use in the Marine Corps Author (GRA)

N77-33128*# Scientific Translation Service Santa Barbara, Calif
ANALYSIS OF AIR ACCIDENTS INVOLVING AIRPLANES OR HELICOPTERS OF VARIOUS TYPES OF APPLICATION
T Kostia Washington NASA Aug 1977 21 p refs Transl into ENGLISH of Polish conf paper Presented at Ergonomics in Aviat 1st Natl Sci Technol Conf, Warsaw, 17-19 May 1975 p 266-282 Original language document was announced as A76-28551
(Contract NASw-2791)
(NASA-TT-F-17443) Avail NTIS HC A02/MF A01 CSCL 01C

The results are presented of a statistical analysis of air accidents involving two- and four-engine communications aircraft and general aviation aircraft up to 5 7 tons with emphasis on agricultural aircraft based on the whole on accident statistics published by the Civil Aeronautics Board The occurrence rate of various kinds of accidents involving fatalities or not was calculated the causes of the accidents are classified and some conclusions are drawn from the results regarding possible directions for future safer designs for general aviation aircraft Author

N77-33129*# Scientific Translation Service Santa Barbara Calif
NOTES ON THE POLLUTION OF AIRPLANES AND HELICOPTERS BY CHEMICALS DURING AGRICULTURAL JOBS
Bernard Straszewski Washington NASA Aug 1977 5 p Transl into ENGLISH of Polish conf paper Presented at Ergonomics in Aviat 1st Natl Sci Technol Conf, Warsaw 17-19 Mar 1975 p 326-328
(Contract NASw-2791)
(NASA-TT-F-17444) Avail NTIS HC A02/MF A01 CSCL 01C

Contamination of the fuselage the pilot s cabin the engine, and the onboard compressed air installations while spraying agricultural fields is briefly discussed Corrosion, service life and exposure of the pilot and service personnel to toxic chemicals are among the factors considered J M S

N77-33130*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
A FLIGHT INVESTIGATION OF THE WAKE TURBULENCE ALLEVIATION RESULTING FROM A FLAP CONFIGURATION CHANGE ON A B-747 AIRCRAFT
Robert A Jacobsen and Barbara J Short Jul 1977 45 p refs
(NASA-TM-73263, A-7116) Avail NTIS HC A03/MF A01 CSCL 01C

A flight test investigation was conducted to evaluate the effects of a flap configuration change on the vortex wake characteristics of a Boeing 747 (B-747) aircraft as measured by differences in upset response resulting from deliberate vortex encounters by a following Learjet aircraft and by direct measurement of the velocities in the wake The flaps of the B-747 have a predominant effect on the wake The normal landing flap configuration produces a strong vortex that is attenuated when the outboard flap segments are raised, however extension of the landing gear at that point increases the vortex induced upsets These effects are in general agreement with existing wind tunnel and flight data for the modified flap configuration Author

N77-33131# National Aeronautical Lab Bangalore (India) Information Centre for Aeronautics
BIRD STRIKE HAZARDS A BIBLIOGRAPHY, 1971 - 1976
H S S Murthy, comp Jun 1977 22 p
(NAL-Bibl-Ser-77) Avail NTIS HC A02/MF A01

A comprehensive collection of literature on aircraft bird strike hazards is presented The entries are arranged into six groups (1) literature survey (2) bird ingestion (3) environmental control (4) laser techniques, (5) radar techniques and (6) structural design An author index is provided Author

N77-33132# ARA Inc, West Covina Calif
INVESTIGATION OF AN ALUMINUM ROLLING HELIX CRASH ENERGY ABSORBER Final Report, Feb - Dec 1975
Bernard Mazelsky May 1977 36 p
(Contract DAAJ02-75-C-0015)
(AD-A042084 ARA-176 USAAMRDL-TR-77-8) Avail NTIS HC A03/MF A01 CSCL 01/3

This report covers an investigation of various aluminum alloy wires suitable for a rolling helix energy absorber strut (TOR-SHOK) for use in crashworthy troop seats Several aluminum alloy wire types were investigated to determine the linear stroking distance that the device could endure prior to the breaking of the helical wires and to ascertain compatibility with the 6061-T6 aluminum tubes that are used as the struts to transmit the impact forces into the energy-absorbing helical wires Once the wire was selected several struts were fabricated and tested In addition, two units were subjected to environmental tests in accordance with Military Standard 810B and were statically tested after the environmental tests This study indicated that the most compatible aluminum wire to be used with the 6061-T6 aluminum tubing is the 5056-H38 series aluminum wire The devices after being subjected to the environmental tests performed the same as those devices that were not subjected to the environmental tests This was primarily a result of properly anodizing and sealing the aluminum tubing GRA

N77-33135# Calspan Corp Buffalo, N Y
MULTIPATH AND PERFORMANCE TESTS OF TRSB RECEIVERS Interim Report, 1974 - Mar 1977
J Beneke C W Wightman C B Vallone, and A M Offt Mar 1977 210 p refs
(Contract DOT-FA74WA-3445)
(AD-A041891 FAA-RD-77-66, CALSPAN-AG-5580-E-1) Avail NTIS HC A10/MF A01 CSCL 17/7

A landing system simulation program has been carried out in support of the Microwave Landing System (MLS) program of the Federal Aviation Administration Both scanning beam and doppler scan techniques were simulated and several angle processors were tested with each technique This report contains the results of extensive simulation evaluations on the time reference scanning beam (TRSB) system The results of the doppler simulation tests are published in the Calspan Technical notes referenced in this report A representative set of multipath parameters was selected and used to explore the dynamic characteristics of the TRSB technique Tests were run to determine the multipath error magnitude as a function of separation angle amplitude scalloping frequency and different processor parameters These tests were conducted on a TRSB simulator that uses a computer to control the multipath parameters for each scan Typical multipath scenarios were programed that represented the signals an aircraft would receive when flying through a multipath interference region Some of the multipath scenarios used in the ICAO AWOP evaluations were simulated The receivers used in the ICAO flight test program were evaluated in the simulator A breadboard processor was developed that operates as a dwell gate processor similar to the flight test receivers, or as a single edge processor (SEP) to evaluate the flare system A closed loop simulation, including aircraft and autopilot characteristics MLS signals with dynamic multipath characteristics and the MLS processor, was used to determine the aircraft perturbations resulting from hangar multipath reflections GRA

N77-33136# Boeing Commercial Airplane Co, Seattle Wash
AIR TRAFFIC CONTROL EXPERIMENTATION AND EVALUATION TEST
S G Wilson C V Paulson, and I R Reese Sep 1976 157 p refs
(Contract DOT-TSC-707-6)
(AD-A041971 D6-44051, FAA RD-75-173-6, FAA-76-22-6) Avail NTIS HC A08/MF A01 CSCL 17/7

Results of performance evaluation of voice, digital data and ranging modems in the aeronautical satellite environment are given Approximately 80 hours of modem performance data were acquired on board an FAA KC-135 jet aircraft operating over the North Atlantic L-band test signals received at the aircraft were generated by ATS-6 satellite relay of transmissions from a NASA ground station The modem evaluation tests were conducted between September 1974 and April 1975 as part of the U S Department of Transportation (DOT) aeronautical technology test program The U S DOT tests were a component of the International ATS-6 L-Band Experiment coordinated by the NASA/Goddard Space Flight Center Measured modem performance includes the word intelligibility achieved by four distinct speech transmission modems, the average bit-error probability and error patterns associated with five phase-shift-keyed 1200-bps data modems and the rms ranging accuracy achieved with two ranging modems In each case the performance was evaluated as a function of carrier-to-noise density ratio (C/No) and direct-signal-to-multipath-signal ratio (S/I) Testing was performed with representative operational-class aircraft antennas as well as with special antennas, allowing the variation of the relative multipath level GRA

N77-33137# Transportation Systems Center, Cambridge, Mass
REQUIREMENTS FOR FLIGHT TESTING AUTOMATED TERMINAL SERVICE Interim Report
Joseph S Dumas May 1977 39 p ref
(AD-A041975 TSC-FAA-77-3 FAA-AEM-77-6) Avail NTIS HC A03/MF A01 CSCL 17/7

This report describes requirements for the flight tests of the baseline Automated Terminals Service (ATS) system The overall objective of the flight test program is to evaluate the feasibility of the ATS concept Within this objective there are two categories of specific ATS flight test objectives (1) the objectives concerned with verifying the basic advisory capabilities of ATS and (2) the objectives concerned with evaluating pilots responses to ATS messages The flight testing is broken down into three parts Part I will consist of system checkout flights Part II will consist of validation and some pilot evaluation tests and will be conducted at NAFEC Part III will consist primarily of normal airport operations at a selected general aviation airport The requirements for the Part II and III evaluations of each of the ATS services to pilots are presented For each service there is a listing of the major issues involved in the evaluation and a discussion of the methods to be used in the evaluation The description of the test methods for each service presents the type of missions that will be required along with a table showing the measures to be taken and the sources of data where these measures can be most easily obtained Author (GRA)

N77-33140# Technische Universitaet Brunswick (West Germany) Sonderforschungsbereich 58 Flugfuehrung
MEASUREMENTS OF THE INFLUENCE OF STATIC AND DYNAMIC INTERFERENCE ON AN ILS-RECEIVER AND MEASUREMENT OF THE CAPTURE EFFECT WITH THE DOUBLE FREQUENCY PROCEDURE [MESSUNGEN DES EINFLUSSES STATISCHER UND DYNAMISCHER INTERFERENZ AUF EINEM ILS-EMPFAENGER UND MESSUNG DES CAPTURE-EFFEKTES BEI ZWEIFREQUENZVERFAHREN]
P Form R Springer, and U Stoldt Sep 1976 25 p In GERMAN
(TUBS/SFB58/50) Avail NTIS HC A02/MF A01

