NASA SP-7037 (62)

# AERONAUTICAL ENGINEERING

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Supplement 62

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NASA SP-7037 (62)

# AERONAUTICAL ENGINEERING

## A Special Bibliography

## Supplement 62

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This supplement to *Aeronautical Engineering—A Special Bibliography* (NASA SP-7037) lists 306 reports, journal articles, and other documents originally announced in September 1975 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*

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

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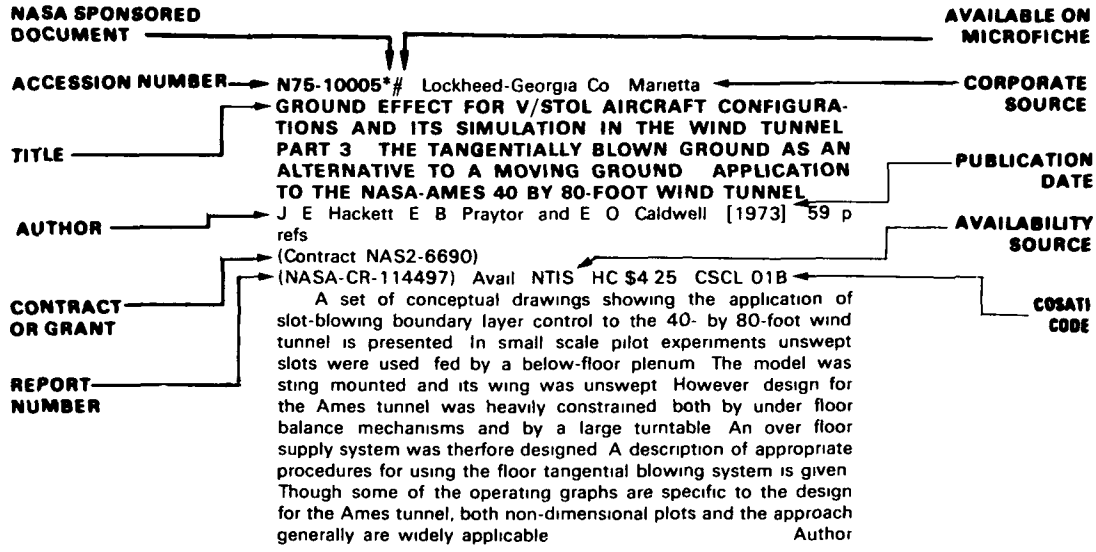


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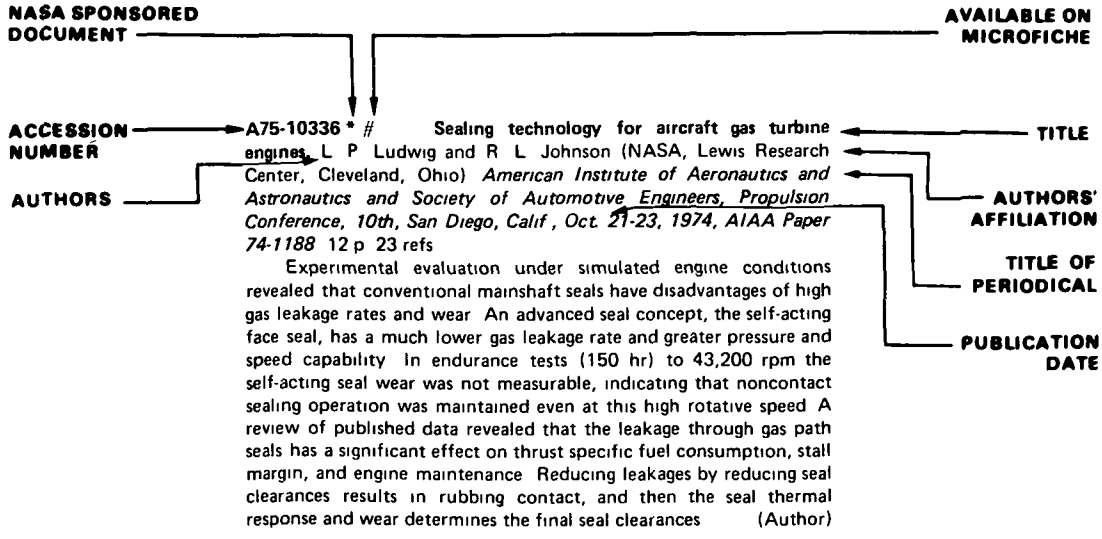

# AERONAUTICAL ENGINEERING

*A Special Bibliography (Suppl. 62)* OCTOBER 1975


## IAA ENTRIES

**A75-35896** **Application of finite element analysis to ceramic components** C Visser, S Lien (Westinghouse Research Laboratories, Pittsburgh, Pa ), and R J. Schaller (Westinghouse Electric Corp , Lester, Pa ). *(American Ceramic Society, Joint Fall Meeting, Pittsburgh, Pa , Sept 23-26, 1973, Paper 30-BC-73F.) American Ceramic Society, Journal,* vol 58, Mar -Apr 1975, p. 131-135 10 refs. Grant No DAAC46-71-C-0162

A finite element analysis of a rotating ceramic gas turbine blade consisting of an airfoil and root is discussed Three-dimensional results were obtained for the blade using both isotropic and orthotropic material properties A two-dimensional study of the root considered the effects of friction, contact area, and root geometry (Author)

**A75-35899** **Kawasaki C-1 - Japan's mini-StarLifter** E Sekigawa *Air International,* vol 9, July 1975, p 7-13

The article traces the development, design and production of Japan's Kawasaki C-1A aircraft from its inception to the present, as will be used by the Air Self-Defense Force (ASDF) Escalating costs of the military transport aircraft forcing a reduction in the total number to be purchased by the ASDF notwithstanding, its specifications (included in the article) meet the ASDF expectations M G

**A75-35943** # **Heat exchange in the hypersonic flow of a rarefied gas past a blunt wedge (Teploobmen pri obtekanii zatuplennogo klina giperzvukovym potokom razrezhennogo gaza)** L L Vasil'ev, Iu A Lapshin, and A N Piskunov (Akademiia Nauk Belorusskoi SSR, Institut Teplo- i Massoobmena, Minsk, Belorussian SSR) *Inzhenerno-Fizicheskii Zhurnal,* vol 28, May 1975, p 788-792 6 refs In Russian

An experiment is described which investigated the aerodynamic heating of a blunt wedge with heat pipes as the wedge is blown by the Mach-8 flow of a gas at 5 5 to 7 7 millitorr static pressure and 500 C stagnation temperature The temperature distribution along the surface of the wedge was studied The effect of cooling of the leading edge by the heat pipes was estimated by carrying out experiments with heat pipes filled with acetone and non-filled heat pipes, and with and without cooling of the heat pipe condensers by a liquid coolant It is shown that use of heat pipes leads to a lowering of the temperature of the leading edge, a leveling of the temperature distribution along the profile, and an increase in radiative heat exchange on account of the higher mean surface temperature P T H

**A75-35967** # **Hodograph method for axisymmetric transonic gas flows (O metode godografa dlia osesimmetrichnykh okolozvukovykh techenii gaza)** Z N Dobrovol'skaia *Prikladnaia Matematika i Mekhanika,* vol 39, Mar Apr 1975, p 280-289 8 refs In Russian

The behavior of a perturbed uniform hypersonic gas flow at large distance from a thin body of revolution serving as obstacle is studied in the hodograph plane Analysis is carried out within the framework of an approximate Karman equation for the potential of perturbed velocity and is based on the method of Guderley and Breiter (1966) An asymptotic expansion of the Legendre potential is obtained, having the necessary regularity properties in the hodograph plane The question of the preservation of regularity by the solution when it is mapped onto the physical flow plane is investigated P T H

**A75-35968** # **The resistance of bodies of revolution at transonic flow velocities (O soprotivlenii tel vrashcheniia pri transzvukovykh skorostiakh potoka)** V N Diesperov and Iu B Lifshits *Prikladnaia Matematika i Mekhanika,* vol 39, Mar -Apr 1975, p 290-297 14 refs. In Russian

The present work investigates theoretically some aspects of the law of stabilization, which concerns the weak effect that the magnitude of the velocity of the main flow has on the deviation of the parameters at a body before the shock wave from their values at sonic velocity at infinity The present investigation also studies the flow behind the shock in order to clarify the nature of the dependence of the resistance of the body on the velocity of the main flow P T H

**A75-36040** **Corrosion resistance of gas turbine blades tested in a high-temperature gas flow** L P Lozitskii, E N Karpov, B Ia Kudriashov, and N N Motrii (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR) *(Problemy Prochnosti,* vol 6, Sept 1974, p 87-90 ) *Strength of Materials,* vol 6, no 9, June 1975, p 1128-1131 Translation

**A75-36099** # **Flow about a conic wing and the optimal configuration of the wing at hypersonic velocities (Obtekanie i optimal'naia forma konicheskogo kryla pri giperzvukovykh skorostiakh)** A L Gonor, N A Ostapenko, and V I Lapygin *Moskovskii Gosudarstvennyi Universitet, Institut Mekhaniki, Otchet* no 981, 1969 21 p 21 refs In Russian

An analytical theory is formulated for the hypersonic flow about a triangular wing with a strong shock wave associated with the leading edge A closed solution is obtained which permits the regions of uniform, potential, and vortical flows to be joined smoothly, and the problem is reduced to solving an integro-differential equation for the form of the shock wave, which expresses all the characteristics of the flow field Flow about a rhomboid wing is analyzed together with the variational problem concerning the configuration of a conic wing having the maximum L/D ratio for a given volume The solution of this problem is shown to reduce to the Lagrange problem with one isoperimetric condition if the pressure distribution is assumed to be determined by Newton's law and the local friction coefficient is a constant The optimal contour is determined by the method of local variations and found to be V-shaped F G M

**A75-36100** # **Investigation of a four-stage ejector for a hypersonic wind tunnel (Issledovanie chetyrekhstupenchatogo ezhektora giperzvukovoi aerodinamicheskoi ustanovki).** Iu P Aksenov, A I Glagolev, A I Zubkov, and A N Timoshin *Moskovskii Gosudarstvennyi Universitet, Institut Mekhaniki, Otchet* no 1274, 1971 28 p In Russian

The present work describes experimental results obtained in tests of a four stage ejector, in each stage of which the critical cross section of the ejecting gas nozzle has a variable area Ejector characteristics are determined for different combinations of the working stages Data are obtained on total pressure loss between

ejector stages Optimality conditions are determined for a multistage ejector The minimum total pressure in a hypersonic wind tunnel receiver operating in conjunction with a multistage ejector is obtained Calculations show the effect of air temperature in a hypersonic pump receiver on ejector parameters P T H

**A75-36107** **The dynamics of the civil aviation industry** A P Ellison (Aviation Planning Services, Montreal, Canada) and E M Stafford (Southampton, University, Southampton, England) Farnsborough, Hants, England, Saxon House, D C Heath, Ltd, Lexington, Mass, Lexington Books, D C Heath and Co, 1974 361 p 363 refs. $18

The structure of the civil aviation market is considered along with a model of the civil aviation industry, air passenger demand models, questions of capital stock measurement, and the world demand for civil aircraft Problems regarding the order-delivery lag in the world civil aviation industry are examined, taking into account distributed lag studies of engineering processes, aspects of exploratory model fitting, and an accurate distributed model derivation Attention is also given to the overall model, passenger demand forecasts, and aircraft forecasts for 1980 G R

**A75-36163** # **Analytic investigation of hypersonic flow around blunt bodies (Analiticheskoe issledovanie giperzvukovogo obtekaniia zatuplennykh tel)** A L Gonor and N A Ostapenko *Moskovskii Gosudarstvennyi Universitet, Institut Mekhaniki, Nauchnye Trudy*, no 32, 1974, p 109-121 14 refs In Russian

Theory is developed for the hypersonic flow around blunt bodies based on the method of two approximations A boundary value problem is set up for the shock layer region produced by symmetric flow, and an approximating system of differential equations of hyperbolic type is obtained, from which an integro-differential equation is derived for the shape of the shock wave The theory is applied to the analysis of hypersonic flow around a circular cylinder P T H

**A75-36165** # **Parabolic wing, resembling a wedge, in supersonic flow (Parabolicheskoe krylo, blizkoe k klinu, v sverkhzvukovom potoke)** M I Folle *Moskovskii Gosudarstvennyi Universitet, Institut Mekhaniki, Nauchnye Trudy*, no 32, 1974, p 127-135 In Russian

**A75-36166** # **Optimization method for a generalized class of functional of several variables, and its application to problems involving the determination of the shape of three-dimensional bodies with optimal aerodynamic characteristics (Metod optimizatsii dlia obobshchennogo klassa funktsionalov neskol'kikh peremennykh i ego prilozhenie k zadacham ob opredelenii formy optimal'nykh po aerodinamicheskim kharakteristikam prostranstvennykh tel)** A I Bunimovich and A V Dubinskii *Moskovskii Gosudarstvennyi Universitet, Institut Mekhaniki, Nauchnye Trudy*, no 32, 1974, p 136 142 9 refs In Russian

**A75-36194** # ***Flutter of a wing with nonlinear elastic characteristic (Flatter plata o nieliniowej charakterystyce sprezystej)*** E Mzyk and J Matusiak *Archiwum Budowy Maszyn*, vol 22, no 2, 1975, p 213-222 7 refs In Polish

Flutter analysis of a simple, nonlinear wing model having two degrees of freedom is presented Unsteady, linear aerodynamic theory is applied to the wing, while a nonlinear elastic bending characteristic is assumed The methods of harmonic linearization and the Laplace transform were used in the stability analysis, and a relation between the single frequency vibrations of the model at the limit cycle and steady flight speed was obtained along with flutter conditions P T H

**A75-36236** * # **Structure of turbulent jets and wakes.** F C Wang (NASA, Marshall Space Flight Center, Systems Dynamics Laboratory, Huntsville, Ala) and T S Lundgren (Minnesota, University, Minneapolis, Minn) *AIAA Journal*, vol 13, May 1975, p 561-565 17 refs Contract No N00014-68-A-0141-0001 Project THEMIS

The structure of two-dimensional turbulent jets and wakes is studied using two eddy viscosity models The turbulent energy equation is used together with the mean momentum equations, and the system is closed by introducing eddy coefficients The fine structure turbulence is obtained by applying proper boundary conditions at the mean turbulent interface position The results, after a second averaging process, are compared with available experimental data (Author)