Static and dynamic interference of an onboard instrument landing system were investigated The static interference tests show that the phase difference between effective and disturbance signal is the most important factor Dynamic interference caused by Doppler shift resulting from the moving aircraft leads to an interchange of side bands and therefore of the information content Measurement of the capture effect of the double frequency procedure showed that the disturbed signal can probably be suppressed to a large extent ESA

N77-33142# European Space Agency, Paris (France)
MONTE CARLO SIMULATION OF VOR/DME HOLDING PROCEDURES BASIC NOTIONS AND APPLICATIONS
Holger Schnuerer Sep 1977 29 p refs Transl into ENGLISH of 'Grundlagen u Anwend der Simulation von VOR/DME Warteverfahren mit der Monte-Carlo-Tech' DFVLR, Brunswick Report DLR-FB-77-08, 17 Mar 1977 Original report in GERMAN previously announced as N77-30105 Original German report available from DFVLR Cologne DM 13 70
(ESA-TT-419 DLR-FB-77-08) Avail NTIS HC A03/MF A01

Using DME in addition to VOR allows a better use of the airspace for holding procedures in civil aviation As yet there are no procedures agreed on by the international authorities for the construction of the airspace to be reserved for a safe execution of these holding procedures A method for the construction of holding areas of different probabilities is described in which the simulation of flight paths in a computer using the Monte Carlo technique has special importance The simulation allows the application of an extensive and detailed error model In addition the locally different physical conditions may be taken into consideration Both factors are most important for safe and economical use of airspace Author (ESA)

N77-33143# Sikorsky Aircraft, Stratford, Conn
PERFORMANCE FLIGHT TESTS OF THE RH-53D DESIGN GROWTH CONFIGURATION
J McCauley 4 Nov 1976 215 p refs
(Contract N00019-74-C-0183)
(SER-651316) Avail NTIS HC A10/MF A01

Performance of the RH-53D design growth configuration (DGC) helicopter was evaluated during hover level flight forward climb, and dynamic tow Test results demonstrate significant

improvements in aircraft performance when compared with the standard RH-53D The RH-53D (DGC) achieved out of ground effect hover at a gross weight of 50,000 pounds Level flight tests showed an improved capability during heavy weight level flight and indicated the ability of the RH-53D (DGC) to maintain level flight at 50 000 pounds with one engine inoperative Dynamic tow tests demonstrated the ability of the helicopter to safely accomplish the tow mission with a significant margin of available power remaining Author

N77-33144# Sikorsky Aircraft Stratford, Conn
HANDLING QUALITIES OF THE RH-53D IN THE DESIGN GROWTH CONFIGURATION
L Bajornas and P Griswold 11 Oct 1976 226 p refs
(Contract N00019-74-C-0183)
(SER-651317) Avail NTIS HC A11/MF A01

A flying qualities flight test program was conducted on the RH-53D in the Design Growth Configuration which included use of improved rotor blades, T64-Ge-415 engine ratings, and increased drive train input horsepower (8660) Sideward flight characteristics, control power and control margins dynamic stability, maneuver stability and response equivalent to external disturbance were investigated as well as engine-out characteristics in static tow, at altitude, and near the surface Tests were made at 42,000 lbs and the design alternate gross weight of 50,000 lbs No significant differences between the handling qualities of a production RH-53D and one in the Design Growth Configuration were found, and no flight control rigging or AFCS gain changes were required The maximum flyaway gross weight following a single engine power loss during tow was increased The height-velocity characteristics at 50,000 lbs G W were improved over those at 42 000 lbs in production RH-53D configuration Author

N77-33146*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
AN ELEMENTARY ANALYSIS OF THE EFFECT OF SWEEP, MACH NUMBER, AND LIFT COEFFICIENT ON WING-STRUCTURE WEIGHT
Albert C Kyser Sep 1977 31 p ref
(NASA-TM-74072) Avail NTIS HC A03/MF A01 CSCL 01C

Results are presented from an elementary analysis of the effect of sweep angle on the idealized structural weight of swept wings with cruise Mach number M and lift coefficient C sub L as parameters The analysis indicates that sweep is unnecessary for cruise Mach numbers below about 0 80, whereas for the higher subsonic speeds, a well defined minimum-weight condition exists at a sweep angle in the neighborhood of 35 deg or 40 deg, depending on M and C sub L The results further indicate that wing-structure weight increases sharply with Mach number in the high subsonic range with Mach 0 85 wings weighing half again as much as Mach 0 75 wings Weight is also shown to increase with cruise lift coefficient but the effect is not strong for the usual range of design lift coefficients Minimum wing-structure weight is found to occur at a ratio of thickness to normal chord of about 18 percent, but it is concluded that the thickness ratio for optimum wing design would probably lie in the range of 12 to 15 percent Author

N77-33147*# Boeing Commercial Airplane Co, Seattle Wash Preliminary Design Dept
TECHNICAL AND ECONOMIC ASSESSMENT OF SWEPT-WING SPAN-DISTRIBUTED LOAD CONCEPTS FOR CIVIL AND MILITARY AIR CARGO TRANSPORTS
Oct 1977 152 p refs
(Contract NAS1-14667)
(NASA-CR-145229 D6-45159) Avail NTIS HC A08/MF A01 CSCL 01C

The feasibility of large freighter aircraft was assessed including the impact of military requirements on the performance, economics, and fuel consumption characteristics Only configurations having net payloads of 272 155 to 544 311 kilograms contained within swept wings of constant chord were studied These configurations were of advanced composite construction with controllable winglets and full-span digitally-controlled trailing-edge surfaces Civil, military and joint civil/military production programs were considered Author

N77-33148*# Virginia Univ Charlottesville Dept of Engineering Science and Systems
THE DEVELOPMENT OF A MODEL FOR PREDICTING PASSENGER ACCEPTANCE OF SHORT-HAUL AIR TRANSPORTATION SYSTEMS
A Robert Kuhlthau and Ira D Jacobson Sep 1977 59 p
(Grant NGR-47-005-181)
(NASA-CR-145250, UVA/528060/ESS77/111) Avail NTIS HC A04/MF A01 CSCL 01C

Meaningful criteria and methodology for assessing, particularly in the area of ride quality the potential acceptability to the traveling public of present and future transportation systems were investigated Ride quality was found to be one of the important variables affecting the decision of users of air transportation, and to be influenced by several environmental factors especially motion, noise pressure temperature and seating Models were developed to quantify the relationship of subjective comfort to all of these parameters and then were exercised for a variety of situations Passenger satisfaction was found to be strongly related to ride quality and was so modeled A computer program was developed to assess the comfort and satisfaction levels of passengers on aircraft subjected to arbitrary flight profiles over arbitrary terrain A model was deduced of the manner in which passengers integrate isolated segments of a flight to obtain an overall trip comfort rating A method was established for assessing the influence of other links (e g , access, terminal conditions) in the overall passenger trip Author

N77-33149*# Douglas Aircraft Co , Inc Long Beach Calif
MODELING AND PARAMETER UNCERTAINTIES FOR AIRCRAFT FLIGHT CONTROL SYSTEM DESIGN Final Report
J D McDonnell, R A Berg, R M Heimbaugh and C A Felton Washington NASA Sep 1977 132 p refs
(Contract NAS1-14151)
(NASA-CR-2887 MDC-J4555) Avail NTIS HC A07/MF A01 CSCL 01C

Values of plant dynamic uncertainties for some recent aircraft design and development programs are given Histories of pertinent aerodynamic, inertial and structural parameter variations are given for a period of time from program initiation to aircraft certification These data can be used as typical of future vehicles so that control system design concepts are evaluated with due consideration to their sensitivity to uncertainties in plant dynamics Author

N77-33150*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
BEHAVIOR OF AIRCRAFT ANTISKID BREAKING SYSTEMS ON DRY AND WET RUNWAY SURFACES A SLIP-RATIO-CONTROLLED SYSTEM WITH GROUND SPEED REFERENCE FROM UNBRAKED NOSE WHEEL
John A Tanner and Sandy M Stubbs Washington Oct 1977 167 p refs
(NASA-TN-D-8455 L-11292) Avail NTIS HC A08/MF A01 CSCL 01C

An experimental investigation was conducted at the Langley aircraft landing loads and traction facility to study the braking and cornering response of a slip ratio controlled aircraft antiskid braking system with ground speed reference derived from an unbraked nose wheel The investigation, conducted on dry and wet runway surfaces, utilized one main gear wheel, brake and tire assembly of a DC-9 series 10 airplane During maximum braking, the average ratio of the drag force friction coefficient developed by the antiskid system to the maximum drag force friction coefficient available was higher on the dry surface than on damp and flooded surfaces, and was reduced with lighter vertical loads, higher yaw angles, and when new tire treads were replaced by worn treads Similarly, the average ratio of side force friction coefficient developed by the tire under antiskid control to the maximum side force friction coefficient available to a freely rolling yawed tire decreased with increasing yaw angle, generally increased with ground speed, and decreased when tires with new treads were replaced by those with worn treads Author

N77-33151*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
LONGITUDINAL HANDLING QUALITIES DURING APPROACH AND LANDING OF A POWERED LIFT STOL AIRCRAFT
James A Franklin and Robert C Innis Mar 1972 68 p refs
(NASA-TM-X-62144) Avail NTIS HC A04/MF A01 CSCL 01C

Longitudinal handling qualities evaluations were conducted on the Ames Research Center Flight Simulator for Advanced Aircraft (FSAA) for the approach and landing tasks of a powered lift STOL research aircraft The test vehicle was a C-8A aircraft modified with a new wing incorporating internal blowing over an augmentor flap The investigation included (1) use of various flight path and airspeed control techniques for the basic vehicle, (2) assessment of stability and command augmentation schemes for pitch attitude and airspeed control, (3) determination of the influence of longitudinal and vertical force coupling for the power control (4) determination of the influence of pitch axis coupling with the thrust vector control and (5) evaluations of the contribution of stability and command augmentation to recovery from a single engine failure Results are presented in the form of pilot ratings and commentary substantiated by landing approach time histories Author

N77-33152# Rockwell International Corp, Columbus, Ohio Columbus Aircraft Div
EVALUATION OF COMPOSITE WING FOR XFV-12A AIRPLANE Final Report, 28 Jun 1974 - 31 Aug. 1976
D N Ulry R W Gehring, and K I Clayton Dec 1976 320 p
(Contract N62269-74-C-0577)
(AD-A041208, NR76H-135 NADC-77183-30) Avail NTIS HC A14/MF A01 CSCL 11/4

A prior study conducted for the Naval Air Systems Command for application of advanced composites in the XFV-12A aircraft indicated the wing torque box to be the component of airframe structure having the greatest potential for significant weight savings through composite material application A Phase II design/development program was undertaken to develop detail design concepts for a XFV-12A composite wing box and fabricate a representative section of this wing box for development test and evaluation to provide a base for subsequent Phase III full scale verification testing GRA

N77-33153# Naval Postgraduate School, Monterey, Calif
HUMAN FACTORS ENGINEERING CONSIDERATIONS IN DESIGNING NAVAL AIRCRAFT FOR MAINTAINABILITY
William Edward Baumgartner Jun 1977 109 p refs
(AD-A041156) Avail NTIS HC A06/MF A01 CSCL 01/3

Rising maintenance costs and the necessity for increased availability have resulted in a new emphasis on maintainability as a design parameter in the acquisition of Naval air systems Human factors engineering, traditionally considered a means of improving operator performance, is also a designer's tool for improving aircraft maintainability Department of Defense directives mandating that all systems be designed according to specific human factors engineering and maintainability criteria confirm the necessity for including the human engineer in the designing of aircraft for maintainability Appendix A 'The Checklist for Human Factors Engineering of Maintainability in Naval Air Systems Design,' has been developed as a tool for aircraft designers and Navy design monitors to ensure human factoring criteria have been incorporated in the maintainability of the major aircraft subsystems Author (GRA)

N77-33154# RAND Corp, Santa Monica, Calif
AN EVALUATION OF VERY LARGE AIRPLANES AND ALTERNATIVE FUELS: EXECUTIVE SUMMARY Interim Report
W T Mikolowsky Dec 1976 41 p refs
(Contract F49620-77-C-0023)
(AD-A042112, R-1889/1-AF) Avail NTIS HC A03/MF A01 CSCL 21/4

Candidate applications of very large airplanes include strategic airlifter, tanker, missile launcher tactical battle platform, maritime air cruiser, and C3 platform This report summarizes AD-A040532 which explored the military utility of very large airplanes (over 1 million pounds gross weight) and examined several alternative fuels that could be used by such airplanes GRA

N77-33155# Army Air Mobility Research and Development Lab, Fort Eustis, Va Research and Development Lab
AN ASSESSMENT OF THE HOVER PERFORMANCE OF THE XH-59A ADVANCING BLADE CONCEPT DEMONSTRATION HELICOPTER
Donald N Arents May 1977 19 p refs
(DA Proj 1L2-6311-D-157)
(AD-A042083, USBAMRDL-TN-25) Avail NTIS HC A02/MF A01 CSCL 01/3

This report documents a study of the hovering characteristics the XH-59A helicopter, which was built to demonstrate the feasibility of the Advancing Blade Concept (ABC) The study examined in- and out-of-ground hover characteristics, aircraft and rotor figures of merit, and hover performance at 10- and 20-foot wheel heights The XH-59A's performance is also compared to the performances of other Army helicopters This indicates that the XH-59A performs better than other helicopters, largely because it lacks a tail rotor GRA

N77-33156# Cessna Aircraft Co, Wichita, Kans Wallace Div
A-37B FATIGUE SENSOR EVALUATION PROGRAM: FULL SCALE TEST AND FIELD AIRCRAFT INSTRUMENTATION Final Report, Jul. 1971 - Jan 1976
Robert W Walker and John Y Kaufman Mar 1977 123 p refs
(Contract F33657-71-C-0163)
(AD-A042114, ASD-TR-77-4) Avail NTIS HC A06/MF A01 CSCL 01/3

Micro Measurements FM Fatigue Sensors were installed on A-37 aircraft at three CONUS bases to determine the longevity and suitability of this device for field installation A similar installation on an A-37B full scale fatigue test provided base line data for relative severity comparisons of accumulated fatigue The sensor is shown to be practical for field installation and this report recommends field installations designed for more advanced data analysis methods Author (GRA)

N77-33157*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
A SUSPENDED ANEMOMETER SYSTEM FOR MEASURING TRUE AIRSPEED ON LOW-SPEED AIRPLANES
David D Kershner Oct 1977 30 p refs
(NASA-TN-D-8523, L-11269) Avail NTIS HC A02/MF A01 CSCL 01D

A suspended anemometer system for calibrating pitot-static systems on low speed research airplanes is described The anemometer measures true airspeed when suspended beneath the airplane on a long cable in regions of undisturbed air The electrical output of the propeller driven tachometer is a sine wave, the frequency of which is proportional to true airspeed The anemometer measures true airspeed over a range from 20 to 60 m/sec at altitudes to 3000 m, with an accuracy of + or - 0 5 percent of full scale range This accuracy is exclusive of errors in the recording system The stability of the suspended system was investigated and was found adequate in the airspeed range For the purpose of determining the location of the anemometer relative to the airplane, a method is given for calculating the shape assumed by the deployed cable Author

N77-33158# Grumman Aerospace Corp, Bethpage, N Y Power Optics and Displays Dept
MASTER MONITOR DISPLAY APPLICATION STUDY FOR F-14 Final Report
Joseph Austin 25 Mar 1977 157 p
(Contract N62269-76-C-0199)
(AD-A041570, NADC-77076-30) Avail NTIS HC A08/MF A01 CSCL 09/5

This Report summarizes the results of a study to replace the existing Caution Advisory Indicator in the F-14 with a Master Monitor Display (MMD) An MMD is described which uses the existing F-14 fault sensors with a few additions, and with several minor modifications to the aircraft interface The MMD design features 'management by exception', and provides automatic display of fault and course of action information on a cathode ray tube readout for all detected faults It also provides for manual display of total systems status, system fault, and fault history information on a call up basis Author (GRA)

N77-33160*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
PROGRESS IN ADVANCED HIGH TEMPERATURE TURBINE MATERIALS, COATINGS, AND TECHNOLOGY
John C Freche and G Mervin Ault 23 Sep 1977 44 p refs Presented at the 50th Panel on Propulsion and Energetics, Ankara, 19-23 Sep 1977, sponsored by AGARD
(NASA-TM-X-73628) Avail NTIS HC A03/MF A01 CSCL 21E

Material categories as well as coatings and recent turbine cooling developments are reviewed Current state of the art is identified, and as assessment, when appropriate, of progress, problems, and future directions is provided Author

N77-33161*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
STEADY-STATE UNBALANCE RESPONSE OF A THREE-DISK FLEXIBLE ROTOR ON FLEXIBLE, DAMPED SUPPORTS
Robert E Cunningham 29 Sep 1977 42 p refs Presented at the Vibrations Conf, Chicago, 26-29 Sep 1977, sponsored by ASME
(NASA-TM-X-73666 E-9091-1) Avail NTIS HC A03/MF A01 CSCL 21E

Experimental data are presented for the unbalance response of a flexible, ball bearing supported rotor to speeds above the third lateral bending critical Values of squeeze film damping coefficients obtained from measured data are compared to theoretical values obtained from short bearing approximation over a frequency range from 5000 to 31000 cycles/min Experimental response for an undamped rotor is compared to that of one having oil squeeze film dampers at the bearings Unbalance applied varied from 0 62 to 15 1 gm-cm Author

N77-33161*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
OVER-THE-WING MODEL THRUST REVERSER NOISE TESTS
J Goodykoontz and O Gutierrez 5 Oct 1977 20 p refs Presented at the 4th Aeroacoustics Conf Atlanta, 3-5 Oct 1977, sponsored by AIAA
(NASA-TM-73495, E-9328) Avail NTIS HC A02/MF A01 CSCL 20A

Static acoustic tests were conducted on a 1/12 scale model over-the-wing target type thrust reverser The model configuration simulates a design that is applicable to the over-the-wing short-haul advanced technology engine Aerodynamic screening tests of a variety of reverser designs identified configurations that satisfied a reverse thrust requirement of 35 percent of forward thrust at a nozzle pressure ratio of 1 29 The variations in the reverser configuration included, blocker door angle, blocker door lip angle and shape, and side skirt shape Acoustic data are presented and compared for the various configurations The model data scaled to a single full size engine show that peak free field perceived noise (PN) levels at a 152 4 meter sideline distance range from 98 to 104 PNdb Author

N77-33162*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
IDENTIFICATION AND MEASUREMENT OF COMBUSTION NOISE FROM A TURBOFAN ENGINE USING CORRELATION AND COHERENCE TECHNIQUES Ph D Thesis
Allen Martin Karchmer Sep 1977 156 p refs
(NASA-TM-73747, E-9319) Avail NTIS HC A08/MF A01 CSCL 20A

Fluctuating pressure measurements within the combustor and tailpipe of a turbofan engine are made simultaneously with far field acoustic measurements The pressure measurements within the engine are accomplished with cooled semi-infinite waveguide probes utilizing conventional condenser microphones as the transducers The measurements are taken over a broad range of engine operating conditions and for 16 far field microphone positions between 10 deg and 160 deg relative to the engine inlet axis Correlation and coherence techniques are used to determine the relative phase and amplitude relationships between the internal pressures and far field acoustic pressures The results indicate that the combustor is a low frequency source region for acoustic propagation through the tailpipe and out to the far field Specifically, it is found that the relation between source pressure and the resulting sound pressure involves a 180 deg phase shift The latter result is obtained by Fourier transforming the cross correlation function between the source pressure and acoustic pressure after removing the propagation delay time Further, it is found that the transfer function between the source pressure and acoustic pressure has a magnitude approximately proportional to frequency squared These results are shown to be consistent with a model using a modified source term in Lighthill's turbulence stress tensor, wherein the fluctuating Reynolds stresses are replaced with the pressure fluctuations due to fluctuating entropy Author