**A75-36241** # **Laminar boundary layer in symmetry plane of blunt-nosed body** R A Smith (Catholic University of America, Washington, D C) and W T Moon (Korean Institute of Science and Technology, Seoul, South Korea) *AIAA Journal*, vol 13, May 1975, p 679, 680 7 refs

The present work investigates the laminar boundary layer in the plane of symmetry on the hemispherical nose of a blunt cylindrical body at angle of attack Computations based on experimental pressure distributions suggest the existence of an embedded vortex on the leeward side for angles of attack of 10 and 15 deg The size of the embedded vortex region indicates a vortex-induced separation at these angles of attack The qualitative behavior of the separation phenomena on the leeward side is in strong agreement with Wang's analysis and postulated behavior of three-dimensional separation on inclined bodies of revolution S J M

**A75-36245** # **Flutter of a panel supported on an elastic foundation** I Chopra (National Aeronautical Laboratory, Bangalore, India) *AIAA Journal*, vol 13, May 1975, p 687, 688 6 refs

The flutter behavior of a thin panel resting on a linear elastic foundation is studied, using an analogy with the flutter of a panel of the same geometry without spring support With quasi-steady aerodynamic loading, it is observed that there is a change not only in the flutter frequency, but also in the total damping of the system, due to the elastic foundation Furthermore, it is found that for small values of aerodynamic damping and spring stiffness, the quasi-static approach is reasonable, whereas for high values of aerodynamic damping or of spring stiffness, quasi-static theory is inadequate For high values of spring stiffness, the flutter mode of the panel exhibits traveling wave motion S J M

**A75-36288** **Flow separation from yawed delta wings.** I P Jones (East Anglia, University, Norwich, England) *Computers and Fluids*, vol 3, June 1975, p 155 177 10 refs Ministry of Defence Contract No AT/2162/05

The flow over a flat plate delta wing at incidence and yaw is studied using a vortex-sheet model The numerical method adopted allows solutions to be obtained in regions of parameter space, in particular at low incidence, where previous methods have failed to converge In the results which are presented attention is focused upon these new solutions Where comparable the agreement with the available experimental results is encouraging For large angles of yaw the leeward leading edge becomes a trailing edge and the associated vortex sheet assumes the characteristics of a trailing edge sheet A

simple analytical model for such a trailing vortex system is also studied The results predicted by this linear model compare favorably with those from a further numerical study which indicates that the nonlinear behavior is similar to that of a flat wake and confirms the asymptotic nature of the linear model (Author)

**A75-36291** **Design estimate of cascade performance** C L S Farn and D K Whirlow (Westinghouse Research Laboratories, Pittsburgh, Pa ) *Computers and Fluids,* vol 3, June 1975, p 225-233 8 refs

A method, which utilizes existing computer programs for analyzing the performance of axial-flow cascades is outlined The method is validated by comparing the analytical results for three low speed compressor, five low-speed turbine and two high-subsonic turbine cascades with the corresponding experimental data The overall error bound for losses is 12 per cent However, the error bound for low-speed cascades operating near the design condition is about 5 per cent The effects of transition location on losses are very significant The contribution to the loss by small trailing-edge separations in the compressor cascades could be as much as one-third of the total loss (Author)

**A75-36366** **Some system considerations for MLS airborne processors** J Beneke and C Wightman (Calspan Corp , Buffalo, N Y ) *(Institute of Navigation, Annual Meeting, 30th, San Diego, Calif , June 25-27, 1974 ) Navigation,* vol 22, Spring 1975, p 35-46 U S Department of Transportation Contract No FA71WA 2592

Various aspects of the scanning beam and Doppler scan MLS systems are examined and compared, based on a previous techniques analysis Means of rejecting multipath interference from other aircraft and airport structures are essential to precision guidance in a severe multipath environment Additional experimental data are required before a final design is adopted, at present, both scanning beam and Doppler scan techniques appear to meet stipulated requirements S J M

**A75-36368** **Development of navigation systems for advanced commercial transports** A F Norwood (Boeing Commercial Airplane Co , Seattle, Wash ) *(Institute of Navigation, Annual Meeting, 30th, San Diego, Calif , June 25-27, 1974 ) Navigation,* vol 22, Spring 1975, p 68 75 9 refs

Attention is given to the design of a system which will best satisfy navigation functional and performance requirements for a new aircraft destined to operate for the next 20 to 25 years in an ATC environment subject to changes Aspects of over ocean navigation are considered along with domestic requirements and airborne derived information requirements Questions of airborne system design are discussed and cost factors are examined G R

**A75-36401** **The promise of air safety** M Eleccion *IEEE Spectrum,* vol 12, July 1975, p 26, 27, 31 36

Problems presented to the air safety system in connection with the increasing air traffic are considered, taking into account the comparatively great number of air fatalities occurring in 1974 Ground-approach hazards are to be reduced by the installation of ground proximity warning systems on all U S commercial jet air carriers The general introduction of collision-avoidance systems (CAS) is considered as a response tc mid-air collision dangers Questions regarding the controversy with respect to the type of CAS to be employed are discussed Attention is given to aspects of ATC system development, taking into account the historical background, the present system, and the planning of the systems for the future G R

**A75-36457 #** **Astrolabe, integrated navigation and landing aid device - Land-bound and airborne presentation of information (Astrolabe, dispositif intégré de navigation et d'aide à l'atterrissage - Présentation au sol et à bord des informations)** J Dorey and G Ringenbach (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(NATO, AGARD, Symposium on Electronic Airborne Displays, Edinburgh, Scotland, Apr 7-11, 1975 ) ONERA, TP* no 1975 17, 1975 9 p In French

A microwave localization system is being developed, based on the properties of synthetic antennas, which permits the two-dimensional (azimuth and elevation) simultaneous analysis of a large number of targets constituted by low power beacons The system ensures airspace surveillance while providing the pilot with a visualization of the surrounding terrain (e g , runway boundaries) in proper perspective It should thus permit the integration of various functions of ground control, such as landing aid and zone navigation, with those needed by the pilot in blind navigation (search for and precise identification of airport beacons) Two data processing and display devices associated with this system are described an optronic device and an integrated digital device Some results obtained at CEV flight test center at Bretigny are analyzed S J M

**A75-36529** **Microwave technology in the microwave landing system** R M Kalafus (U S Department of Transportation, Transportation Systems Center, Cambridge, Mass ) In Microwaves in service to man, International Microwave Symposium, Palo Alto Calif , May 12-14, 1975, Digest of Technical Papers New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 343-345 FAA-supported research

The purpose, format, principles of operation, and equipment of the microwave landing system (MLS) are outlined MLS is devised to provide lateral and vertical guidance to approaching aircraft from about 20 miles out through final approach, flare, touchdown, and roll-out, as well as through missed approach The basic MLS outputs are the azimuth angle, elevation angle, and slant range The angle and range measurement techniques are discussed along with the micro wave components (phase shifters, solid-state sources, and voltage controlled attenuators) Opportunities for innovation in technology development are examined S D

**A75-36530** **Instrument Landing System performance prediction** G. Chin, L Jordan, D Kahn, and S Morin (U S Department of Transportation, Transportation Systems Center, Cambridge, Mass ) In Microwaves in service to man, International Microwave Symposium, Palo Alto, Calif , May 12-14, 1975, Digest of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 346-348.

An electromagnetic scattering model has been developed for predicting Instrument Landing System (ILS) localizer and glide slope performance The model is used to predict course structure degradation resulting from a change in the airport environment Such changes include the addition of new hangars, terminal buildings and control towers as well as terrain modifications In addition, the model is used to predict comparative ILS antenna array performance in order to help determine which ILS system is required for new runway instrumentation and for the upgrading of existing instrumented runways to a higher FAA category (Author)

**A75-36651** **Aircraft engine lube oil filtration study** H C Mouwen (Purolator Products, Inc , Newbury Park, Calif ) and P Duncan (Swift-Aire Lines, San Luis Obispo, Calif ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750505* 16 p

The aircraft engine lube oil filter maintenance practices of a small commercial airline were studied Engines with known Times Since Overhaul (TSO) were selected and operating hours on the filters were controlled at 50 and 100 hours The differences in filter pressure drops and particle contamination levels were recorded and a spectrometric analysis was performed on an oil sample from each oil change The practices evaluated are satisfactory for both the 50 and 100 hours filter periods The oil spectrometric analyses showed little oil degradation and no relationship between TSO and the recorded data could be obtained (Author)

**A75-36652** **Thrust reversers for the TFE-731 turbofan** W K Greathouse and S F Martin (Grumman Aerospace Corp, Bethpage, N Y) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750506* 26 p

Improved design features have made the pivoted target thrust reverser concept most attractive for modern small turbofans with coaxial flow exhaust systems These aerodynamic, mechanical and structural design improvements provide 40% or more reverse thrust effectiveness in a simple, light weight, low cost unit that has clean aerodynamic lines and minimum effect on engine performance The pivoted target thrust reverser system, under development at Grumman for the AiResearch TFE-731 2 and -3 engines, is described Applications include the IAI Westwind 1124, the Gates Learjet 35/36 and the Dassault Falcon 10 aircraft (Author)

**A75-36655** **Regional fatigue environment study for commuter airlines** M G Nagati and M G Huff (Beech Aircraft Corp, Wichita, Kan) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750512* 7 p

An investigation involving the acquisition and the processing of pertinent data was conducted to determine a safe wing fatigue life for an aircraft operated in a localized area The aircraft used in the investigation included Beechcraft Models 99, 99A, A99A, and B99 airliners Readings from a counting accelerometer (fatigue meter) were collected over 12 months to cover all four seasons It was found that, except for a few extreme cases, the normalized fatigue lives fell within a narrow scatter band for each regional area considered G R

**A75-36656** **The B-1 structural integrity program** G P Haviland (Rockwell International Corp, El Segundo, Calif) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750514* 10 p

The general characteristics of the B-1 structural integrity program for assuring airframe integrity are described The program features design verification tests and a limit load, full-scale proof test instead of a full scale static test to ultimate The combination of the large specimen tests to ultimate, and correlation of test results with the analyses will provide a good measure of how much growth is in the airframe P T H

**A75-36657** **New directions in aircraft propulsor noise research** F B Metzger and B Magliozzi (United Aircraft Corp, Hamilton Standard Div, Windsor Locks, Conn) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750515* 13 p 33 refs

Propellers and fans have in the past been tested under static conditions to provide test data for comparison with noise predicted using empirical or theoretically based procedures This has resulted in noise prediction methodology adjusted to correlate with static test data Recent tests have shown that the noise of propulsors in flight differs significantly from propulsors tested statically This paper discusses the current knowledge of propulsor noise from an experimental and analytical standpoint in both static and forward flight operating regimes Also, the advantages and disadvantages of various approaches to conducting definitive forward flight tests are presented Emphasis is placed on evaluation of propellers and fans operating at subsonic tip speeds where experimental and theoretical developments can most easily be applied (Author)

**A75-36658 *** **Factors affecting the noise from small propeller driven aircraft** D J Maglieri and H H Hubbard (NASA, Washington, D C) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750516* 9 p 21 refs

The factors affecting noise from small propeller driven airplanes are reviewed to quantify their affects where possible, and to indicate the potential for noise reduction The main sources of external noise are noted to be the propellers and engines, the airframe being of less importance for both aural detection and community annoyance Propeller noise is a strong function of tip speed and is affected adversely by nonuniform inflows Reciprocating engine exhausts are noisier than those of comparably rated turboshaft engines, but their noise can be reduced by the use of flight certified exhaust mufflers Presently, there are no generally accepted engineering methods for development of optimized propellers and exhaust muffler designs from weight and performance penalty standpoints Flight demonstration results, however, suggest that required noise reductions for future certification should be possible with potentially small penalties (Author)

**A75-36660** **Commercial developments in airborne VLF navigation** A B Elliott (Global Navigation, Inc) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750518* 10 p 10 refs

Systems utilizing phase-stable transmissions of VLF communications stations and unique frequency transmissions available from some of the Omega network stations are discussed Phase comparison techniques have been used to derive the navigational information Advances in semiconductor and integrated circuit technology, coupled with a growing need for inexpensive long-range and remote area navigation capability, made commercial embodiment of VLF phase comparison systems possible Emphasis in the current work is on airborne VLF systems S J M

**A75-36661 *** **Propeller modulation effects on a scanning-beam microwave landing system** J M Pope (NASA, Ames Research Center, Moffett Field, Calif) and W N Staehle (NASA, Ames Research Center, Moffett Field, Calif, Raytheon Co, Equipment Div, Sudbury, Mass) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750521* 12 p 13 refs

The results of a systems study and ground test of the effects of propeller modulation on a time-multiplexed, scanning-beam microwave landing system (MLS) are presented Propeller modulation effects are analyzed in terms of spacing between receiving antenna and propeller, propeller blade width, and propeller speed Principal study conclusions (1) scanning beam MLS is susceptible to errors due to synchronous propeller modulation, (2) the number of synchronous interference multiples increases as the number of propeller blades increases and as the data rate decreases, (3) the probability of synchronous interference decreases at higher data rates, and (4) MLS receiver susceptibility to propeller modulation depends upon the dynamic response of the receiver automatic gain control and the respective tracking loops (Author)

**A75-36663 *** **Wind tunnel and flight development of spoilers for general aviation aircraft** W H Wentz, Jr, H C Seetharam (Wichita State University, Wichita, Kan), and J T Calhoun (Robertson Aircraft Corp, Renton, Wash) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan, Apr 8-11, 1975, Paper 750523* 12 p 6 refs NASA-sponsored research

Wind tunnel tests have been carried out to develop a spoiler lateral control system for use with the GA(W)-1 airfoil with a 30% Fowler flap Tests show that unfavorable aerodynamic interactions can occur between spoiler and flap for large flap deflections Providing venting of lower surface air through the spoiler opening substantially improves performance Results of tests with a number of spoiler and cavity shapes are presented and discussed Applications of two-dimensional wind tunnel results to the design of satisfactory manual lateral control systems are discussed (Author)

**A75-36664 * Design of low-speed airfoils by numerical optimization** R M Hicks and G N Vanderplaats (NASA, Ames Research Center, Moffett Field, Calif ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750524* 14 p 7 refs