N77-33163*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
MEASUREMENT OF FAR FIELD COMBUSTION NOISE FROM A TURBOFAN ENGINE USING COHERENCE FUNCTIONS
A M Karchmer, M Reshotko, and F J Montegani 5 Oct 1977 33 p refs Presented at 4th Aeroacoustics Conf, Atlanta, 3-5 Oct 1977, sponsored by AIAA
(NASA-TM-73748, E-9320, AIAA-Paper-77-1277) Avail NTIS HC A03/MF A01 CSCL 21E

Coherence measurements between fluctuating pressure in the combustor of a YF-102 turbofan engine and far-field acoustic pressure were made The results indicated that a coherent relationship between the combustor pressure and far-field existed only at frequencies below 250 Hz, with the peak occurring near 125 Hz The coherence functions and the far-field spectra were used to compute the combustor-associated far-field noise in terms of spectra, directivity, and acoustic power, over a range of engine operating conditions The acoustic results so measured were compared with results obtained by conventional methods, as well as with various semiempirical predictions schemes Examination of the directivity patterns indicated a peak in the combustion noise near 120 deg (relative to the inlet axis) Author

N77-33165*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
OUTPUT FEEDBACK REGULATOR DESIGN FOR JET ENGINE CONTROL SYSTEMS
Walter Merrill 1977 14 p refs Presented at Intern Forum on Alternatives for Linear Multivariable Control, Chicago, 13-14 Oct 1977, sponsored by Natl Elec Conf
(NASA-TM-73776) Avail NTIS HC A02/MF A01 CSCL 21E

A multivariable control design procedure based on the output feedback regulator formulation is described and applied to turbofan engine model Full order model dynamics, were incorporated in the example design The effect of actuator dynamics on closed loop performance was investigaged Also the importance of turbine inlet temperature as an element of the dynamic feedback was studied Step responses were given to indicate the improvement in system performance with this control Calculation times for all experiments are given in CPU seconds for comparison purposes Author

N77-33166*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
STATE-OF-THE-ART OF TURBOFAN ENGINE NOISE CONTROL

W L Jones and J F Groeneweg Oct 1977 22 p refs Presented at NOISE-CON 77 Hampton, Va 17-19 Oct 1977 cosponsored by Inst of Noise Control Eng
(NASA-TM-73734 E-9254) Avail NTIS HC A02/MF A01 CSCL 21E

The technology of turbofan engine noise reduction is surveyed Specific topics discussed include (1) new fans for low noise, (2) fan and core noise suppression (3) turbomachinery noise sources and (4) a new program for improving static noise testing of fans and engines Author

N77-33167*# National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio
MINIMUM TIME ACCELERATION OF AIRCRAFT TURBOFAN ENGINES BY USING AN ALGORITHM BASED ON NONLINEAR PROGRAMMING
Fred Teren Jul 1977 182 p refs
(NASA-TM-73741) Avail NTIS HC A09/MF A01 CSCL 21E

Minimum time accelerations of aircraft turbofan engines are presented The calculation of these accelerations was made by using a piecewise linear engine model and an algorithm based on nonlinear programming Use of this model and algorithm allows such trajectories to be readily calculated on a digital computer with a minimal expenditure of computer time Author

N77-33168*# AiResearch Mfg Co , Phoenix Ariz
POLLUTION REDUCTION TECHNOLOGY PROGRAM FOR SMALL JET AIRCRAFT ENGINES, PHASE 1 Final Report, Nov 1974 - Jun 1976
T W Bruce F G Davis, T E Kuhn, and H C Mongia Sep 1977 177 p refs
(Contract NAS3-18560)
(NASA-CR-135214 AiResearch-21-2498) Avail NTIS HC A09/MF A01 CSCL 21E

A series of combustor pressure rig screening tests was conducted on three combustor concepts applied to the TFE731-2 turbofan engine combustion system for the purpose of evaluating their relative emissions reduction potential consistent with prescribed performance, durability, and envelope contraints The three concepts and their modifications represented increasing potential for reducing emission levels with the penalty of increased hardware complexity and operational risk Concept 1 entailed advanced modifications to the present production TFE731-2 combustion system Concept 2 was based on the incorporation of an axial air-assisted airblast fuel injection system Concept 3 was a staged premix/prevaporizing combustion system Significant emissions reductions were achieved in all three concepts, consistent with acceptable combustion system performance Concepts 2 and 3 were identified as having the greatest achievable emissions reduction potential and were selected to undergo refinement to prepare for ultimate incorporation within an engine Author

N77-33169*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
F100 MULTIVARIABLE CONTROL SYNTHESIS PROGRAM EVALUATION OF A MULTIVARIABLE CONTROL USING A REAL-TIME ENGINE SIMULATION
John R Szuch, James F Soeder Kurt Seldner and David S Cwynar Oct 1977 103 p refs
(NASA-TP-1056 E-9170) Avail NTIS HC A06/MF A01 CSCL 21E

The design, evaluation and testing of a practical multivariable linear quadratic regulator control for the F100 turbofan engine were accomplished NASA evaluation of the multivariable control logic and implementation are covered The evaluation utilized a real time hybrid computer simulation of the engine Results of the evaluation are presented, and recommendations concerning future engine testing of the control are made Results indicated that the engine testing of the control should be conducted as planned Author

N77-33171# AiResearch Mfg Co Torrance Calif
SUBSYSTEM DESIGN ANALYSIS LIGHT WEIGHT ALTERNATOR (MODEL TEST PROGRAM) ADDENDUM 2 Final Report
C H Lee, D Berker G Tatro and P Walia Mar 1977 105 p
(Contract F29601-74-C-0055)
(AD-A041257, AFWL-TR-75-66-Add-2) Avail NTIS HC A06/MF A01 CSCL 10/2

This report discusses the test and computer simulation activities conducted on a modified-design small-rating aircraft alternator These activities were intended to provide additional verifications of the alternator analytical approach utilized in designing two specialized large-rating lightweight alternators The latter designs have been previously detailed in Air Force technical reports AFWL-TR-75-66 Subsystem Design Analysis Report for Lightweight Alternator (AC Load Case) and AFWL-TR-75-66 Addendum 1, Subsystem Design Analysis Report for Lightweight Alternator (DC Load Case) Author (GRA)

N77-33172# Aeronautical Research Council London (England)
THE CURRENT STATE OF RESEARCH AND DESIGN IN HIGH PRESSURE RATIO CENTRIFUGAL COMPRESSORS
P M Came Jul 1976 75 p refs Supersedes NGTE-NT-1029
(AD-A041011 ARC-CP-1363 NGTE-NT-1029) Avail NTIS HC A04/MF A01 CSCL 21/5

A review of the achievements of research effort in centrifugal compressors is presented and its effect on current design methods is discussed The paper concludes with recommendations for future research Author (GRA)

N77-33175# General Electric Co Cincinnati Ohio Aircraft Engine Group
HIGH VELOCITY JET NOISE SOURCE LOCATION AND REDUCTION TASK 4 DEVELOPMENT/EVALUATION OF TECHNIQUES FOR INFLIGHT INVESTIGATION Final Report
W S Clapper and E J Stringas 22 Feb 1977 569 p refs
(Contract DOT-OST-30034)
(AD-A041849 Rept-R77AEG189 FAA-RD-76-79-4) Avail NTIS HC A24/MF A01 CSCL 20/1

This report presents the results of Task 4 as conducted under the subject program over a period of 30 months Task 4 was formulated to identify and evaluate several inflight simulation techniques select the most promising technique for demonstration and validation and employ that technique in testing under Task 5 of the program Techniques evaluated include closed-circuit wind tunnels free jets rocket sleds and high speed trains Pertinent results from the evaluation phase and rationale which led to selection of the free jet simulation technique are discussed including advantages and disadvantages The results of a theoretical study aimed at relating the noise signature obtained in a free jet facility for simulation of forward flight effects on jet noise with the noise signature in true flight are presented Transformation is carried out by extracting 'static directivity' of the noise after correcting for refraction turbulent scattering and absorption effects and then employing a suitable multipole source decomposition to evaluate the proper dynamic effect A flowchart describing the details of the transformation procedure and a listing of the computer program are included Acoustic results from the Learjet and NASA-Lewis F-106 Aircraft Flyovers and the French Aerotrain Tests taken with a baseline 8-lobe and 104-tube nozzle were used to formulate a data base for verification of the free jet simulation technique Detailed directivity and spectra comparisons between aerotrain data and transformed free jet data are presented for three primary jet velocities and two flight velocities for the three nozzle types GRA

N77-33176# National Gas Turbine Establishment, Farnborough (England)
THE EFFECT OF FLIGHT ON THE NOISE OF SUBSONIC JETS
B J Cocking Oct 1976 30 p refs
(AD-A041730 NGTE-R-343 DRIC-BR-556165) Avail NTIS HC A03/MF A01 CSCL 20/4

The noise of a single-stream circular jet and a coaxial jet with coplanar nozzles of 2 5 area ratio has been measured under simulated flight conditions The majority of tests were conducted with the single-stream jet and primary section of the coaxial jet at a nominal temperature of 880 K The data have been used to quantify the effect of jet temperature and were combined with measurements from an earlier test series to establish a prediction method for the effect of flight on the noise of single-stream subsonic jets This method is based on jet noise theory modified by experimentally derived constants For coaxial jets it is concluded that the noise reductions, which are independent of the secondary stream velocity, are predicted to an acceptable degree by the method suggested for unheated single-stream jets GRA