A practical procedure for the optimum design of low-speed airfoils is demonstrated The procedure uses an optimization program based on a gradient algorithm coupled with an aerodynamic analysis program that uses a relaxation solution of the inviscid, full-potential equation The analysis program is valid for both incompressible and compressible flow, thereby making optimum design of high-speed, shock-free airfoils possible Results are presented for the following three constrained optimization problems at fixed angle of attack and Mach number (1) adverse pressure-gradient minimization, (2) pitching-moment minimization, and (3) lift maximization All three optimization problems were studied with various aerodynamic and geometric constraints (Author)

**A75-36665 Drag analysis methods for light aircraft** F O Smetana and D C Summey (North Carolina State University, Raleigh, N C ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8 11, 1975, Paper 750526* 11 p 10 refs

Questions regarding the analysis of two- and three-dimensional wing characteristics are considered, taking into account the vortex distribution procedure and aspects regarding a suitable location of the stagnation point Modifications required in an available computer program are discussed along with the study of fuselage characteristics, problems of wing-tail interference, and methods of flight verification It is concluded that the considered approach appears to offer a reliable means of determining both thrust horsepower and aircraft drag at the same time with a minimum of flight time G R

**A75-36666 * An in-flight investigation of nonlinear roll control** D R Ellis and N W Tilak (Princeton University, Princeton, N J ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750528* 6 p NASA-supported research

An in flight simulation was undertaken to study the piloting problems associated with a type of nonlinear control effectiveness which is characteristic of spoiler roll control systems Typically, the initial response is small or even zero, followed by a narrow region of highly effective control, and a final one of moderate effectiveness Results for the landing flare and touchdown, which turned out to be the critical flight phase, indicate that a substantial amount of dead zone and changing effectiveness can be tolerated, but the best level of handling is obtained with linear, aileron like control (Author)

**A75-36667 Flight mechanics and pilot evaluation of conventional landings** E Seckel and P H Whyte (Princeton University, Princeton, N J ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8 11, 1975, Paper 750529* 9 p

The results are given of an extensive investigation of conventional landing flares in general aviation type airplanes Experimental landings in a variable stability Navion have simulated a wide range of parameters influencing flare behavior The most important feature of the flare has turned out to be the airplane's deceleration in the flare, and it has been found to be possible to correlate various effects on this in terms of the average flare load factor Certain kinds of ground effects are found to be favorable, if they are small and in the right combination Piloting technique is extensively discussed Certain implications for design are presented (Author)

**A75-36669 Damage resistance of high modulus aramid fiber composites in aircraft applications** J C Norman (Du Pont de Nemours and Co , Inc , Wilmington, Del ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750532* 11 p 5 refs

Analyses of impact resistance are made for composites reinforced with fibers of high modulus aramid, glass, graphite, and graphite/high modulus aramid hybrids which indicate that the aramid fiber offers advantages over the other materials in thin laminate specimens when measured by Charpy, Izod, and ball drop impact tests while retaining some structural integrity Use of the high modulus aramid fiber as a hybrid with graphite resulted in higher impact energy resistance than the all-graphite fiber composite The fracture characteristics of notched quasi isotropic high modulus aramid, E-glass, and A-S graphite epoxy lamina and of notched fabric epoxy lamina of aramid and of glass are analyzed Aramid showed the highest fracture resistance, followed by glass and graphite (Author)

**A75-36670 Graphite composite materials applications in aircraft structures** S L Cross (Hercules, Inc , Wilmington, Del ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750533* 12 p 13 refs

Aircraft components using graphite composite materials include spoilers, rudders, and ailerons Unlike homogeneous metals, the properties of fiber reinforced composites are directionally dependent on the fiber orientation A composite construction design can, therefore, be selected which will best suit the load-carrying requirements The material characteristics are considered, taking into account strength, stiffness, fatigue, environment, and impact and damage tolerance Questions of fabrication technology are discussed, giving attention to raw material and component fabrication Material cost trends are also briefly investigated G R

**A75-36671 Ducted propulsors - Progress in the United Kingdom** D G M Davis (Dowty Rotol, Ltd , Gloucester, Glos , England) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750534* 12 p

The relative merits of the ducted propulsor are examined, taking into account a general correlation of velocity and noise Propeller diameter must be increased as tip speed is reduced below a given value in order to avoid the imparting of excessive rotational energy to air It is found that the ducted propulsor provides a more cost effective approach for meeting noise regulations than the conventional propeller Experimental work related to ducted propulsors is discussed along with low speed fan rig tests, wind tunnel tests, and plans for further development work G R

**A75-36672 Low emission, water-tolerant combustor for a small, all-weather turboshaft gas turbine engine** R M Wood, J G Tomlinson, D L Troth, and J J Petraits (General Motors Corp , Detroit Diesel Allison Div , Detroit, Mich ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750535* 12 p

An experimental program has been conducted to select a combustion system design for the 500 shp Model 250-C28 turboshaft/turboprop engine A prototype prechamber combustor configuration developed from this program demonstrates compliance with the significantly reduced environmental pollution requirements defined by 1979 EPA standards and is capable of operating under environmental conditions exceeding natural, all weather flight operation S J M

**A75-36673 A second generation turbo-prop power plant** J B Houston and D F Black (de Havilland Aircraft of Canada, Ltd , Downsview, Ontario, Canada) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8 11, 1975, Paper 750536* 9 p

A survey of the design concepts and features of the powerplant installation in the de Havilland Aircraft of Canada Dash 7 is presented The Dash 7 is a 50 passenger, four-engined turboprop STOL aircraft The UACL PT6 A 50 engines, their mountings, intakes and control systems are described The construction and

control system of the Hamilton Standard 24 PF propellers are discussed A brief description of the accessory systems concludes the paper (Author)

**A75-36675 * Discussion of an aeromechanical gust alleviation system to improve the ride comfort of light airplanes** E C Stewart (NASA, Langley Research Center, Hampton, Va ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750544* 15 p 5 refs

A discussion of an on-going NASA research project of a gust alleviation system to improve the ride comfort of a light airplane is presented The discussion includes a description of the proposed system which uses auxiliary aerodynamic surfaces to drive the trailing-edge flaps The results of analytical work on the effects of the system on stability and effectiveness of the system are presented Static wind tunnel tests of the system installed in a 1/6 scale model of a popular light airplane are also described Problem areas which may need future investigation are discussed (Author)

**A75-36676 Some ideas of vortex lift** W A Kasper *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750547* 12 p

In tests on a glider designed for experimenting with vortex generated lift, the author experienced an unknown phenomenon which kept the glider afloat at half the usual sink rate and stalling speed After study it was realized that a huge vortex had been forming after the stall which explained the presence of additional lift at high angles of attack and low speeds The implications that this discovery has in terms of improving the slow speed characteristics of airplanes are explained in the paper in addition to a detailed study of the characteristics of this vortex (Author)

**A75-36677 * Technology for reducing aircraft engine pollution** R A Rudey and E E Kempke, Jr (NASA, Lewis Research Center, Cleveland, Ohio) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750550* 37 p 11 refs

Programs have been initiated by NASA to develop and demonstrate advanced technology for reducing aircraft gas turbine and piston engine pollutant emissions These programs encompass engines currently in use for a wide variety of aircraft from widebody-jets to general aviation Emission goals for these programs are consistent with the established EPA standards Full-scale engine demonstrations of the most promising pollutant reduction techniques are planned within the next three years Preliminary tests of advanced technology gas turbine engine combustors indicate that significant reductions in all major pollutant emissions should be attainable in present generation aircraft engines without adverse effects on fuel consumption Fundamental-type programs are yielding results which indicate that future generation gas turbine aircraft engines may be able to utilize extremely low pollutant emission combustion systems (Author)

**A75-36678 * NASA General Aviation Research overview - 1975** R L Winblade and J A Westfall (NASA, Washington, D C ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750500* 67 p 91 refs

An overview of the 1975 NASA Research and Technology efforts directly focused on general aviation is presented Current status and accomplishments during the past year are described An updated bibliography of technical reports generated by the NASA program, including seven recently declassified reports on airplane noise reduction, is included as an Appendix to this report (Author)

**A75-36679 Handling and performance characteristics of swept-forward flying wing aircraft** J J Marske (Marske Aircraft **propeller driven aircraft** D J Maglieri and H H Hubbard (NASA, Washington, D C ) *Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan , Apr 8-11, 1975, Paper 750516* 9 p 21 refs

The factors affecting noise from small propeller driven airplanes are reviewed to quantify their affects where possible, and to indicate the potential for noise reduction The main sources of external noise are noted to be the propellers and engines, the airframe being of less importance for both aural detection and community annoyance Propeller noise is a strong function of tip speed and is affected adversely by nonuniform inflows Reciprocating engine exhausts are noisier than those of comparably rated turboshaft engines, but their noise can be reduced by the use of flight certified exhaust mufflers Presently, there are no generally accepted engineering methods for development of optimized propellers and exhaust muffler designs from weight and performance penalty standpoints Flight demonstration results, however, suggest that required noise reductions for future certification should be possible with potentially small penalties (Author)

**A75-36718 European industry and civil air transport /28th Louis Blériot Lecture/** P Lecomte (Societe Nationale Industrielle Aerospatiale, Paris, France) *Aeronautical Journal,* vol 79, May 1975, p 189-197 5 refs

A historical overview of the Western European aircraft industry, the article characterizes the development, current problems and future objectives of public transport aircraft of moderate capacity (40 or more passengers) Europe has the necessary expertise and research establishment to meet the requirements and the needs of the 1980's aircraft A cooperative, inter-European undertaking, charging a single organization (originating from all the constructors) with (1) the commercial and financial role for all products, namely sales and product support, (2) overall planning and distribution of work amongst the constructors to achieve the best possible workload continuity, and (3) progressive standardization of methods and products is suggested for the European aircraft industry M G

**A75-36719 Alternative fuels for aviation** E M Goodger (Cranfield Institute of Technology, Cranfield, Beds , England) *Aeronautical Journal,* vol 79, May 1975, p 212-224 17 refs

Overall characteristics of alternative fuels, proposed to meet the desired technological improvements are discussed, together with the feasibility of using these possible replacements for petroleum products in the aviation industry Low and high density fuels, hydride fuels, carbon containing fuels, vaporising and/or endothermically reacting fuels, hydrocarbon fuels, aromatic mixtures, liquid methane, liquid hydrogen, nitrogen hydrides, alcohols, nuclear fuels, and various mixtures are analyzed for their performance, levels of volumetric and combined gravimetric energy densities, handling safety, pollution, thermal stability and capacity, and availability M G

**A75-36720 Evaluation of the overall fuel mass penalty of an aircraft system** R Le Claire (Hawker Siddeley Aivation, Ltd , Kingston-on-Thames, Surrey, England) *Aeronautical Journal,* vol 79, May 1975, p 225-228

A method for evaluating the fuel mass penalty incurred in flight after fitment of a system to an aircraft is discussed The relative importance of the parameters involved in the method are shown, in particular, the relationship between fuel penalty due to system basic mass and that due to system drag It is concluded that fuel penalty associated with drag is significantly more critical than that due to weight, therefore any drag reduction (without an increase in basic system mass) would result in substantial fuel savings and possibly increased payload M G

**A75-36765 Awacs - Boeing's radar patroller** S Broadbent *Flight International,* vol 107, June 26, 1975, p 993-1000

Moving targets can be detected and analyzed within a 200 mile radius and data can be relayed to the ground by the Boeing E-3A

aircraft, known as Awacs (Airborne Warning and Control System), using a planar array coupled to a digital computer in a Boeing 707 airframe The historical development, aircraft structure, aerodynamics and radar operation of the Awacs are discussed The surveillance radar equipment can operate in 7 modes including Pulse-Doppler Non-elevation Scan, Pulse-Doppler Elevation Scan, Beyond the Horizon, Passive and Maritime The nine multi-purpose consoles which analyze the data collected by the radar antenna in the rotodome, are shown together with other operational equipment and the environmental system M G

**A75 36848** # **Technical diagnostics in aircraft maintenance (*Technische Diagnostik in der Flugzeuginstandhaltung*)** L Brehmer (Hochschule fur Verkehrswesen, Dresden, East Germany) *Technisch-okonomische Information der zivilen Luftfahrt,* vol 11, no 2, 1975, p 66-78 In German

The objectives of technical diagnostic procedures in aircraft maintenance operations are considered along with questions regarding the significance and the range of applications of such procedures Modern technical inspection methods include approaches related to holography, thermography, acoustic emission, and spectrometric oil analyses Details concerning an inspection method based on holography are discussed and a description of approaches based on thermography is given G R

**A75-36849** # **Aviation in undulating flow - The Dolphin principle, its technical implementation, and its application in aviation (Luftfahrt in gewellter Stromung Das Delphin-Prinzip, seine technische Umsetzung und Anwendung in der Luftfahrt)** U Queck (Kammer der Technik, Berlin, East Germany) *Technisch-okonomische Information der zivilen Luftfahrt,* vol 11, no 2, 1975, p 83-101 28 refs In German

It is pointed out that the principle of undulating propulsion has found general application in biology for movements of animals in water and in air The operational procedures of aviation, on the other hand, are currently exclusively based on the principle of the reaction drive It is claimed that the reasons for this development are related to the incomplete form of the present theory of flight mechanics which is restricted in its considerations to certain areas of aerodynamics The possibility for the design of a vehicle based on novel operational principles is considered, giving attention to a vehicle which will optimally combine the advantages of an aircraft, an airship, and a helicopter The principles utilized in the locomotion of a dolphin are discussed along with details concerning the flight of birds and insects G R

**A75-36850** # **Specific properties of high-strength and heat-resistant wrought aluminum alloys and the consideration of these properties in the maintenance of aircraft II (Spezifische Eigenschaften hoch- und warmfester Al-Knetlegierungen und deren Beachtung bei der Instandhaltung von Flugzeugen II)** L Ahnert (VEB Kombinat Spezialtechnik, Dresden, East Germany) *Technisch-okonomische Information der zivilen Luftfahrt,* vol 11, no 2, 1975, p 107-116 28 refs In German

Approaches to be used in a description of material sensitivity against intercrystalline corrosion are examined, taking into account differences in the properties of alloys based on AlCuMg and AlZnMgCu and the effects of heat treatment and rate of cooling Questions related to the material characteristics in the case of stress corrosion are also discussed along with the significance of internal stresses and their consideration G R

**A75-36888** # **Performance of three vaned radial diffusers with swirling transonic flow** S Baghdadi (General Motors Corp, Detroit Diesel Allison Div, Indianapolis, Ind) and A T McDonald (Purdue University, West Lafayette, Ind) *American Society of Mechanical Engineers, Joint Fluids Engineering and Lubrication Conference, Minneapolis, Minn, May 5-7, 1975, Paper 75-FE-19* 8 p 12 refs Members, $1 00, nonmembers, $3 00

A unique vortex nozzle facility has been conceived and developed to simulate the exit flow from a high pressure ratio centrifugal compressor impeller Visual studies and performance measurements have been made for three vane sets representing common designs for vaned radial diffusers Motion pictures show the progression from choke through operating to surge conditions as the back pressure on the diffuser is increased The films, together with total and static pressure measurements, indicate that surge is an instability triggered by flow separation in the vaneless or quasi-vaneless space ahead of the diffuser throat A geometrical criterion for the onset of surge is identified The surge-to-choke operating range of the three diffusers appears to be a function of the number of diffuser vanes only (Author)

**A75-36890** # **Transonic flow around rotor blade elements** J W Kurzrock and A S Novick (General Motors Corp, Detroit Diesel Allison Div, Indianapolis, Ind) *American Society of Mechanical Engineers, Joint Fluids Engineering and Lubrication Conference, Minneapolis, Minn, May 5-7, 1975, Paper 75 FE-24* 13 p 23 refs Members, $1 00, nonmembers, $3 00 Contract No F33615-72-C 1098

An analytical/numerical method for calculating blade-to blade transonic flow fields around blade elements of an axial compressor rotor of a turbomachine is presented Radius variation and stream sheet convergence are included The analysis considers the time-dependent Navier-Stokes equations in conservation law form which allows for viscous shock wave formation A discretized method of characteristics is used to determine the boundary conditions along the blade surface and exit plane An explicit, time-dependent, second-order, finite difference technique is utilized to numerically solve these partial differential equations in a transformed computational plane Comparison of numerical results with cascade and rotor data indicate good agreement for blade surface pressure distributions and mixed-out exit conditions (Author)

**A75-36896** # **Uniform shear flow within rectangular parallel-walled diffusers** S Masuda, I Ariga (Keio University, Tokyo, Japan), and I Watanabe (Aoyama Gakuin University, Tokyo, Japan) *American Society of Mechanical Engineers, Joint Fluids Engineering and Lubrication Conference, Minneapolis, Minn, May 5-7, 1975, Paper 75-FE-34* 10 p 14 refs Members, $1 00, nonmembers, $3 00

In the present paper, the previous results concerning the effects of uniform shear flows within the rectangular parallel-walled diffusers were extended to the low inlet turbulence case and also the effect of viscosity was included Low turbulence shear flows were generated and it was found that the coupled effects of the inlet mean velocity profile and the inlet turbulence intensity were so important that the former alone gave little information in predicting the diffuser performance Furthermore, the effects of uniform shear flow upon the turbulent boundary layer growth on the diffuser walls were examined It was revealed that the boundary layer grew more rapidly on the low velocity wall than on the high velocity wall and these effects became more remarkable with an increasing divergence angle The predicted static pressure recovery and other boundary layer parameters agreed well with the experimental results except in the cases where the inlet velocity gradient and the divergence angle were large (Author)

**A75-36899** # **A three-dimensional method for the calculation of flow in turbomachines using finite elements on a blade-to-blade surface of revolution** C Korving Delft, Technische Hogeschool, Doctor in de Technische Wetenschappen Dissertation, 1974 120 p 12 refs

A mathematical method is presented showing that complex fluid flows in turbomachines can be analyzed by a three-dimensional approach The method is characterized by an approximation technique providing results whose accuracy is independent of the geometry of the impeller, the blade shape, and the number of blades Moreover, it features a low computation time and a small amount of storage required to calculate the blade velocity distribution on a computer S J M

**A75-36951** **Omega Symposium, 2nd, Washington, D C, November 5-7, 1974, Proceedings** Symposium sponsored by the Institute of Navigation Washington, D C, Institute of Navigation, 1974 221 p Members, $25, nonmembers, $30

Aspects of Omega signal coverage prediction are considered along with accuracy specifications for automatic Omega navigators, Omega navigation systems specification and performance measurement, a computerized integrated Omega position fixing system, and a differential Omega in the air traffic control environment Attention is given to results concerning a parametric analysis of differential Omega error, an evaluation of differential Omega for general aviation area navigation, airborne Omega navigation system integration, the error characteristics of Omega-derived velocity, and digital phase processing for low cost Omega receivers

G R

**A75-36952** # **Omega signal coverage prediction** J E Bortz, Sr, R R Gupta (Analytic Sciences Corp, Reading, Mass), D C Scull, and P B Morris (U S Coast Guard, Washington, D C) In Omega Symposium, 2nd, Washington, D C, November 5-7, 1974, Proceedings Washington, D C, Institute of Navigation, 1974, p 1-8

A set of coverage prediction diagrams is presented for the 10 2 kHz signal from each OMEGA transmitter The diagrams show the -20 dB signal-to-noise ratio contours (in a 100 Hz noise bandwidth) for both local noon and local midnight Composite diagrams are also presented on which all individual -20 dB contours are plotted for the current transmitter network for local noon and for local midnight Similar diagrams are presented for the planned full OMEGA operational network A full-wave signal-propagation computer program was employed to generate signal strength profiles along radial paths from each transmitter Noise values from the CCIR noise map were applied to the profiles Sensitivity tables showing the shifts that result from small changes in transmitted power or from seasonal variations in the noise power are also included (Author)

**A75-36953** # **Accuracy specifications for automatic Omega navigators** F C Sakran, Jr (U S Naval Air Test Center, Patuxent River, Md) In Omega Symposium, 2nd, Washington, D C, November 5 7, 1974, Proceedings Washington, D C, Institute of Navigation, 1974, p 9-20 13 refs

Fully automatic Omega navigation systems have been demonstrated and are beginning to be used operationally in aircraft and other vehicles A natural question is the accuracy achieved by such systems Concern over the probability of maintaining correct lane identification complicates this question Use of the root-mean square (rms) statistic is shown to be a misleading measure of operational performance Alternate methods of specifying the navigational errors of automatic Omega navigators are discussed Cumulative percentile plots are recommended for the specification of errors Use of Weibull probability paper to study radial error trends is demonstrated Illustrations of error analysis techniques are given, based on actual Omega flight test data (Author)

**A75-36954** # **Experimental Omega four frequency format extends lane ambiguity** W E Rupp, Jr (U S Naval Air Test Center, Patuxent River, Md) In Omega Symposium, 2nd, Washington, D C, November 5-7, 1974, Proceedings
Washington, D C, Institute of Navigation, 1974, p 21 29

A Global Rescue Alarm Net (GRAN) program has been conducted with the objective to develop a global universally acceptable search and rescue system A very serious limitation in the adaptation of the Omega Navigation System is the possibility of ambiguously provided position estimates inherent in the transmission format now committed for implementation Multiple position estimates are separated by only 72 nautical miles The part of the GRAN program which is directed at extending this distance between ambiguously indicated positions is discussed G R

**A75-36955** * # **A comprehensive experimental program for investigation of various Omega operational modes with selected data analysis results** C D Lytle, E S Bradshaw (NASA, Langley Research Center, Hampton, Va), and L J Jowers (LTV Aerospace Corp, Hampton, Va) In Omega Symposium, 2nd, Washington, D C, November 5-7, 1974, Proceedings
Washington, D C, Institute of Navigation, 1974, p 30-41 6 refs

The investigations considered are concerned with a better definition of the achievable accuracy and propagation characteristics of Omega and the provision of data which could be used for an analysis to study the potential application of Omega position determination to support other NASA projects The data collection program is considered along with the experimental equipment employed Attention is given to the design of the receiving station, aspects of data processing, position measurement errors, differential errors, problems of lane decision, and the definition of the update rate G R

**A75-36956** # ***Omega navigation systems specification and performance measurement*** O J Baltzer and E C Fraser (Tracor, Inc, Austin, Tex) In Omega Symposium, 2nd, Washington, D C, November 5-7, 1974, Proceedings Washington, D C, Institute of Navigation, 1974, p 42 45

Attention is given to those areas in which the behavior of VLF systems differs markedly from that of more conventional radio systems The proposal is made to employ a standardized terminology and measurement procedures which will provide an accurate measure of a system's performance capability and permit valid comparisons between alternative systems It is pointed out that a performance specification for an Omega navigation system naturally divides into two parts, including an instrument accuracy specification and a navigational accuracy specification G R

**A75-36957** # **Hand held calculator technology applied to an advanced Omega receiver** B N Gaon (Rockwell International Corp, Anaheim, Calif) In Omega Symposium, 2nd, Washington, D C, November 5 7, 1974, Proceedings Washington, D C, Institute of Navigation, 1974, p 62-67

An automatic Omega system which simplifies the standard Omega receiver/processor has been developed MOS/LSI micro processors are utilized to obtain a low cost, fully automatic composite airborne system The system functions are considered along with aspects of system mechanization and system performance The basic function of the Omega set is to determine the position by receiving and processing the Omega VLF transmissions The set has been designed to provide also steering information to preselected waypoints G R

**A75-36958** # **Differential Omega in the air traffic control environment** H G Miller (Mitre Corp, McLean, Va) In Omega Symposium, 2nd, Washington, D C, November 5 7, 1974, Proceedings Washington, D C, Institute of Navigation, 1974, p 68-73 11 refs

Attention is given to the technical feasibility of implementing a differential Omega system which would provide complete coverage of the continental U S The monitor station configuration and location concepts are discussed along with the differential message format and differential Omega communications alternatives It is found that approximately fifty ground monitor stations would be required to implement a differential system for the domestic air space G R

**A75-36959** * # **Recent results on parametric analysis of differential Omega error** E G Baxa, Jr and P V Piserchia (Research Triangle Institute, Research Triangle Park, N C) In Omega Symposium, 2nd, Washington, D C, November 5-7, 1974, Proceedings Washington, D C, Institute of Navigation, 1974, p 74-84 22 refs Contracts No NAS1-12043, No NAS1-13290

Previous tests of the differential Omega concept and an analysis of the characteristics of VLF propagation make it possible to delineate various factors which might contribute to the variation of errors in phase measurements at an Omega receiver site An experimental investigation is conducted to determine the effect of each of a number of parameters on differential Omega accuracy and to develop prediction equations The differential Omega error form is considered and preliminary results are presented of the regression analysis used to study differential error G R

**A75-36960** * # **An evaluation of differential Omega for general aviation area navigation** W M Hollister and S M Dodge (MIT, Cambridge, Mass ) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings
Washington, D C , Institute of Navigation, 1974, p 85-95 11 refs
Grant No NGL-22-009-640

This paper reports on a study which compared the expected cost and performance of Differential Omega with that of Loran-C and VORTAC for general aviation area navigation Analysis is directed toward a comparison of the systems with respect to specified performance parameters and the cost-effectiveness of each system in relation to the specifications Loran-C offers the highest performance with respect to accuracy Differential Omega requires the least expenditure It was found cost ineffective to attempt to obtain complete coverage by expanding the existing VORTAC system
(Author)

**A75-36961** # **State of experimentations and program of development of Differential OMEGA in France.** G Nard (Sercel, Nantes, France) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 96-107h

**A75-36962** # **Alternative approaches to integrated airborne OMEGA/Inertial navigation** D E Gentry, J A D'Appolito, and J F Kasper, Jr (Analytic Sciences Corp , Reading, Mass ) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 108-110, 112, 113 11 refs

Integrated OMEGA/Inertial navigation systems appear attractive in airborne applications since the excellent short-term accuracy of an inertial navigator is well-complemented by the intermittent availability of bounded, moderately accurate OMEGA position fixes There are a number of different approaches which can be taken to accomplish the desired system integration, three such approaches are considered The first involves a straightforward output reset, the second is essentially a Kalman-based variant of rate-aiding and the third involves conventional optimal integration These schemes are evaluated using models for various navigation system errors to yield predictions of system position and velocity error behavior Additionally, the schemes are compared on the basis of operational factors such as ease of implementation and computer utilization
(Author)

**A75-36963** # **Airborne Omega navigation system integration and test** R L Fischer (Northrop Corp , Electronics Div , Hawthorne, Calif ) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 114-121

The integration and test of an airborne multi-sensor (Omega-inertial-Doppler) navigation system is described with an emphasis on the systematic approach required for proper testing of major hardware/software elements that comprise the system A systematic approach to integration, testing and evaluation of the major hardware/software elements of Omega signal measurement with other navigation sensors is reviewed The paper includes a description of the simulation techniques utilized to verify system design and the integration of Omega derived information with data from other navigational sensors by a Kalman combinational filter, providing optimal system performance The modular concept of integration and test, using combinations of Omega, inertial, Doppler, and aircraft sensor signal simulations with the systems under test, is treated with the development of the system traced through the early stages of the flight test program (Author)

**A75-36964** # **Mix and match - A hybrid Omega-Inertial airborne navigation system** D E Steybe (Northrop Corp , Electronics Div , Hawthorne, Calif ) In Omega Symposium, 2nd, Washington, D C , November 5 7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 122-126

The hybrid system considered provides the navigation data for use in the Airborne Weather Reconnaissance System The navigation quantities needed include latitude, longitude, attitude including accurate heading, and instantaneous velocity relative to the ground In conjunction with true airspeed this velocity is used to compute instantaneous wind velocity The main technical problem concerning the implementation of the system was related to the development of a mechanization which would best combine the system components to achieve the desired navigation performance G R

**A75-36965** # ***An empirical computed evaluation of composite Omega*** D Mactaggart (Canadian Marconi Co , Montreal, Canada) In Omega Symposium, 2nd, Washington, D C , November 5 7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 131-138

Computer modelling is used to demonstrate that the composite Omega technique considered is viable The composite model is discussed, taking into account advantages and disadvantages The accuracy obtainable is found to be quite adequate for most general navigation uses It is pointed out that this capability is derived from fully legitimate signals intended and provided for navigation use G R

**A75-36966** # **Flight test of ARN-99/V/2 Omega Navigation Set in F-4 aircraft.** E J Smith (Northrop Corp , Hawthorne, Calif ) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 139 142

Previous evaluation programs of the navigation set considered have produced excellent results in the case of multiengined aircraft operating in the subsonic flight regimes The investigation reported was conducted to test the extension of the operational use of the navigation set to the tactical and supersonic flight regimes To date 12 flights have been completed The test results demonstrate the ability of the AN/ARN-99 to provide accurate navigation in a tactical aircraft under both normal and high maneuver environments G R