N77-33177# General Electric Co , Cincinnati, Ohio Aircraft Engine Group

SUPERSONIC JET EXHAUST NOISE INVESTIGATION VOLUME 4 ACOUSTIC FAR-FIELD/NEAR-FIELD DATA REPORT Final Technical Report, 1 Dec 1972 - 23 Sep. 1976

Paul R Knott and John F Brausch Wright-Patterson AFB, Ohio AFAPL Jul 1976 510 p Sponsored in part by DOT
(Contract F33615-73-C-2031)
(AD-A041819, R74AEG452-Vol-4, AFAPL-TR-76-68-Vol-4)
Avail NTIS HC A22/MF A01 CSCL 20/1

This report is an acoustic data report presenting a series of parametric acoustic far-field and near-field results for subsonic and supersonic heated flow conditions for a simple conical nozzle (thin lip and thick lip) and a convergent-divergent nozzle at design and off-design conditions Author (GRA)

N77-33179# Tennessee Univ Space Inst Tullahoma

INVESTIGATION OF FEASIBLE NOZZLE CONFIGURATIONS FOR NOISE REDUCTION IN TURBOFAN AND TURBOJET AIRCRAFT VOLUME 3 SHROUDED SLOT NOZZLE CONFIGURATIONS Final Report, Aug 1975 - Mar 1977

B H Goethert J R Maus William A Dunnill, M C Joshi and V Veerasamy Mar 1977 127 p refs
(Contract DOT-FA72WA-3053)
(AD-A041782 FAA-RD-75-162-3) Avail NTIS HC A07/MF A01 CSCL 21/5

This report presents the results of a study of the acoustic and fluid dynamic characteristics of a shrouded slot nozzle Experiments were carried out on a slot nozzle of aspect ratio 27 with an ejector shroud having a cross sectional area of four times the primary nozzle area Parameters varied during the tests were, shroud length shroud divergence ratio and acoustical impedance of the shroud wall Tests were conducted for primary flow Mach numbers from 0 5 to choking and stagnation temperatures from ambient to 1200 R The results of the study show that both the thrust and the noise attenuation characteristics of the ejector shroud improve with increasing length Thrust increases of near 40% were obtained for the longest shroud tested A noise reduction of 13 dB was obtained for the lined shroud with a near choked, high temperature primary jet The corresponding thrust augmentation was approximately 20%
Author (GRA)

N77-33180# Association Aeronautique et Astronautique de France Paris

TURBULENT EFFECTS IN AXIAL COMPRESSORS [EFFETS INSTATIONNAIRES DANS LES COMPRESSEURS AXIAUX]

M Sagnes 1977 63 p refs In FRENCH Presented at the 13th Colloq d'Aerodyn Appl Lyon, 8-10 Nov 1976
(Contract DRME-74/607)
(AAAF-NT-77-20, ISBN-2-7170-0437-8) Avail NTIS HC A04/MF A01, CEDOCAR Paris FF 25 (France and EEC) FF 29 (others)

An attempt to improve the lift and reduce the drag in turbocompressors by provoked turbulence is presented The experimental setup is detailed and the results are discussed establishing unequivocally the possibility of inducing the required effects by sinusoidal orientation of the blades ESA

N77-33181# Advisory Group for Aeronautical Research and Development Paris (France)

POWER PLANT RELIABILITY

Aug 1977 222 p refs In ENGLISH and FRENCH Presented at the 49th Meeting of the AGARD Propulsion and Energetics Panel The Hague 31 Mar - 1 Apr 1977
(AGARD-CP-215 ISBN-92-835-0198-5) Avail NTIS HC A10/MF A01

The reliability of current civil and military engines is discussed Plans to improve engine reliability and the role of engine diagnostics and monitoring is explored

N77-33182# Aeronautical Systems Div Wright-Patterson AFB Ohio

ENGINE STRUCTURAL INTEGRITY PROGRAM (ENSIP)

Eric E Abell and Edward G Koepnick *In* AGARD Power Plant Reliability Aug 1977 4 p

Avail NTIS HC A10/MF A01

A new military standard for turbine engines for use by the Air Force is discussed The standard is aimed at providing overall policy and requirements for turbine engine structural development during the entire system life cycle A first review of the tasks involved in the standard are outlined Specific items such as duty cycle and tests concerned with fatigue considerations are noted Author

N77-33183# Ministero della Difesa Aeronautica Rome (Italy)

MILITARY ENGINE DETERIORATION IN SERVICE CONNECTED WITH LIFE CYCLE COSTS

G Facca and L Giorgieri *In* AGARD Power Plant Reliability Aug 1977 18 p refs

Avail NTIS HC A10/MF A01

Problems responsible for military jet engine deterioration are identified and cost structure for these problems is analyzed Since a large amount of labor, skill and costs are involved in maintaining engines in service at an adequate standard of efficiency and safety several standards must be met Overall maintenance and repair life cycle costs must be comparable to the new engine cost Design must pay proper attention to reliability and maintainability concepts from the beginning and trade-offs should be performed in order to optimize the engine overall life cycle costs Author

N77-33184# Direction Centrale du Materiel de l Armee de l Air, Paris (France)

MAINTENANCE METHODS FOR IMPROVING PROPULSION SYSTEM RELIABILITY [METHODES DE MAINTENANCE POUR AMELIORER LA FIABILITE DES PROPULSEURS]

Claude Sprung *In* AGARD Power Plant Reliability Aug 1977 9 p In FRENCH
Avail NTIS HC A10/MF A01

Preventive measures used by the French Air Force in systematic aircraft engine maintenance procedures are described Topics discussed include spectrometry of oils analysis of metal particles engine vibration, and the use of endoscopy, ultrasonics and gammagraphy Transl by A R H

N77-33185# Civil Aviation Authority Redhill (England) Airworthiness Div

CIVIL AIRWORTHINESS REQUIREMENTS FOR POWER-PLANT RELIABILITY

John Slatford *In* AGARD Power Plant Reliability Aug 1977 6 p
Avail NTIS HC A10/MF A01

Several aspects of aircraft reliability are discussed These considerations relating to the safety of the aircraft and its occupants are summarized into three objectives Any failure of an engine that could hazard the aircraft must be kept to an absolute minimum Loss of thrust in flight must not reduce the total thrust available to the aircraft to such an extent that the flight cannot be completed safely A normally operating engine

must provide the thrust necessary for the aircraft to meet its scheduled performance and respond quickly and accurately to the demands of the pilot Author

N77-33186# KLM Royal Dutch Airlines, Amsterdam (Netherlands)
RELIABILITY VERSUS COST IN OPERATING WIDE BODY JET ENGINES
S K W J Demarteau *In* AGARD Power Plant Reliability Aug 1977 7 p
Avail NTIS HC A10/MF A01

The high degree of reliability from aircraft and engines required by scheduled international airline operational and maintenance characteristics is discussed Standards must be met in order to offer a safe but also commercially and economically justified product A specific cost/reliability level was investigated for the General Electric CF6 engine Reliability was found to be influenced by inherent design deficiencies, operation environment and maintenance policy Cost consequences were dependent on airline operation, the way an airline is organized, the scale of operation and airline standards Author

N77-33187# Service des Etudes de Propulsion, Paris (France)
RISKS AFFECTING THE STRUCTURAL RESISTANCE AND INTEGRITY OF MODERN PROPULSION SYSTEMS [LES RISQUES AFFECTANT LA RESISTANCE STRUCTURALE ET LA SECURITE DES PROPULSEURS MODERNES]
Jean A Aguer *In* AGARD Power Plant Reliability Aug 1977 14 p refs In FRENCH

Avail NTIS HC A10/MF A01

The performance of modern engines already in service or those which will be in use in the 1980's and thereafter depends on higher temperature levels greater thermal and kinetic stress and constraints, and new materials technologies for improved efficiency To maintain the structural integrity of these engines, the effects of thermal and kinetic energies to be used in the future must be determined Precise examples are given to demonstrate what precautions must be taken The most important priorities should be given to the use of titanium engine ingestion turbine blades fuels and lubricants and the thrust/weight ratio Transl by A R H

N77-33188# Ministry of Defence London (England) Directorate of Engine Development
DEVELOPMENT PROCEDURES TO PROMOTE RELIABILITY
R Holl *In* AGARD Power Plant Reliability Aug 1977 14 p refs
Avail NTIS HC A10/MF A01

Reliability attainment so far as the military aircraft gas turbine is concerned was studied Civil engine development and operational reliability were considered in order to emphasize that the aircraft gas turbine particularly in a basically non-complete form provided a step change in reliability when compared with its predecessor the high powered piston propeller engine Conclusions indicate that recent concentration on the achievement of performance goals has resulted in increasingly complex and very costly engines as well as a near total lack of attention to design reliability Author

N77-33189# Societe Nationale d Etudes et de Construction de Moteurs d Aviation, Moissy-Cramayel (France)
CFM56 TURBOFAN MAINTAINABILITY AND RELIABILITY-ORIENTED DEVELOPMENT
Jean-Pierre Marechal *In* AGARD Power Plant Reliability Aug 1977 19 p In ENGLISH and FRENCH

Avail NTIS HC A10/MF A01

Reliability and maintainability criteria introduced in the CFM 56 turbofan engine are described A 7500 operating program will provide methodical accumulation of data so that maintenance costs may be minimized through high repairability accessibility, modularity, and interchangeable features Author

N77-33190# General Electric Co, Cincinnati, Ohio Aircraft Engine Group
AIRCRAFT ENGINE DESIGN AND DEVELOPMENT THROUGH LESSONS LEARNED
Bernard L Koff *In* AGARD Power Plant Reliability Aug 1977 11 p
Avail NTIS HC A10/MF A01

Aircraft engine design was examined in terms of performance and reliability Durability, maintenance, weight, initial cost and timing were also considered It is stated that design and development are derivatives of a lessons learned' approach Since materials, modern analytical and experimental techniques have progressed so has our ability to design and develop modern aircraft Author