**A75-36967** # **Airborne ONS - A low cost alternate to INS** N C Dickerson, Jr and W J Judge (Litton Systems, Inc , Amecom Div , College Park, Md ) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings
Washington, D C , Institute of Navigation, 1974, p 143 153

Anticipation of the expanded market made possible through the worldwide implementation of the Omega transmitting system and its obvious economic advantages for intercontinental navigation has spurred the development and testing of low cost airborne Omega Navigation Systems for the guidance and steering of military and commercial aircraft The development of the ONS-201 by Litton addresses the problem of navigating an aircraft from takeoff to destination and providing continuous in-flight navigational output to the pilot/navigator The basic intent of the development was to design a system which could provide the same navigational guidance as is currently provided by airborne inertial navigation systems The results of flight tests aboard commercial and military aircraft indicate that all of the designed goals were achieved and that the system can be operated without extensive training by pilots already familiar with operations of inertial navigation systems such as Litton's LTN 72
(Author)

**A75-36968** * # **Binary phase locked loops for Omega receivers** K Chamberlin (Ohio University, Athens, Ohio) In Omega

Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 154-159 7 refs Grant No NGR-36-009-017

An all-digital phase lock loop (PLL) is considered because of a number of problems inherent in an employment of analog PLL The digital PLL design presented solves these problems A single loop measures all eight Omega time slots Memory-aiding leads to the name of this design, the memory-aided phase lock loop (MAPLL) Basic operating principles are discussed and the superiority of MAPLL over the conventional digital phase lock loop with regard to the operational efficiency for Omega applications is demonstrated G R

**A75-36969 * #** **Binary processing and display concepts for low-cost Omega receivers** R W Lilley (Ohio University, Athens, Ohio) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 160-167 Grant No NGR-36-009-017

A description is given of concepts related to plans for developing a low-cost, all-digital Omega receiver capable of offering to the small-aircraft pilot a reliable and accurate navigation aid The receiver base considered includes a receiver front end module, a receiver control module, a memory-aided phase-locked loop module, a housekeeping timer module, and a synthesizer module G R

**A75-36970 #** **Digital phase processing for low-cost Omega receivers** D B Cox, Jr , W H Lee, W M Stonestreet (Charles Stark Draper Laboratory, Inc , Cambridge, Mass ), and E V Harrington, Jr (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 168-177 8 refs Contract No F33615-72-C-1335 AF Task 2,1

The functional organization of an Omega receiver incorporating serial digital phase filters (SDPF's) is considered along with operational and design details for an SDPF It is shown that the SDPF is suitable for filtering and analog-to-digital conversion of the phase information from the front end of an Omega receiver The SDPF performs its functions well in tracking and synchronization modes in a variety of environments The SDPF is also found to be an unusually efficient processor which can be utilized cost-effectively to reduce the computing load on a general-purpose microprocessor G R

**A75-36971 * #** **On observations of modal interference of the North Dakota Omega transmission** E G Baxa, Jr (Research Triangle Institute, Research Triangle Park, N C ) and C D Lytle (NASA, Langley Research Center, Hampton, Va ) In Omega Symposium, 2nd, Washington, D C , November 5 7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 188-197 13 refs Contracts No NAS1 12043, No NAS1-13290

Phase perturbations due to apparent modal interference make a distinctive contribution to the navigation error according to an evaluation of Omega navigation accuracies In general the North Dakota VLF Omega signal phase has been observed to lag consistently at virtually all of the receiver sites considered Attention is given to modal excitation in a spherical waveguide and the sensitivity of receiver phase to parameter variations It is found that the large phase fluctuations which have occurred at night at ranges from North Dakota could deteriorate navigation accuracies particularly in and near the coastal confluence regions G R

**A75-36972 #** **Blunders caused by Omega propagation - SPA's and PCA's** E R Swanson (U S Naval Electronics Laboratory Center, San Diego, Calif ) In Omega Symposium, 2nd, Washington, D C , November 5 7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 202 206 11 refs

Omega errors beyond the 95th percentile are primarily the result of Sudden Phase Anomalies (SPA's) due to Sudden Ionospheric Disturbances (SID's) and Polar Cap Absorptions (PCA's) due to particle precipitation toward the magnetic poles resulting from certain solar flares The statistical significance of these events is assessed (Author)

**A75-36973 #** **Evaluation of real-time algorithms for Omega propagation prediction** A N Beavers, Jr , D E Gentry, and J F Kasper, Jr (Analytic Sciences Corp , Reading, Mass ) In Omega Symposium, 2nd, Washington, D C , November 5-7, 1974, Proceedings Washington, D C , Institute of Navigation, 1974, p 207-212 8 refs

Approaches for the automatic computation of predicted propagation corrections (PPC's) in an Omega receiver are considered, taking into account the tabular storage of published PPC's, a simplified version of the existing propagation prediction process, and a functional approximation of PPC's and/or their individual components The investigation shows that there are a number of excellent alternatives for Omega propagation prediction which are not inordinately burdensome computationally G R

**A75-36992 Results of an investigation of two three-dimensional low-level flight systems (Ergebnisse der Untersuchung zu zwei dreidimensionalen Tiefflugfuhrungssystemen)** A Hessel (Messerschmitt-Bolkow-Blohm GmbH, Ottobrunn, West Germany) *(Deutsche Gesellschaft fur Luft und Raumfahrt, Jahrestagung, 7th, Kiel, West Germany, Sept 17-19, 1974 ) Zeitschrift fur Flugwissenschaften*, vol 23, June 1975, p 189-196 In German

A three-dimensional low-level flight system A, having automatic terrain-following and terrain avoidance capabilities, is compared to a system B Terrain avoidance is achieved in system B by flying along preset waypoints The performance of the systems was investigated by digital simulations using a three-dimensional model of natural terrain It is demonstrated that both systems show equivalent avoidance capabilities Essential differences are the increased number of waypoints necessary for system B and a simpler sensor Compared to the simple terrain following, terrain avoidance means flying at a lower altitude above sea level But the load factors have negligibly changed to lower ones (Author)

**A75-37002 #** **HASPA design and flight test objectives** F J Petrone and P R Wessel (U S Naval Surface Weapons Center, Silver Spring, Md ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-924* 12 p Navy-supported research

In the early Fall of 1975 the first of four scheduled flights to be conducted in the High Altitude Superpressured Powered Aerostat (HASPA) Program will take place The vehicle is a remotely piloted airship of some 800,000 cubic feet volume which will operate at an altitude near 70,000 feet This paper briefly describes the evolution of the concept and presents a general design overview The propulsion system and the different power supplies to be used on the three powered flights are described The power supplies are primary Ag/Zn batteries, an H2/O2 fuel cell, and a solar array-secondary battery combination These units are to provide both operating power and propulsion power for nominal periods of 30 hours, 7 days, and 30 days respectively The flight test objectives and test measurement programs are described along with the launch, flight and recovery procedures Most of the equipment being used in the test program has been designed to allow for maximum use of existing hardware which will minimize the program length and cost (Author)

**A75-37003 #** **Development and flight experience of a manned thermal airship** R R Parsons (Raven Industries, Inc., Sioux Falls, S Dak ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-925* 6 p

A manned thermal airship has been developed The airship is in the light payload class with a useful lift of 500 pounds It has a true airspeed of 25 mph and duration of three hours The airship uses hot air generated by on-board propane burners for its buoyancy medium

By regulating the use of hot air, altitude control is achieved An engine driven fan is used to keep the airship pressurized The airship is propelled by a single propeller driven by a 65 hp aircraft engine The airship was developed as a commercial venture with a wide range of uses Flight tests have been performed and certification of the airship is underway (Author)

**A75-37004** # **A balloon transport system** H E Reed (Pan American World Airways, Inc, Patrick AFB, Fla) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo, July 15-17, 1975, Paper 75-926* 8 p 27 refs ARPA-Navy-sponsored research

A presentation that describes the experiments and results obtained during a series of tests conducted to evaluate the feasibility of adapting the heavy lift natural-shape balloon, used commercially by the logging industry for the harvesting of timber, to off-load containerships in areas without prepared port facilities Feasibility, operational concepts and plans, hardware definition and required critical studies and testing of such a balloon transport facility are discussed (Author)

**A75-37005** # **A non-polluting powerplant for large airships** F Morse (Boston University, Boston, Mass) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo, July 15-17, 1975, Paper 75-927* 7 p 7 refs

A report is presented describing the features of an aircraft propulsion system which is characterized principally by (1) use of a Rankine cycle to transform chemical energy into shaft work and (2) use of liquid hydrogen as the energy source Such a system would produce a nearly pollution-free exhaust and would have additional benefits of low sound level and marked improvement in specific fuel consumption over existing types However, owing to relatively high specific weights, extensive condenser surfaces and the low volumetric heating value of hydrogen, the system as described would be exclusively applicable to large, lighter-than air craft (Author)

**A75-37006** # **A feasibility study of a trans-ocean hybrid cargo airship operating in ground effect** D E Calkins *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo, July 15-17, 1975, Paper 75-929* 10 p 10 refs

The hybrid airship is developed in the context of an all-cargo aircraft operating in ground effect for increased performance The concept is proposed for the transportation of containerized freight on the Trans-Atlantic route from New York to London A performance and economic algorithm has been developed to compare the hybrid and conventional airship designs A parametric study has been performed that covered vehicle gross weights from 250 to 4000 tons The metric used for comparing the two designs was the Profit Margin (P M) for a year's operation Results of the study show that the hybrid has a higher P M up to a gross weight of 1500 tons A 1000 ton hybrid, offering a 43% higher P M over the conventional airship, is selected as a feasible design point for further development (Author)

**A75-37007** * # **Evaluation of advanced airship concepts** B A Joner and J J Schneider (Boeing Vertol Co, Philadelphia, Pa) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo, July 15-17, 1975, Paper 75-930* 13 p NASA supported research

A historical overview of the airship, technical and operational characteristics of conventional and hybrid concepts, and the results of a parametric design analysis and evaluation are presented The lift capabilities of certain buoyant fluids for a hypothetical 16 million cu ft volume airship are compared The potential advanced airship concepts are surveyed, followed by a discussion of the six configurations conventional nonrigid, conventional rigid, Deltoid (Dynairship), Guppoid (Megalifter), Helipsoid, and Heli-Stat It is suggested that a partially buoyant Helipsoid concept of the optimum buoyancy ratio has the potential to solve the problems facing future airship development, such as Ballast and Ballast Recovery System, Full Low-Speed Controllability, Susceptibility to Wind/Gusting, Weather/Icing Constraints, Ground Handling/Hangaring, and Direct/Indirect Operating Costs M G

**A75-37008** # **The Shell natural gas airship, and other L T A. activities by Aerospace Developments** J E R Wood (Aerospace Developments, London, England) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo, July 15-17, 1975, Paper 75-932* 5 p

Feasibility of transporting natural gas by means of lighter than air craft and the design of a large monocoque airship are studied Neither the nonrigid, semirigid nor the Zeppelin type rigid craft are suitable for this application Traditional methods of construction of airships are also not suitable, but tests have shown the adhesive bonding assembly techniques to be structurally advantageous, especially the honeycomb sandwich technique The basic pre-assembly requirements for the 'unitary panel' which forms the basis of the hull structure of the airship are presented The gas separator and the transverse membranes are discussed, in addition to the main propulsion system, control systems, and the mode of operation An 8 million cu ft ship is predicted to fly by 1979 and the 'fleet size' craft of 100 million cu ft by 1984 M G

**A75-37009** # **Structural design of a High-Altitude Superpressure Powered Aerostat** D R Lagerquist and L B Keen (Sheldahl, Inc, Northfield, Minn) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo, July 15-17, 1975, Paper 75-933* 11 p Contract No N60921-75-C-00050

Structural design features are described for a High-Altitude Superpressure Powered Aerostat (HASPA) currently being built Loading conditions are predicted for the flaccid launch, free ascent, and operational mode at float altitude Special design considerations were required for the equipment bay attachment and at the stern-mounted propulsion system Stresses and structural stability were computed by finite element and other analytical methods A composite material consisting of Kevlar yarns and Mylar film has been designed to meet the stringent requirements on strength, weight and permeability Design analysis and material qualification test results are presented (Author)

**A75-37010** * # **Structural materials research for lighter-than-air systems** V L Alley, Jr and A D McHatton (NASA, Langley Research Center, Hampton, Va) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo, July 15-17, 1975, Paper 75-935* 9 p 9 refs

Inflatable systems have widespread applications in military, government, and industrial sectors Improvements in inflatable materials have followed each salient advancement in textiles The new organic fiber, Kevlar, is a recent and most significant advancement that justified reexamination of old and new inflatable materials' applications A fertile frontier exists in integrating Kevlar with various other material combinations, in optimization of geometric features, and in selection of thermomechanical characteristics' compatibility with the environment Expectations regarding Kevlar have been justified by the performance of two experimental materials Styrene-butadiene-styrene block copolymers appear promising as a constituent adhesive for low temperature applications Biaxial testing for both strength and material elastic properties is a technology area needing greater awareness and technology growth along with improved facilities Because of dramatic materials' advancements, inflatable systems appear to be moving toward an increased position in tomorrow's aerospace industry (Author)

**A75-37011** # **The Navy role in buoyant and semi-buoyant** **Proceedings** Conference supported by the Israel Ministry of Transport, Israel Ministry of Defence, Israel Ministry of Commerce and Industry, et al *(Israel Journal of Technology,* vol 13, no 1-2, 1975 ) Jerusalem, Weizmann Science Press of Israel, 1975, 166 p

Papers are presented dealing with propulsion, control and guidance, fluid mechanics, and structural mechanics and vibrations Some of the topics covered include a parametric study of a pyrogen-type BPN igniter for rocket motors, synthesis of disturbance-rejection controllers for linear multivariable continuous time systems, experimental study of shear lag in axially loaded panels, the role of gas flow and turbulence in electric discharge lasers, and flexure analysis of axially loaded beam by infinite element method with integral parameters

P T H

**A75-37012** # **Operational considerations of large rigid airships in military applications** B B Levitt (Operations Research, Inc , Silver Spring, Md ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-938* 9 p

It is proposed that a large rigid airship is particularly well suited to perform the Navy's sea control mission This mission is defined and the operational requirements examined Two specific airship configurations are suggested for accomplishment of this mission In the 'self-contained' version all mission requirements are performed by on-board systems In the 'carrier' configuration improved effectiveness is achieved by the use of aircraft or RPV's operated from the airship General characteristics are developed for each of these configurations A number of operational considerations are then examined (Author)

**A75-37015** # **HASPA flight control concepts** R O Hookway and J R Pretty (Martin Marietta Aerospace, Denver, Colo ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-942* 11 p 5 refs

Objectives of the HASPA control system analysis were to determine the effect of the control system concept on overall vehicle design and vice versa The analysis helped to define the fin configuration, select the number of controls required, select the location of the center of gravity, and to design the hull to gondola attachments The controls analysis utilized linear and nonlinear techniques Fins are desirable, active control is required in pitch and yaw, the horizontal location of the CG should be positioned to balance the pitching moment coefficient about the center of buoyancy at zero angle of attack, vertically it should be as far below the CB as possible, relative motion between the gondola and the hull should be minimized (Author)

**A75-37017** # **Wing-Tip-Winglet propulsion for Aerocrane-type hybrid lift vehicles** A L Elias *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-944* 11 p

A non-tilting propulsion scheme for the 'Aerocrane' vehicle, consisting of vertically-mounted 'Wing Tip Winglets' is analyzed The performance of this system is naturally dependent on the program used to cycle the pitch of the Winglets To better evaluate these programs, a geometrical limit to the performance of the system is obtained Next, the simplest (sinusoidal) program is evaluated, and its performance found to be virtually the maximum Simple control laws for this program are derived and a digital simulation of an All American Engineering Model 1050 Aerocrane, with added Winglets, is flown The control performance of the basic vehicle is compared to the Winglet-equipped vehicle The Winglet system is seen to be capable of overcoming basic control limitations of the vehicle (Author)

**A75-37018** * # **Computer aided airship design** S J Davis and H Rosenstein (Boeing Vertol Co , Philadelphia, Pa ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-945* 12 p 5 refs NASA-supported research

The Comprehensive Airship Sizing and Performance Computer Program (CASCOMP) is described which was developed and used in the design and evaluation of advanced lighter than air (LTA) craft The program defines design details such as engine size and number, component weight buildups, required power, and the physical dimensions of airships which are designed to meet specified mission requirements The program is used in a comparative parametric evaluation of six advanced lighter-than-air concepts The results indicate that fully buoyant conventional airships have the lightest gross lift required when designed for speeds less than 100 knots and the partially buoyant concepts are superior above 100 knots When compared on the basis of specific productivity, which is a measure of the direct operating cost, the partially buoyant lifting body/tilting prop-rotor concept is optimum (Author)

**A75-37019** * # **Potential missions for advanced airships** D T Grant and B A Joner (Boeing Vertol Co , Philadelphia, Pa ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-946* 8 p 8 refs NASA-supported research

The freight commodity transport and the intercity passenger travel markets in the U S for 1967 and 1972 are analyzed, along with 1985 estimates, in order to establish the size, speed and cost enabling use of the airship in these markets Items examined include frozen meat, confectionary, drugs, electrical equipment, mechanical parts, clothing and plastic products A 50 ton/500 passenger payload capacity, a cruise speed of 100 kt and a VTOL capability or at minimum short take-off and vertical landing capability are needed to make an LTA vehicle viable in the transport market if it had a direct operating cost of $500 to $800 per hour for freight carrying and $1100 to $2700 an hour in passenger service with utilizations between 2000 hours and 4000 hours a year M G

**A75-37020** # **A strategy for getting LTA systems airborne.** J S Brown (U S Navy, Military Sealift Command, Washington, D C ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-949* 7 p

The article discusses the need for a coordinated, formalized and comprehensive program for Lighter Than Air (LTA) systems development Broad market analysis, economic and technical studies on LTA systems, and LTA vehicle classification system, and a priorities listing of potential market/mission opportunities are needed to create a viable LTA development program In addition to existing markets in cargo transportation, creation of new markets, employments and services based on employing the advantages in LTA capabilities is suggested for economically sustaining a new LTA vehicle system

M G

**A75-37021** # **Airships in gusts - Apprehensions and assurance** T H Troller *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15-17, 1975, Paper 75-950* 6 p

It is recommended that atmospheric turbulence and gusts be considered prime factors in airship design The construction of a water tank test stand, a gust duplicating facility, is described Means for recording longitudinal, transverse and angular displacements in a coordinated way, together with measurement of the distribution of the gust velocity were provided Test results of Akron-Macon shape models, including the lateral and angular displacements of airships under the influence of a gust reaching its maximum strength over a distance of about one-half the length of a ship, and direct

measurements of bending moments as they occur at various stations along the hull of the ship as it travels through the gust are presented Also, measurements were made to establish fin forces directly, and the establishment of a stand for vertical gusts is recommended M G

**A75-37048** # **Modern hubs of helicopter rotors. II (Wspolczesne piasty wirnikow smiglowcowych II).** Z Brodzki *Technika Lotnicza i Astronautyczna,* vol 30, June 1975, p 27-29 11 refs In Polish

Helicopter rotors of advanced design are reviewed with particular reference to innovations and improvements in the field of rotor hubs The use of elastomer bearings, as in the HLH hub, is noted, along with the trend of giving preference to rigid rotor structural design The simplifications evidenced by the Lynx rotor system, the NAT-FLEX and TRIFLEX hubs, and the British Sycamore and Hafner hubs are examined V P

**A75-37063** # **Flame stabilization by leading edge vortex breakdown above a delta shape.** R. H Sweat and R L Panton (Texas, University, Austin, Tex ) *Combustion Institute, Central and Western States Sections Meeting, San Antonio, Tex , Apr 21, 22, 1975, Paper* 27 p 6 refs

A flameholding device utilizing the aerodynamics of a delta wing was investigated Modes of combustion, combustion limits, and vortex breakdown positions were determined in tests where free-stream velocity, fuel flow rate, and angle of attack were varied Two burner operation modes were observed (1) symmetric in flame configuration with respect to the wing centerline, and (2) asymmetric with respect to the wing centerline Temperature profiles showed that combustion in a symmetric mode with vortex bursting represented the hottest and most concentrated combustion zones The observed changes in vortex burst locations were substantially different from those reported in the literature, most of the discrepancies were attributed to an interaction between pressure and combustion fields S J M

**A75-37084** **General problems concerning the helicopter (Les problèmes généraux de l'hélicoptère)** J Soulez-Lariviere (Société Nationale Industrielle Aérospatiale, Paris, France) *Sciences et Techniques,* June 15, 1975, p 22-28 In French

Problems in general principles, problems in technology, and problems remaining to be resolved regarding the helicopter are discussed Long-term flight, speed and handling, cost of production, and transport capacity are the main difficulties yet to be worked out It is concluded that the helicopter and its derivatives have increasing potential in the commercial aviation field S J M

**A75-37096** **Ceramic airframe bearings** J W Van Wyk (Boeing Aerospace Co , Seattle, Wash ) *American Society of Lubrication Engineers, Annual Meeting, 30th, Atlanta, Ga , May 5-8, 1975, Preprint 75AM-7A-3* 7 p Contract No N00019 73-C-0230

A ceramic-solid-lubricant material screening test program was conducted to select materials and lubricants for a plain spherical bearing design Friction and wear screening testing was conducted at stress levels to 7500 psi using PTFE, graphite, and molybdenum disulfide lubricants Best performance was obtained with an alumina rider specimen sliding against a silicon nitride plate lubricated with an MoS2 solid lubricant compact A lubricant reservoir bearing design development program was conducted The manufacturing details for fabricating plain spherical bearings using alumina balls in contact with an alumina lubricant reservoir race are described Four bearings indicated low wear when tested for fifty hours in a simulated helicopter rotor pitch link test Tests conducted under simulated hydrofoil flap bearing operation resulted in fracture of the ceramic outer race The highest load capacity attained was 8570 psi (Author)

**A75-37135** * **Digital adaptive flight control design using single stage model following indices** G Alag and H Kaufman (Rensselaer Polytechnic Institute, Troy, N Y ) In Conference on Decision and Control, 5th and Symposium on Adaptive Processes, 13th, Phoenix, Ariz , November 20-22, 1974, *Proceedings* New York, Institute of Electrical and Electronics Engineers, Inc , 1974, p 122-127 11 refs Grant No NGR 33-018 183

Simple mechanical linkages are often unable to cope with many control problems associated with high-performance aircraft This has led to the development of digital fly by-wire control systems and in particular digital adaptive controllers that can be efficiently adjusted during system operation To this effect, a control law has been derived based upon the minimization of a single-stage weighted combination of control energy and the squared error between the states of a linear plant and model This control logic is interfaced with an on-line weighted least-squares estimator and a Kalman state filter The utility of the resultant control system is illustrated by its application to the linearized dynamics of a typical fighter aircraft (Author)

**A75-37136** **Performance of a sliding window detector in a high-interference air traffic environment** B Rubinger (U S Department of Transportation, Transportation Systems Center, Cambridge, Mass ) In Conference on Decision and Control, 5th and Symposium on Adaptive Processes, 13th, Phoenix, Ariz , November 20-22, 1974, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1974, p 142 152 10 refs

Target detection and azimuth determination is accomplished in the enroute air traffic control radar beacon system with a sliding window processor Due to missed replies and the presence of interference the center mark is not deterministic, and can only be described in a statistical sense A novel approach is taken which introduces a class of input/output sequences that establish the validity of a target start An expression for the center mark distribution is developed around these 'valid chains' The resulting analytic tool is used to examine sliding window performance in several current and projected ATC environments and is available to determine optimal sliding window parameter settings An important finding is that the centermark estimate is biased, for low reply probability or high interference-rates this term is a significant source of error (Author)

**A75-37138** **A technique to improve the performance of a nonlinear filter with an application to satellite-aided aircraft navigation** A N Joglekar (Mitre Corp , McLean, Va ) In Conference on Decision and Control, 5th and Symposium on Adaptive Processes, 13th, Phoenix, Ariz , November 20-22, 1974, Proceedings New York, Institute of Electrical and Electronics Engineers, Inc , 1974, p 159-164 9 refs

This paper evaluates the performance of a filter that transforms nonlinear measurements in the coordinate system of the state before using them in the filter The bias and computational performance of this mechanization are compared with the conventional extended Kalman (EK) filter The bias in the EK filter is a function of the covariance of the estimation error, while in the state-coordinate system (SCS) it depends on variance of the transformed measurement noise, which is independent of the estimation error and depends only on the nonlinearity Thus when the initial covariance of the state is large, the SCS filter has less bias than the EK filter This reduction in the bias is achieved at a cost of additional computations required to implement the transformation The improved performance of the filter due to the coordinate transformation is then demonstrated with an example of satellite aided aircraft navigation (Author)

**A75-37182** **Near-field supersonic flow pattern of slender delta wings** S N Chaudhuri (Tennessee, University, Tullahoma, Tenn ) and S C Prahara] (Northrop Services, Inc , Huntsville, Ala ) *International Journal of Engineering Science,* vol 13, Sept -Oct 1975, p 889-904 17 refs U S Department of Transportation Contract No FA70WA-2260

The theory of linearized conical flow has been applied to calculate pressure distributions over slender delta wings and at points in the field away from the wings The study also gives linearized results of the variations of some of the important wing parameters Near-field flow patterns due to both first and second order conical flow fields around delta wings have been worked out. Slender delta wings with constant angle of attack, camber and thickness distribution along the span have been considered Whitham's quasilinear approach is used for these slender delta wings to obtain a first-order uniformly valid solution All these results are compared with those obtained from the equivalent body theory and significant differences are observed in the near-field region (Author)

**A75-37299** **Anatomy of the helicopter II - Engine and transmission ratings** P Brittan *Shell Aviation News,* no 429, 1975, p 8-13

**A75-37300** **MADGE - Evaluating a helicopter approach guidance system** F W Free (British Airways Helicopters, Ltd , Horley, Surrey, England) *Shell Aviation News,* no 429, 1975, p 14-17

Successful trials performed with a Microwave Aircraft Digital Guidance Equipment (MADGE), using a Sikorsky S61N helicopter are described The aim of the trials was to make a preliminary assessment of MADGE as an approach aid for helicopters operating on a regular daily schedule between Penzance and the Scilly Isles in the West of England The main features of the MADGE system which operates in the 5 0 to 5 25 GHz frequency band are discussed V P

**A75-37308** # **Composite box beam optimization program** P J Donohue and H A Erbacher (Grumman Aerospace Corp , Bethpage, N Y ) In Reinforced plastics - Milestone 30, Proceedings of the Thirtieth Anniversary Technical and Management Conference, Washington, D C , February 4-7, 1975 New York, Society of the Plastics Industry, Inc , 1975, p 14-A1 to 14-A6 USAF-sponsored research

The present program was undertaken to extend the design and manufacturing technological base for highly loaded wings fabricated from mixed composites and to demonstrate, with a representative component, a minimum weight savings on the order of 30 percent over a comparable baseline metal design This was achieved by judicious structural and material optimization based on selection and integration of the newer advanced composite materials, and by minimization of the use of structural metallic elements (Author)

**A75-37309** # **Kevlar 49 hybrid composites for commercial and aerospace applications** P G Riewald and C Zweben (Du Pont de Nemours and Co , Inc , Industrial Fibers Div , Wilmington, Del ) In Reinforced plastics Milestone 30, Proceedings of the Thirtieth Anniversary Technical and Management Conference, Washington, D C , February 4-7, 1975 New York, Society of the Plastics Industry, Inc , 1975, p 14-B1 to 14-B10

Mechanical properties and projected cost reductions obtainable with Kevlar 49-graphite/epoxy and Kevlar 29-graphite/epoxy composites are presented It is shown that Kevlar 49-graphite hybrid aircraft fuselage panels have significantly better resistance to impact damage than do all-graphite laminates Kevlar 49-graphite hybrids used for commercial fabrication of bows and golf club shafts furnish considerable savings over conventional woven graphite implements S J M

**A75-37310** # **Design fabrication and test of an F-14 composite overwing fairing** A Cowles (U S Naval Air Systems Command, Washington, D C ) and H Forsch (Grumman Aerospace Corp , Bethpage, N Y ) In Reinforced plastics - Milestone 30, Proceedings of the Thirtieth Anniversary Technical and Management Conference, Washington, D C , February 4-7, 1975 New York, Society of the Plastics Industry, Inc , 1975, p 14-C1 to 14-C5

The F-14 overwing fairing considered utilizes hybrid advanced composite materials The overwing fairing provides a smooth aerodynamic transition between the fuselage and the wing at all wing sweep positions and during wind deflection Attention is given to a redesign of fairing elements, including the triangular panel, the inboard and outboard beams, and the fairing fingers Questions of composite design are discussed G R