N77-33192# Air Force Aero Propulsion Lab Wright-Patterson AFB, Ohio
A PROCEDURE FOR PREDICTING THE LIFE OF TURBINE ENGINE COMPONENTS
R J Hill *In* AGARD Power Plant Reliability Aug 1977 9 p refs
Avail NTIS HC A10/MF A01

A procedural method is presented for the creation of a life estimate of aircraft gas turbine engine components The method consists of three segments -- the calculation of a modulus, the determination of a critical material property and a comparison of the modulus to the material property with a resulting judgment Each segment is discussed in qualitative terms and related to required validation and acceptance testing Author

N77-33193# Direction du Materiel Etudes de Propulsion Paris (France)
THE EVOLUTION AND CONTROL OF DIFFERENT PERFORMANCE DEGRADATION PROCESSES IN MODERN PROPULSION SYSTEMS [EVOLUTION ET CONTROLE DES DIFFERENTS PROCESSUS DE DEGRADATION DE PERFORMANCE SUR LES PROPULSEURS MODERNES]
P Chetail *In* AGARD Power Plant Reliability Aug 1977 17 p refs In FRENCH

Avail NTIS HC A10/MF A01

The development of policies for jet engine maintenance and the basic principles for applying monitoring methods are discussed Processes involved in the degradation of thermodynamic and mechanical performance are examined A computer program is described for evaluating the efficacy of the monitoring methods from a technical and economic point of view Transl by A R H

N77-33194# Pisa Univ (Italy)
TESTING SIMULATION OF DAMAGES OCCURRED IN SERVICE
D Dini and L Giorgieri (Ministero della Difesa Aeronautica) *In* AGARD Power Plant Reliability Aug 1977 22 p refs

Avail NTIS HC A10/MF A01

A basic framework is presented from which further simulation of increased complexity and sophistication can be easily implemented regarding engine failures by an in-flight foreign object, large overpressure signature inlet flow distortion and icing environment A general basic engine reliability program is provided, capable of simulating a running turbojet-engine and its air supplying environment as an integrated system The specific subroutines for the possible damages are to be supplied by the user Recent advances on testing simulation of flight-incurred power plant damages promise to reduce accidents due to engine operation at low altitudes and in rugged confined terrain State-of-the-art design techniques are discussed to improve engine reliability including an analysis of three particular experimental simulations to determine damage causes and effects Recommendations are put forth that will eliminate or reduce the causes of aviation accidents Author

N77-33195# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France)
PROGRESS IN DETERMINING SERVICE LIFE BY ENDURANCE TESTS [PROGRES DE LA DETERMINATION DE LA VIE EN SERVICE PAR LES ESSAIS D'ENDURANCE]
B Devoge *In* AGARD Power Plant Reliability Aug 1977 6 p In FRENCH
Avail NTIS HC A10/MF A01

For numerous reasons, aircraft engine builders conduct long endurance tests which are notably distinguished from the usual development and certification tests Formulas for accelerated cyclic tests were adapted for the Olympus MK 610-14-28 engine used on the Concorde Topics discussed include a description of the cycle test compared to the flight cycle, the installation of the test equipment, and the precautions that were taken to assure a faithful representation of operational conditions When commercial Concorde service began, the accumulated cycles represented several years of usage Transl by A R H

N77-33196# Pratt and Whitney Aircraft, West Palm Beach Fla Government Products Div
ACCELERATED MISSION TEST: A VITAL RELIABILITY TOOL
B J McDonnell *In* AGARD Power Plant Reliability Aug 1977 6 p
Avail NTIS HC A10/MF A01

The Accelerated Mission Test (AMT) has been successfully used in the F100 engine program to anticipate potential future problems Early identification of service oriented problems has provided the lead time necessary to take corrective action before the problems occur in operation which decreases engine 'down' time thereby improving life cycle cost The AMT is a supplemental testing procedure and must be used in conjunction with all of the advanced structural analysis techniques Plans are now being developed to conduct accelerated mission tests on engines that have completed the overhaul or depot cycle The purpose of the testing will be to identify potential problem areas associated with engine parts that have been repaired in accordance with the overhaul procedures Author

N77-33197# Technische Hochschule, Aachen (West Germany) Inst fuer Strahlantriebe und Turboarbeitsmaschinen
EXPERIMENTAL INVESTIGATION ON THE INFLUENCE OF COMPONENT FAULTS ON TURBOJET ENGINE PERFORMANCE
H Toenskoetter *In* AGARD Power Plant Reliability Aug 1977 12 p refs
Avail NTIS HC A10/MF A01

Some results of experimental investigations on the effect of implanted local faults, e g turbine guide vane damage, plugged fuel nozzles, and turbine rotor blade damage, on the performance of a single spool turbojet engine are presented The formation of flow non-uniformities downstream from the faults is especially described In one-dimensional gas path analysis systems circumferential-averaged thermodynamic parameters are used for fault detection The effect of the implanted faults on some of these averaged parameters will be shown in comparison with the local parameter changes in the disturbed sector The possibilities of using the analysis of flow non-uniformities for the isolation of local faults in the hot section of turbojet engines are discussed and questions of probe position for this diagnostic technique are ventilated Author

N77-33198# Vereinigte Flugtechnische Werke-Fokker G m b H Bremen (West Germany)
METHODS OF IMPROVING THE PERFORMANCE RELIABILITY OF ADVANCED MILITARY POWER PLANT SYSTEMS
Richard Smyth *In* AGARD Power Plant Reliability Aug 1977 23 p refs
Avail NTIS HC A10/MF A01

Advanced military propulsion systems will be equipped with multi-parameter control systems based around an electronic computer making use of digital technology Such control systems have a high degree of flexibility and can be used for a wide range of applications This offers new possibilities of efficient and accurate monitoring of engine performance in the aircraft and by the flight support organization responsible for reliability and safety of the propulsion system The possibilities are discussed based on the experience gained with a multi-parameter electronic engine controller of a V/STOL fighter aircraft Special consideration is given to practical aspects such as handling procedures Author

N77-33199# Air Force Logistics Command, Wright-Patterson AFB, Ohio
PRELIMINARY RESULTS OF USAF EXPERIENCE WITH ENGINE MONITORING AND DIAGNOSTICS
A Bruce Richter and Kenneth E Eickmann *In* AGARD Power Plant Reliability Aug 1977 6 p
Avail NTIS HC A10/MF A01

A formal flight test evaluation of an engine health monitoring system being used on ten T-38 supersonic aircraft is described The system consists of engine sensors, an airframe mounted Data Processing Unit (DPU), and a ground based diagnostic display unit The sensors continuously monitor some 24 parameters including an EGT, RPM, fuel flow, and EPR, however, data is only recorded if the pilot wishes or if a gate in the DPU is triggered Author

N77-33200*# Virginia Polytechnic Inst and State Univ, Blacksburg
DIGITAL FLIGHT CONTROL SYSTEMS
Alper K Caglayan and Hugh F VanLandingham Sep 1977 51 p refs
(Grant NGR-47-004-116)
(NASA-CR-145246) Avail NTIS HC A04/MF A01 CSCL 01C

The design of stable feedback control laws for sampled-data systems with variable rate sampling was investigated These types of sampled-data systems arise naturally in digital flight control systems which use digital actuators where it is desirable to decrease the number of control computer output commands in order to save wear and tear of the associated equipment The design of aircraft control systems which are optimally tolerant of sensor and actuator failures was also studied Detection of the failed sensor or actuator must be resolved and if the estimate of the state is used in the control law, then it is also desirable to have an estimator which will give the optimal state estimate even under the failed conditions Author

N77-33201*# Rockwell International Corp, Los Angeles, Calif
DESIGN AND DEVELOPMENT OF A STRUCTURAL MODE CONTROL SYSTEM
Oct 1977 184 p refs
(Contract NAS4-2347)
(NASA-CR-143846, NA-77-296) Avail NTIS HC A09/MF A01 CSCL 01C

A program was conducted to compile and document some of the existing information about the conceptual design, development, and tests of the B-1 structural mode control system (SMCS) and its impact on ride quality This report covers the following topics (1) Rationale of selection of SMCS to meet ride quality criteria versus basic aircraft stiffening (2) Key considerations in designing an SMCS, including vane geometry rate and deflection requirements, power required, compensation network design, and fail-safe requirements (3) Summary of key results of SMCS vane wind tunnel tests (4) SMCS performance (5) SMCS design details, including materials, bearings, and actuators (6) Results of qualification testing of SMCS on the 'Iron Bird' flight control simulator, and lab qualification testing of the actuators (7) Impact of SMCS vanes on engine inlet characteristics from wind tunnel tests Author

N77-33202*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center

F-8C ADAPTIVE FLIGHT CONTROL LAWS Final Report

G. L. Hartmann, C. A. Harvey, G. Stein, D. N. Carlson and R. C. Hendrick. Washington NASA Sep 1977 334 p refs (Contract NAS1-13383)

(NASA-CR-2880 HONEYWELL-76SRC/16) Avail NTIS HC A15/MF A01 CSCL 01C

Three candidate digital adaptive control laws were designed for NASA's F-8C digital flyby wire aircraft. Each design used the same control laws but adjusted the gains with a different adaptative algorithm. The three adaptive concepts were high-gain limit cycle, Liapunov-stable model tracking and maximum likelihood estimation. Sensors were restricted to conventional inertial instruments (rate gyros and accelerometers) without use of air-data measurements. Performance growth potential and computer requirements were used as criteria for selecting the most promising of these candidates for further refinement. The maximum likelihood concept was selected primarily because it offers the greatest potential for identifying several aircraft parameters and hence for improved control performance in future aircraft application. In terms of identification and gain adjustment accuracy, the MLE design is slightly superior to the other two, but this has no significant effects on the control performance achievable with the F-8C aircraft. The maximum likelihood design is recommended for flight test, and several refinements to that design are proposed. Author

N77-33203*# Honeywell Inc. Minneapolis, Minn. Systems and Research Center

F-8C ADAPTIVE FLIGHT CONTROL EXTENSIONS Final Report

Gunter Stein and Gary L. Hartmann. Washington NASA Sep 1977 143 p refs (Contract NAS1-13383)

(NASA-CR-2881 HONEYWELL-76SRC/16) Avail NTIS HC A07/MF A01 CSCL 01C

An adaptive concept which combines gain-scheduled control laws with explicit maximum likelihood estimation (MLE) identification to provide the scheduling values is described. The MLE algorithm was improved by incorporating attitude data estimating gust statistics for setting filter gains and improving parameter tracking during changing flight conditions. A ...teral MLE algorithm was designed to improve true air speed ...id angle of attack estimates during lateral maneuvers. Relationships between the pitch axis sensors inherent in the MLE design were examined and used for sensor failure detection. Design details and simulation performance are presented for each of the three areas investigated. Author

N77-33204# Naval Postgraduate School, Monterey, Calif.