**A75-37311** # **Recent development and experience of an all fiberglass RP undercarriage for a STOL-aircraft** R Abelin and B Andreasson (Saab-Scania AB, Malmo Flygindustri, Malmo, Sweden) In Reinforced plastics - Milestone 30, Proceedings of the Thirtieth Anniversary Technical and Management Conference, Washington, D C , February 4-7, 1975 New York, Society of the Plastics Industry, Inc , 1975, p 14 D1 to 14-D2

Materials, methods of construction, and general design characteristics of an all glass fiber reinforced plastic undercarriage for the Saab-MFI 15/17 STOL aircraft are briefly described The main landing gear consists of two legs, the same leg being used on both left and right side The legs overlap each other in the fuselage, which allows for considerably more deflection than if they were rigidly attached to the fuselage After full-scale drop testing of the complete undercarriage, where the ultimate load was exceeded, no damage was found on any part of the landing gear Aircraft with this type of undercarriage are now operating under rough conditions, including fully-loaded take-offs and landings at 10,000 feet density altitude on unprepared gravel strips P T H

**A75-37405** **Israel Annual Conference on Aviation and Astronautics, 17th, Tel Aviv and Haifa, Israel, May 21, 22, 1975, Proceedings** Conference supported by the Israel Ministry of Transport, Israel Ministry of Defence, Israel Ministry of Commerce and Industry, et al *(Israel Journal of Technology,* vol 13, no 1-2, 1975 ) Jerusalem, Weizmann Science Press of Israel, 1975, 166 p

Papers are presented dealing with propulsion, control and guidance, fluid mechanics, and structural mechanics and vibrations Some of the topics covered include a parametric study of a pyrogen-type BPN igniter for rocket motors, synthesis of disturbance-rejection controllers for linear multivariable continuous time systems, experimental study of shear lag in axially loaded panels, the role of gas flow and turbulence in electric discharge lasers, and flexure analysis of axially loaded beam by infinite element method with integral parameters P T H

**A75-37409** **Synthesis of disturbance-rejection controllers for linear multivariable continuous-time systems** B Porter, T R Crossley, and A Bradshaw (Salford, University, Salford, England) *(Israel Journal of Technology,* vol 13, no 1-2, 1975 ) In Israel Annual Conference on Aviation and Astronautics, 17th, Tel Aviv and Haifa, Israel, May 21, 22, 1975, Proceedings Jerusalem, Weizmann Science Press of Israel, 1975, p 25 30 6 refs

Explicit criteria are derived which indicate clearly the extent to which constant disturbances can be rejected by the judicious introduction of integral feedback in continuous time systems with either accessible or inaccessible states These theoretical results are illustrated by designing a disturbance rejection controller for a Sea King SH-3D helicopter in hovering flight in a steady crosswind (Author)

**A75-37423** **A parametric evaluation of the performance of the bypass jet engine** H A Arbib (Technion - Israel Institute of Technology, Haifa, Israel) *(Israel Journal of Technology,* vol 13, no 1 2, 1975 ) In Israel Annual Conference on Aviation and Astronautics, 17th, Tel Aviv and Haifa, Israel, May 21, 22, 1975, Proceedings Jerusalem, Weizmann Science Press of Israel, 1975, p 152-156

A parametric analysis of the performance of a bypass jet engine is carried out The importance of three nondimensional parameters is brought out the bypass ratio mu, the fraction of the available enthalpy drop transferred to the secondary stream k, and the ratio of freestream to fully expanded gas generator velocity V/Vj The variation of the thrust augmentation ratio A with the above three parameters is considered, the conditions for optimum augmentation are investigated, and conclusions are drawn concerning these parameters (Author)

**A75-37424** **Two dimensional, inviscid, transonic flowfield around a profile** B L Coleman (Israel Aircraft Industries, Ltd , Lod, Israel) *(Israel Journal of Technology,* vol 13, no 1 2, 1975 ) In Israel Annual Conference on Aviation and Astronautics, 17th, Tel Aviv and Haifa, Israel, May 21, 22, 1975, Proceedings Jerusalem, Weizmann Science Press of Israel, 1975, p 157 161 Research supported by the Ministry of Defence of Israel

A knowledge of the flowfield around an airfoil is important in estimating the disturbance near the walls of a wind tunnel The method of Garabedian and Korn for calculating the pressure distribution on a profile is extended to enable the velocity vector in the physical plane to be exhibited Examples with and without shocks are plotted (Author)

**A75-37425** # **Intuitive design** E Schatzki *Israel Ministry of Transport, Israel Ministry of Defence, and Israel Ministry of Commerce and Industry, Israel Annual Conference on Aviation and Astronautics, 17th, Tel Aviv and Haifa, Israel, May 21, 22, 1975, Paper* 12 p

The complex character of design parameters occasionally prevent a mathematical or iterative treatment, especially when the design problem is completely novel The designer is forced to approach it by a method of 'trial and error', which leads his search in a direction of greatest possibility This process is partially subconscious and may end in an intuitive design solution It is shown that intuition is composed of two diametrically opposed but interacting phases, one is creative, the other one analytical The creative one designs, the analytical one criticizes the created design Both are essential, they can be taught and learned The deductions are elucidated by two examples, which form part of the design of an aircraft (Author)

**A75-37450** * # **Aircraft wake turbulence minimization by aerodynamic means** A Gessow (NASA, Washington, D C ) *American Meteorological Society and American Institute of Aeronautics and Astronautics, Conference on Aerospace and Aeronautical Meteorology, 6th, El Paso, Tex , Nov 12-14, 1974, Paper* 32 p 10 refs

The paper reviews NASA's efforts on wake vortex turbulence minimization by aerodynamic design or retrofit modifications to large transport aircraft Theoretical and experimental (ground-based and flight) results are presented which show that the adverse effects of a vortex wake produced by a large aircraft on a small following aircraft can be reduced significantly (Author)

**A75-37489** **Pilot problems in low visibility approach and landing** F Ormonroyd (British Airways, Ruislip, Middx , England) In Human factors in safe flight operations, Proceedings of the Twenty-seventh Annual International Air Safety Seminar, Williamsburg, Va , November 10-14, 1974 Arlington, Va , Flight Safety Foundation, Inc , 1974, p 71-82

The British Airways Trident low-approach procedures in low-visibility weather conditions, especially as regaros requirements for ILS systems, are reviewed Extension of instrument performance demands from category I (autopilot down to 200 ft) to category II (to 100 ft) is recommended Preferably, ILS systems should be *reliable to category III (12 ft) or even touchdown* The ability to overshoot and the potential of automatic overshoot facilities are discussed S J M

**A75-37497** **Noise control features of the DC-10** A H Marsh (Douglas Aircraft Co , Long Beach, Calif ) *Noise Control Engineering,* vol 4, May June 1975, p 130-139 7 refs

The special acoustical features of the three versions of the DC-10 aircraft, designed to minimize the generation of turbomachinery and jet noise, and to reduce noise transmitted into the cabin and crew compartments during high speed cruise conditions, are described Designs for the acoustically absorptive linings of the inlet and exhaust ducts in the wing engine nacelle installations are illustrated, and four basic duct lining constructions are presented perforated aluminum sheet bonded to aluminum honeycomb core, perforated fiberglass laminate bonded to slotted fiberglass laminate double diamond core, perforated steel sheet brazed to corrugated steel core, and perforated steel sheet welded to ribbed-ribbon steel core Results of the noise control features are given in terms of aircraft flyover noise during takeoff and landing and interior cabin speech interference during cruise M G

**A75-37538** **Theory of air frame noise** W C Meecham (California, University, Los Angeles, Calif ) *Acoustical Society of America, Journal,* vol 57, June 1975, pt 2, p 1416-1420 10 refs

Air frame noise is examined using Curle's theory for noise from rigid surfaces interacting with turbulence Measured 'air frame noise' often is open to question because of engine contribution A large number of examples are considered model airfoil in a jet, glider noise, jet wing in atmospheric turbulence, boundary layer noise on trailing wing edge, flat-generated noise, landing gear noise, noise from jet impinging on flap, and some others Of all of these estimated noise sources it appears that for commercial jets the noises from jets on flaps (when present) and from landing gear may be the only sources of possible practical significance (Author)

**A75 37593** **Rotorcraft parasite drag, Proceedings of the Thirty-first Annual National Forum, Washington, D C , May 14, 15, 1975** Forum sponsored by the American Helicopter Society New York, American Helicopter Society, Inc , 1975 130 p

The papers presented deal with methods for reducing rotorcraft parasite drag, possible design tradeoffs associated with drag reduction, additional benefits resulting from drag reduction, and rotorcraft drag measurement, prediction, and analysis A detailed examination of some present configurations indicates that, with the exception of the hub region, marked drag reductions are possible using contemporary design knowledge The major topics discussed include guidelines for reducing helicopter parasite drag, cost effectiveness of drag reduction, effect of drag reduction on rotor dynamic loads and blade lift, and aerodynamic analysis of helicopter configurations

Individual items are announced in this issue S D

**A75-37594** # **A general review of helicopter rotor hub drag data** T W Sheehy (United Technologies Corp , Sikorsky Aircraft Div , Stratford, Conn ) In Rotorcraft parasite drag, Proceedings of the Thirty first Annual National Forum, Washington, D C , May 14, 15, 1975 New York, American Helicopter Society, Inc , 1975, p 2 1-2 10 18 refs Grant No DAAJ02 74 C 0050

A data review has been conducted to identify parameters affecting the contribution of the rotor hub to the total drag of the aircraft Significant results of the review are presented and recom-

mendations are given relevant to the design of helicopter hub/pylon configurations (Author)

**A75-37595** * # **Rotorcraft low-speed download drag definition and its reduction** J C Wilson (U S Army, Air Mobility Research and Development Laboratory, NASA, Langley Research Center, Low-Speed Aerodynamics Branch, Hampton, Va ) In Rotorcraft parasite drag, Proceedings of the Thirty first Annual National Forum, Washington, D C , May 14, 15, 1975 New York, American Helicopter Society, Inc , 1975, p 4 1-4 9 26 refs

*Download drag for rotorcraft in hover and low speed flight is a* burden which significantly affects useful load, fuel, and payload Reduction of the burden will enhance these aspects of rotorcraft and complement the forthcoming improvements in isolated rotor performance Analyses and experimental data are available, though *fragmentary, regarding gross drag,* thrust recovery, and other characteristics which can be utilized to define interim rotorcraft design changes to reduce the burden Eventually the experimental data and a comprehensive combination of rotor, rotor wake, and potential-flow analyses can evolve to reduce the burden to an absolute minimum (Author)

**A75-37596** # **Some important practical design constraints affecting drag reduction** R E Gormont (U S Army, Systems Development and Qualification Div , St Louis, Mo ) In Rotorcraft parasite drag, Proceedings of the Thirty-first Annual National Forum, Washington, D C , May 14, 15, 1975 New York, American Helicopter Society, Inc , 1975, p 7 1 7 6 6 refs

Rotorcraft drag reduction has as its prime objectives the improvement in range, speed, payload capability, and productivity, *as well as the associated reduction of operating costs A first glance* at drag reduction would lead one to believe that all of the above objectives are attained by simply designing a lower drag configuration which results in a lower airframe parasite power and a resulting decrease in engine power and fuel requirements However, a more cautious approach must be taken to fully account for all of the ramifications of the low drag configuration In order to balance the ledger, all secondary design features which may result from a low drag configuration must be adequately considered when assessing the overall success or failure of a configuration drag reduction program The purpose of this paper is to provide guidelines and significant areas which must be considered in performing drag reduction tradeoffs (Author)

**A75-37597** # **The relationship between rotorcraft drag and stability and control** J A Hoffman (Paragon Pacific, Inc , Hawthorne, Calif ) In Rotorcraft parasite drag, Proceedings of the Thirty first Annual National Forum, Washington, D C , May 14, 15, 1975 New York, American Helicopter Society, Inc , 1975, p 8 1 8 3

The influence of drag on stability and control characteristics is examined The discussion covers the reduction of empennage dynamic pressure, linear and nonlinear wake effects, and constraints on fuselage design placed by stability and control requirements Recommendations for integrating stability and control considerations into drag study programs are set forth S D

**A75-37598** # **Prediction of rotorcraft drag** R Tracy (U S Naval Air Systems Command, Washington, D C ) In Rotorcraft parasite drag, Proceedings of the Thirty-first Annual National Forum, Washington, D C , May 14, 15, 1975 New York, American Helicopter Society, Inc , 1975, p 13 1-13 4

Techniques are described for predicting helicopter forward flight power in the three cases of one-day preliminary design effort, three-to-five-day review of a brochure-type proposal, and detailed four-to-six-week evaluation of a contractor's proposal The estimates necessary to predict the capabilities of a helicopter in each of the *cited cases are identified It is suggested that careful testing and more* detailed documentation of results will yield enough data to provide a ready method of estimating performance in all phases of helicopter design S D

**A75-37599** # **Aerodynamic analysis of helicopter configurations** F A Dvorak (Analytical Methods, Inc , Bellevue, Wash ) In Rotorcraft parasite drag, Proceedings of the Thirty-first Annual National Forum, Washington D C , May 14, 15 1975 New York, American Helicopter Society, Inc , 1975, p 14 1-14 15 14 refs

A brief review is made of applications of two and three-dimensional aerodynamic analysis methods to rotary winged aircraft Results are shown which indicate that simple separation models considerably improve comparisons between theory and experiment Similarly, the inclusion of boundary layer displacement effects results in good predictions of aerodynamic performance Proposed extensions of these aerodynamic methods should lead to analyses capable of accurately predicting forces and moments on helicopter fuselages. Inclusion of rotor wake effects both in hover and forward flight would further enhance the capability of these methods (Author)

**A75-37600** # **A method for correlating wind tunnel experiments with potential flow theory** P S Montana (U S Naval Material Command, Ship Research and Development Center, Bethesda, Md ) In Rotorcraft parasite drag, Proceedings of the Thirty-first Annual National Forum, Washington, D C , May 14, 15, 1975 New York, American Helicopter Society, Inc , 1975, p 16 1-16 7 6 refs

A straightforward five step method is proposed for correlating potential flow computer analyses with experimental results for high-blockage configurations The correlation technique is developed with the cut-and-try approach, i e , when the potential flow results *fail to match the experiment,* new potential flow modeling methods are tried The pressure coefficients obtained from the potential flow analysis are corrected by adjusting the reference velocity for the technique used in measuring the wind speed in the experiment and for flow leakage in the potential flow model The method incorporates the reference velocity as a fundamental parameter previously ignored in this type of theory experiment comparison An example is given for an elliptical rotor hub fairing S D