WING ROCK AS A LATERAL-DIRECTIONAL AIRCRAFT LIMIT CYCLE OSCILLATION INDUCED BY NONLINEAR AERODYNAMICS OCCURRING AT HIGH ANGLE OF ATTACK. M.S. Thesis

Paul David Young. Jun 1977 69 p refs

(AD-A042104) Avail NTIS HC A04/MF A01 CSCL 01/3

Wing rock at high angle of attack is an oscillatory lateral-directional motion phenomenon known to exist in some of today's high performance tactical aircraft. The motion has been consistently characterized as a lightly damped Dutch-Roll oscillation attributable to asymmetric wing stall. However, evidence gathered from wind tunnel simulations and at least one British study indicate that aerodynamic nonlinearities may be the source of wing rock. Regardless of the actual cause of the phenomenon, a study of wing rock has positive ramifications with respect to gaining a clear r understanding of the aerodynamics associated with high angle of attack flight. This report presents the results of an investigation of wing rock which centered on the premise that two distinct nonlinear aerodynamic mechanisms (aerodynamic hysteresis and a cubic nonlinearity in yawing moment) not only can cause wing rock but may drive it to a limit cycle oscillation as well. Author (GRA)

N77-33206# Missouri Univ., Columbia. Dept. of Electrical Engineering

ANALYSIS OF INHERENT ERRORS IN ASYNCHRONOUS DIGITAL FLIGHT CONTROLS Interim Report, 1 Feb 1976 - 31 Jan 1977

Charles Slivinsky. 31 Jan 1977 17 p refs (Grant AF-AFOSR-2968-76)

(AD-A041813 AFOSR-77-0728TR) Avail NTIS HC A02/MF A01 CSCL 01/4

Progress has been achieved in the study of inherent errors in asynchronous digital flight controls. The research involves model development, software development and parametric analysis of representative flight control systems. Author (GRA)

N77-33207# Bell Helicopter Co., Fort Worth, Tex.

ROTORCRAFT FLIGHT SIMULATION WITH COUPLED ROTOR AEROELASTIC STABILITY ANALYSIS VOLUME 1. ENGINEER'S MANUAL Final Technical Report, May 1975 - May 1976

Tyce T. McLarty. May 1977 347 p refs (Contract DAAJ02-75-C-0025 DA Proj. 1F2-62209-AH-76)

(AD-A042462, USAAMRDL-TR-76-41A *Rept-699-099-022*) Avail NTIS HC A15/MF A01 CSCL 20/4

This report consists of three volumes and documents the current version in the C81 family of rotorcraft flight simulation programs developed by Bell Helicopter Textron. This current version of the digital computer program is referred to as AGAJ76. The accompanying program for calculating fully-coupled rotor blade mode shapes is called DN9100. The first volume, the Engineer's Manual, presents an overview of the computer program capabilities plus discussions for the background and development of the principle mathematical models in the program. The models discussed include all those currently in the program. GRA

N77-33208# Advisory Group for Aeronautical Research and Development, Paris (France)

STRUCTURAL ASPECTS OF ACTIVE CONTROLS

Aug 1977 102 p refs Partly in ENGLISH and FRENCH. Proc. of 44th Meeting of AGARD Struct. and Mater. Panel, Lisbon, 21 Apr. 1977

(AGARD-CP-228, ISBN-92-835-0200-00) Avail NTIS HC A06/MF A01

Design and implementation factors regarding flight control systems are reviewed. Flutter suppression system testing is discussed including wind tunnel tests, as well as actual flight tests. Also considered is the impact flight command stability systems have on aircraft dynamic response.

N77-33209# British Aircraft Corp., Filton (England). Commercial Aircraft Div.

A PRACTICAL OPTIMUM SELECTION PROCEDURE FOR A MOTIVATOR IN ACTIVE FLUTTER SUPPRESSION SYSTEM DESIGN ON AN AIRCRAFT WITH UNDERWING STORES

M. R. Turner and C. G. Lodge. *In* AGARD Structural Aspects of Active Controls Aug 1977 19 p

Avail NTIS HC A06/MF A01

Theoretical active flutter control of a variable sweep wing with external stores with four combinations of store configuration/wing sweep/Mach number was studied. Electrically modified outputs of a structure-mounted transducer were used to drive an auxiliary control surface on the wing or store. The best transducer/force positions on the wing and stores were found using Nyquist plots, representing the control surface loads by point forces. The object was to see if a common active flutter control system using a control surface on the wing could be found for a range of stores, Mach numbers and wing sweep angles. Difficulties were due to two instabilities with close frequencies in two of the configurations and very low dampings in some of the stable modes. Author

N77-33210# Vereinigte Flugtechnische Werke-Fokker G m b H , Bremen (West Germany)
IMPACT OF A COMMAND AND STABILITY AUGMENTATION SYSTEM ON GUST RESPONSE OF A COMBAT AIRCRAFT
K D Collmann and O Sensburg (Messerschmitt-Boelkow-Blohm GmbH Munich) *In* AGARD Structural Aspects of Active Controls Aug 1977 17 p refs

Avail NTIS HC A06/MF A01

To get reasonable results for just response calculations it is necessary to introduce the elastic aircraft behaviour as well as the Command and Stability Augmentation System (CSAS) into the mathematical model It is demonstrated how calculation results are influenced by using aerodynamic interference air forces the influence of the CSAS is then presented It is shown that the influence of the CSAS on the dynamic response is of prime interest and often far exceeds the influence of the elastic structure The unsteady aerodynamic forces should be determined with three-dimensional theories including interference and corrections to match the steady derivatives measured in the wind tunnel should be included The impedance function control loop transfer functions are highly nonlinear due to the nonlinearities of the hydraulic actuators All these functions must be determined experimentally and introduced into the elastic aircraft equation Response plots of the total system should be calculated and compared with results of so-called structural mode coupling tests' If correlation is good, a major part for the investigation of structural response of the aircraft due to various input functions is verified Author

N77-33211# British Aircraft Corp Filton (England) Unternehmensbereich Flugzeuge
ACTIVE FLUTTER SUPPRESSION OF AN AIRPLANE WITH WING MOUNTED EXTERNAL STORES
H Hoenlinger *In* AGARD Structural Aspects of Active Controls Aug 1977 15 p refs

Avail NTIS HC A06/MF A01

A wing store flutter suppression system with store mounted vanes was designed The system was proved effective when implemented and flight-tested on a Fiat G 91/T3 aircraft The relatively small vanes used were very effective in controlling flutter and their use did not alter aircraft flight mechanical characteristics J L H

N77-33212# Boeing Co , Wichita Kans
AIRPLANE MATH MODELING METHODS FOR ACTIVE CONTROL DESIGN
Kenneth L Roger *In* AGARD Structural aspects of active controls Aug 1977 11 p refs

Avail NTIS HC A06/MF A01

Selected analytical methods are described which are useful and practical in math modeling for airplane active control system design A technique for writing state equations is presented which is suitable for incorporating lifting surface aerodynamic solutions An economical method of computing unsteady aerodynamic influence matrices is presented for line doublets and plate doublets, the latter usable at any Mach number An economical way to analyze three-dimensional turbulence and a convenient way of using design criteria in n-dimensions are presented to aid in designing for statistical performance Recommendations include the use of a single airplane math model for analysis of multiple performance parameters and the use of control hardware math modeling during preliminary design Author

N77-33213# Air Force Flight Dynamics Lab , Wright-Patterson AFB, Ohio Flight Control Div
CONSISTENCY IN AIRCRAFT STRUCTURAL AND FLIGHT CONTROL ANALYSIS
Robert C Schwanz *In* AGARD Structural Aspects of Active Controls Aug 1977 18 p refs

Avail NTIS HC A06/MF A01

Military Specifications (MILSPECS) are often employed by the USAF procuring authority as guidelines for design development, acceptance testing and mission application of military aircraft The MILSPECS must usually be satisfied by formulations of the aerodynamic and dynamic analyses that are consistent or equivalent if not identical When control configured vehicle considerations are involved however, inconsistencies resulting from analysis expediency or previous engineering convention may occur In this paper YF-16, C-5A, B-52E and large transport aircraft design studies and flight tests provide data for a discussion and numerical illustration of these inconsistencies It is concluded that they may be minimized or avoided altogether if flight control specialists become more familiar with restrictions of present-day unsteady aerodynamic theory, and structural specialists increase their knowledge of modern dynamics and control theory Author

N77-33214# Boeing Aerospace Co Seattle Wash
YC-14 CONTROL SYSTEM REDUNDANCY
William T Hamilton *In* AGARD Structural Aspects of Active Controls Aug 1977 7 p refs

Avail NTIS HC A06/MF A01

The YC-14 is the Boeing entry in the USAF Advanced Medium STOL Transport program The task of operating a large jet aircraft into and out of a semi-prepared, 2 000 feet long airstrip with a 27,000 pound payload presents an unusual flight control challenge The YC-14 answers this challenge using an advanced flight control system that includes digital computers Excellent STOL flying qualities have been achieved through control wheel steering and speed hold modes Fail operational-fail safe performance is provided by a triplex flight control system Aircraft dynamics following an engine failure are docile and do not require immediate pilot attention or unusual skill The superior capability of digital computers to perform logic functions enables a comprehensive, semi-automated preflight test Failures are detected and identified to the Line Replaceable Unit The YC-14 s use of redundant digital computers in the flight control role is a first for an aircraft designed to demonstrate operational use Author

N77-33215# Office National d'Etudes et de Recherches Aerospatiales, Paris (France) Div de Recherche
WIND TUNNEL STUDY OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM
Roger Destuynder *In* AGARD Structural Aspects of Active Controls Aug 1977 9 p refs In FRENCH ENGLISH summary

Avail NTIS HC A06/MF A01

Active flutter control was tested in a wind tunnel on a model of wing carrying an external tank The aerodynamic forces of the control system were generated by a classical aileron piloted by a miniaturized servo-control from a signal issued by an accelerometer detecting the wing movement A single control law was used in the whole velocity range A gain of more than 15% was obtained on the flutter critical velocity Author

N77-33216# Air Force Human Resources Lab Brooks AFB Tex Flying Training Div
INVESTIGATION OF DIAGNOSTIC, ERROR DETECTOR AND SELF-TAUGHT INSTRUCTIONAL STRATEGIES FOR FLIGHT SIMULATOR PROGRAMS Final Report, Apr 1975 - May 1976
Dolores Tyler, Robert W McFadden, Edward E Eddowes, and Robert R Fuller Oct 1976 211 p refs
(AD-A035682 AFHRL-TR-76-65) Avail NTIS HC A10/MF A01 CSCL 05/9

This study investigated the use of three instructional strategies in the training of basic instrument flight maneuvers in a T-40 simulator under standard conditions and two levels of increased task loading The three strategies investigated were (a) diagnostic (b) error detector and (c) self-taught Diagnostic instructors used immediate feedback through error analysis the error detector instructor used limited feedback and the self-taught group was instructed without the aid of any feedback from the instructor pilot The three levels of loading were (a) no task loading (b)

a change in the center of gravity from normal to full forward and (c) a change in air turbulence from zero to maximum Twenty-seven Air Force officers awaiting entry into undergraduate pilot training were randomly assigned to one of the three instructional strategy groups The results indicate that there were no significant differences between the three instructional strategies i e , the students of any one strategy performed equally as well as the students of the other two strategies The results indicated that there were significant differences among task load conditions A general decrement in performance was noted when the students flew the maneuvers with the center of gravity change and an even greater decrement when they flew with maximum turbulence GRA

N77-33230*# Systems Technology, Inc , Mountain View, Calif
RESEARCHER'S GUIDE TO THE NASA AMES FLIGHT SIMULATOR FOR ADVANCED AIRCRAFT (FSAA)
John B Sinacon, Robert L Stapleford, Wayne F Jewell, and John M Lehman Washington NASA Aug 1977 276 p refs
(Contract NAS2-9024)
(NASA-CR-2875 STI-TR-1074-1) Avail NTIS HC A13/MF A01 CSCL 14B

Performance, limitations supporting software, and current checkout and operating procedures are presented for the flight simulator, in terms useful to the researcher who intends to use it Suggestions to help the researcher prepare the experimental plan are also given The FSAA's central computer cockpit and visual and motion systems are addressed individually but their interaction is considered as well Data required available options, user responsibilities, and occupancy procedures are given in a form that facilitates the initial communication required with the NASA operations group Author

N77-33252*# National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston, Tex
SPACE SHUTTLE PROGRAM: LIGHTNING PROTECTION CRITERIA DOCUMENT
4 Nov 1975 79 p refs Revised
(NASA-TM-74974, JSC-07636-Rev-A) Avail NTIS HC A05/MF A01 CSCL 22B

The lightning environment for space shuttle design is defined and requirements that the design must satisfy to insure protection of the vehicle system from direct and indirect effects of lightning are imposed Specifications, criteria, and guidelines included provide a practical and logical approach to protection problems Author

N77-33480# Weapons Research Establishment, Adelaide (Australia)
AN ACCURATE ANGULAR POSITION AND ANGULAR VELOCITY INSTRUMENT BASED ON AN OPTICAL INCREMENTAL ENCODER
B Humski Dec 1976 35 p refs
(WRE-TN-1730(WR/D)) Avail NTIS HC A03/MF A01

An instrument designed to measure the instantaneous angular position and angular velocity of a freely rotating wind tunnel model is described The transducer based on a photo-optical incremental encoder, is insensitive to vibrations Although primarily intended for studying the roll behaviour of a wind tunnel model its high resolution instantaneous response to roll reversal, freedom from accummulated errors and error detection capabilities make it suitable for general purpose usage in a wide range of applications Author

N77-33685# Bolt, Beranek, and Newman Inc , Canoga Park, Calif
AIRCRAFT SIDELINE NOISE A TECHNICAL REVIEW AND ANALYSIS OF COMTEMPORARY DATA
David Q Walker Apr 1977 47 p refs
(Contract F33615-76-C-0507)
(AD-A042076, BBN-3291 AMRL-TR-76-115) Avail NTIS HC A03/MF A01 CSCL 20/1

This report presents a review and analysis of recent aircraft flyover data where the aircraft is at a low angle of elevation relative to the observer Excess attenuation factors (attenuation in addition to normal spherical divergence and atmospheric absorption losses), evaluated for a range of aircraft types were found to vary between aircraft and could be generally characterized as a function of aircraft angle of elevation only Fuselage sheilding or installation effects could not be positively identified although their presence is suggested by the differing excess attenuation characteristics of each aircraft type Lack of detail in the data available for review precluded the identification of any propagation losses due to turbulent scattering of sound in the atmosphere The results of the study suggest that currently applied predictive models for sideline noise tend to overestimate noise levels - particularly for 3 and 4 engine aircraft An alternative approach to sideline noise prediction is suggested and recommendations are made to encourage technical development in this uncertain area of aircraft noise prediction Author (GRA)

N77-33686# Bolt, Beranek and Newman, Inc Canoga Park, Calif
FURTHER SENSITIVITY STUDIES OF COMMUNITY-AIRCRAFT NOISE EXPOSURE (NOISEMAP) PREDICTION PROCEDURES Final Report
Dwight E Bishop, Thomas C Dunderdale, Richard D Horonjeff, and John F Mills Apr 1977 88 p refs
(Contract F33615-76-C-0507 AF Proj 7231)
(AD-A041781, BBN-3295) Avail NTIS HC A05/MF A01 CSCL 20/1

This report describes the results of studies of the sensitivity of the noise exposure contours to various model parameters and assumptions presently in the NOISEMAP procedure The areas within Day/Night Level (LDN) contours for ten Air Force airbases increased by 11 to 40 percent when the noise measure was adjusted for the presence of pure tones The contour areas for typical mixed fighter, bomber/tanker, and training airbases were reduced by 3 to 11 percent by substitution of the SAE algorithms for ground-to-ground propagation and transition models, whereas adding the fuselage shielding algorithm reduced the contour areas by 13 to 22 percent Since there is little firm evidence showing one set of algorithms more accurate than the other, the present NOISEMAP models will be retained until further technical analyses or new data show a clear basis for alteration GRA

N77-33696# Technical Univ of Norway, Trondheim Akustisk Lab
AIRPLANE NOISE: DIMENSIONS AND MEANS OF NOISE REDUCTION
M Ringheim Oct 1976 13 p refs In NORWEGIAN, ENGLISH summary
(ELAB-STF44-A75080 ISBN-82-595-696-3) Avail NTIS HC A02/MF A01, Tech Univ of Norway, Trondheim Nor Kr 20

An estimate was made of the number of people exposed to noise from military and civil aircraft in Norway Possibilities for the reduction of noise exposure are reviewed and costs are estimated for various alternatives ESA

N77-33959*# Kansas Univ Center for Research, Inc Lawrence
A RESEARCH PROGRAM TO REDUCE INTERIOR NOISE IN GENERAL AVIATION AIRPLANES Progress Report
Jan Roskam, Vincent U Muirhead Howard W Smith, Tonnis D Peschier, Don Durenberger, Kees Vandam and Tzy-Chuan Shu Oct 1977 76 p refs
(Grant NsG-1301)
(NASA-CR-155154, KU-FRL-317-5) Avail NTIS HC A05/MF A01 CSCL 20A

Analytical and semi-empirical methods for determining the transmission of sound through isolated panels and predicting panel transmission loss are described Test results presented include the influence of plate stiffness and mass and the effects of pressurization and vibration damping materials on sound transmission characteristics Measured and predicted results are presented in tables and graphs Author

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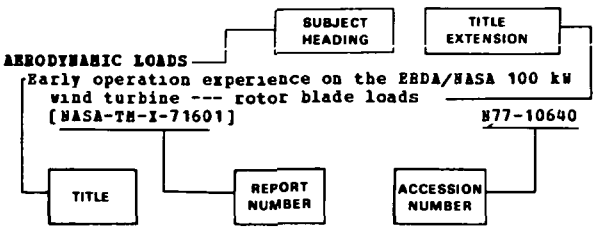

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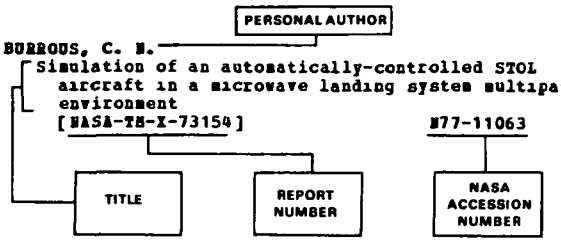

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