**A75-37601** # **Helicopter parasite drag bibliography** R M Williams (U S Naval Material Command, Ship Research and Development Center, Bethesda, Md ) In Rotorcraft parasite drag, Proceedings of the Thirty-first Annual National Forum, Washington, D C , May 14, 15, 1975 New York, American *Helicopter Society, Inc , 1975, p 17 1-17 11 169 refs*

**A75-37638** **A multifunction radar for helicopter applications** K D Knapp (Texas Instruments, Inc , Dallas, Tex ) In NAECON '75, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, June 10 12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 149-155 Army-supported research

The Helicopter Multifunction System (HELMS) is a high-resolution radar designed to perform functions for helicopter instrument flight and for special helicopter missions In its basic configuration, the HELMS has operating modes for high resolution groundmapping, beacon operation, terrain avoidance, weather avoidance, enroute stationkeeping, and landing approach An attack/scout configuration has all the basic modes plus modes for moving-target indication, electro-optic sensor cueing, and fire control All these modes are described, and actual radar performance

during extensive flight testing in UH-1 helicopters is presented The discussion of the attack/scout modes includes a description of an integral radar/electro optic system in which the HELMS radar is used (Author)

**A75-37644 On-board test and monitoring of advanced weapon systems** J R Stephens (Boeing Aerospace Co , Seattle, Wash ) In NAECON '75, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, June 10-12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 198-204

The impact of the advancement in electronic technology on weapon system design has led to an increased complexity and sophistication of the avionic subsystem design In direct relationship, the requirement for improved weapon system maintenance has increased with this advancement in technology This paper presents a brief summary of the objectives and design requirements that led to formulation of an Integrated Test System design An introduction to the basic elements of an Integrated Test System is provided as an overview to introducing the subject This includes a general description of each element and its functional role within the system Following this introduction, a discussion of specific examples of Boeing's application of integrated testing functions for the B 1 is provided This discussion is limited to integrated testing methods that are considered unique and representative of techniques applicable to advanced weapon systems (Author)

**A75-37646 Full authority electronic control application to military gas turbine engines** G R Adams (USAF, ASD/ENJEA, Wright-Patterson AFB, Ohio) In NAECON '75, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, June 10-12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 213-218

General and specific benefits to engine performance to be derived from implementing full-authority electronic control in present gas turbine engines and next-generation engines are discussed General benefits include lower acquisition and life cycle costs, improved reliability and maintainability, and increased flexibility and growth potential A specific benefit would be the incorporation of extensive self-checking and failure accomodation in electronic control, which is expected to operate at or near full performance levels with single sensor losses by detecting the loss and synthesizing a calculated value from the available sensor information Electronic control can also take better account of coupling effects in the engine by using multi variable control techniques The future variable cycle engine may be so complex that a full-authority electronic control will be a requirement to realize all performance gains P T H

**A75-37647 Terrain following evaluation simulation** K E Brostrom (Boeing Aerospace Co , Seattle, Wash ) In NAECON '75, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, June 10-12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 219-225 7 refs

The design of the B-1 Avionics has considered the interaction of the elements of the total system in order to maximize the weapon system performance To study and evaluate the performance requires a large scale simulation of the details of each subsystem This paper describes an all digital simulation developed by The Boeing Company and being used for evaluation of B-1 terrain following system performance It simulates both the automatic terrain following and the manual terrain following modes The manual mode can be used with either a man in loop cockpit or a paper pilot (Author)

**A75 37674 B-52G/H Protective Systems Test Range /PSTR/** J F Feltz (Systems Research Laboratories, Inc , Dayton, Ohio) In NAECON '75, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, June 10 12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 416 423 Contract No F30602-73-C-0182

An antenna range developed for obtaining high-quality, accurate antenna patterns from B-52 G/H aircraft protective systems is described The facility consists of a B-52 G/H aircraft Phase VI ECM configuration mounted on a modified FPS-35 antenna pedestal, a computer controlled RF source in the aircraft, a tower with a computer-controlled elevator system providing variable elevation of the test range, a computer-controlled receiver system to simultaneously measure two signal amplitudes and the electrical phase between the two signals, and a control room with a data acquisition computer and control hardware General test procedures are described Since the installations need not be flightworthy, the tests can be performed at a fraction of the cost for flight tests P T H

**A75-37700 The F-14 aircraft head up display** A R Doucette (Grumman Aerospace Corp , Bethpage, N Y ) In NAECON '75, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, June 10-12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 594-600

Difficulties are examined which were encountered in implementing a head up display in a sophisticated fighter aircraft The optical principles involved in such a display are reviewed, and the original F-14 configuration is described which used a conventional combiner and a vertical display indicator Problems encountered with this configuration included placement constraints due to aerodynamic considerations, multiple reflections between the windscreen and the combiner, and intrinsic windscreen reflection Windscreen projection was employed in a reconfiguration to overcome these problems, but created a new set of problems, including sunlight reflections in the optical system and reduction of the instantaneous field of view Ways in which sunlight reflection and alignment problems were overcome are described, and it is noted that a cockpit incorporating the concept of using the windscreen as the combiner in its original design could improve the present limited instantaneous field of view F G M

**A75-37703 Performance comparison of space stable and local level inertial platform mechanizations for a strategic aircraft application** J E Bergeson (Boeing Aerospace Co , Seattle, Wash ) and J H Witte (Boeing Computer Services, Inc , Seattle, Wash ) In NAECON '75, Proceedings of the National Aerospace and Electron ics Conference, Dayton, Ohio, June 10 12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 617-624 12 refs

**A75-37711 Blindside connector selection** C R Hand (Boeing Commercial Airplane Co , Renton, Wash ) In NAECON '75, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, June 10-12, 1975 New York, Institute of Electrical and Electronics Engineers, Inc , 1975, p 709-712

Data are presented which are necessary for extrapolating current-carrying capacity for electrical connectors with single ratings assigned to them Contact ratings are explained, and it is shown that a contact rating will depend on the wire size Selection methods and standards are noted which are described in detail in certain cited handbooks on aircraft wiring F G M

**A75-37777 Residual stresses caused by variable service loads in notches and their significance for the applicability of the linear damage accumulation hypothesis (Durch veranderliche Betriebslasten in Kerben erzeugte Eigenspannungen und ihre**

**Bedeutung fur die Anwendbarkeit der linearen Schadensakkumulations-Hypothese)** D Schutz and G Gassner (Laboratorium fur Betriebsfestigkeit, Darmstadt, West Germany) *Zeitschrift fur Werkstofftechnik,* vol 6, June 1975, p 194-205 58 refs In German

In order to improve the reliability of fatigue life estimations based on the linear damage accumulation hypothesis, residual stresses at the notch root of open-hole specimens of the aluminum alloys AlCuMg2 (2024 T3) and AlZnMgCuAg (7075 T6) were continuously measured during their macrocrack-free life range Based on the variation of residual stress with time, a corrected linear damage accumulation hypothesis is derived The new hypothesis narrows down the amount of variation of the fatigue life predictions for the different loading modes from 1 6 to 1 3 S J M

**A75-37778** # **Autopilot for British Airways** T E Ford *Aircraft Engineering,* vol 47, June 1975, p 9-12, 14

Equipped with a Marconi-Elliot autopilot E2200, the Super One-Eleven aircraft now have the ability to operate in Cat 2 conditions The single channel automatic touchdown system and the development of the E2200 are described in detail The E2200 autopilot operates aileron, elevator, rudder and throttle controls from signals produced by sensors, radio and manometric references together with demand signals from the autopilot controller When engaged, flight control is accomplished by processing and amplifying these signals which then drive servo motors coupled to the aircraft control systems The autopilot operational modes selected at the controller in conjunction with the controls on the selected flight compass are as follows Manual - Preset Heading, Manometric - IAS Lock, Autothrottle, Height Lock, Height Acquire, Radio - VOR, Localiser, Glidepath (Auto and Manual) M G

**A75-37779** # **The use of computers in flight testing** D Batten (Rank Xerox, Ltd , Data Systems Div , Wembley, Middx , England) *Aircraft Engineering,* vol 47, June 1975, p 15 17, 20, 23

In order to reduce the duration and cost of flight testing of high performance aircraft, computerization of the flight data processing procedure is considered The ground station computer system can perform all the data processing for a broad range of flight test departments including (1) flight data acquisition - the system receives, demultiplexes and analyzes data from a telemetry transmission or from a replay of flight tape, (2) secondary tape generation for distribution to other processing centers, (3) data display, in accordance with flight test engineer requests, (4) instrumentation - use of the main computer to calibrate the transducer and automatically update the library of transducer characteristics Software and hardware developments are also discussed M G

**A75-37799** # **The concept of trustworthiness in the safety of structures (Prispevek ke spolehlivostnimu pojeti bezpecnosti konstrukci)** O Gregr *Zpravodaj VZLU,* no 2, 1975, p 53-66 20 refs In Czech

The problem is examined of reducing the weight of modern aircraft required to perform in stringent conditions, such as instrument flight and/or landing and heavy air traffic under unfavorable meteorological conditions, without impairing economic efficiency and payload Two approaches to the problem, one based on optimal structural design, and the other on the concept of trustworthiness are discussed V P

**A75-37823** # **Aircraft loading spectra (Spektra zatizeni letounu)** V Kahanek *Zpravodaj VZLU,* no 1, 1975, p 5-20 19 refs In Czech

The basic loading spectra of conventional aircraft, defined by the load factor at the center of mass, are examined Random load-time histories are analyzed, and recommendations for selecting the proper loading spectrum are given Current measurement methods are critically evaluated, and improved measurement techniques are proposed Attention is given to maneuvering and gust load spectra V P

**A75-37824** # **Measurements on an isolated wing, using an aeroelastic model (Mereni na aeroelastickem modelu izolovaneho kridla)** J Malecek *Zpravodaj VZLU,* no 1, 1975, p 21 33 9 refs In Czech

The properties of an isolated wing with one degree of freedom in roll, loaded by a suspended weight, are studied in a subsonic wind tunnel, using an aeroelastic model of the wing The techniques used in impulse and frequency tests are described, along with a data processing procedure based on the use of a Minsk 22 computer and fast Fourier transforms V P

**A75-37897** # **Viscous interaction with separation in transonic flow (Interaction visqueuse avec décollement en écoulement transsonique)** J Delery, J -J Chattot, and J C Le Balleur (ONERA, Châtillon-sous-Bagneux, Hauts de Seine, France) *(NATO, AGARD, Symposium on Flow Separation, Gottingen, West Germany, May 27-31, 1975 ) ONERA, TP* no 1975 15, 1975 14 p 23 refs In French

Theoretical and experimental study of strong viscous interactions in transonic flows past airfoils, which give rise to thickening of the boundary layer and frequent formation of a separation region Under these conditions, flow calculations must make use of fast interaction theories The application of such theories to the case of a turbulent boundary layer is studied in this paper The flow around a half profile in a transonic wind tunnel was analyzed using interferometric methods Calculations of the flow were attempted by following Klineberg's (1972) approach The flow is divided into two regions a weak interaction zone where the pressure gradient is either negative or slightly positive, and a fast interaction zone in regions where separation is likely P T H

**A75-37899** # **Laminar separation at a trailing edge** J P Guiraud (Paris VI, Universite, Paris, ONERA, Châtillon sous-Bagneux, Hauts de Seine, France) and R Schmitt (ONERA, Châtillon sous Bagneux, Hauts de-Seine, France) *(NATO, AGARD, Symposium on Flow Separation, Gottingen, West Germany, May 27 31, 1975 ) ONERA, TP* no 1975 13, 1975 6 p 11 refs

A model is proposed for the beginning of flow separation from the trailing edge of a thin wing in incompressible flow at very high Reynolds number It is shown that for very large values of the product of the wedge semiangle at the trailing edge and the fourth root of the Reynolds number, one can construct a model of separated flow with a small recirculation zone and with streamwise length of a specified order of magnitude, which is compatible with a representation of the solution of the Navier Stokes equations obtained by the method of matched asymptotic expansions for the vicinity of the trailing edge The structure of the flow involves a triple layer of Sytchev (1972) type, very close to the separation, embedded in another triple layer of Stewartson type applied to the wholly separated flow The flow depends on two constants vorticity in the recirculation zone, and exact position of the separation A solution of Sytchev's canonical triple deck problem will give one relation between these constants P T H

**A75-37900** # **Methodology for certification of aircraft nuisances (Methodologie de la certification des nuisances des avions)** M Pianko (ONERA, Châtillon-sous Bagneux, Hauts de-Seine, France) *(Association Aéronautique et Astronautique de France, Congres International Aéronautique sur le Transport Aérien et*

*l'Environnement, 12th, Paris, France, May 29, 30, 1975 ) ONERA, TP* no 1975 48, 1975 22 p In French

Some guidelines are proposed with regard to certifying aircraft nuisance Three paths are explored leading to nuisance certification (1) acceptability by the surrounding community, (2) aircraft usefulness, and (3) increased technological efforts A methodology for nuisance certification is outlined based chiefly on the third way, but account is also taken of the other two Three steps leading to certification emerge (1) classification of aircraft, (2) description of the nuisance, and (3) selection of limit levels Solutions are discussed for noise and pollution regulation P T H

**A75-37905** # **Hybrid nonstationary noise simulator of the aircraft overflight type (Simulateur hybride de bruit non stationnaire du type survol d'avion)** M Ernoult and J Hay (ONERA, Châtillon sous Bagneux, Hauts-de Seine, France) *(Colloque National sur le Traitement du Signal et ses Applications, 5th, Nice, France, June 16-21, 1975 ) ONERA, TP* no 1975 46, 1975 6 p In French

A hybrid noise simulator has been built, based on nonstationary noise characteristics measured by a fixed microphone during a low altitude airplane overflight The simulator synthesizes electric noise whose second-order moment at any time is known The main features of the device are described, and potential areas for its application are discussed which depend on knowledge of its bias and variance S J M

**A75-38052** # **Elastically retracting ACLS trunks** T D Earl (Bell Aerospace Co , Buffalo, N Y ) *Canadian Aeronautics and Space Journal,* vol 21, May 1975, p 169 173

A new rubber/nylon material has been developed for use in the retractable elastic trunks of air cushion landing systems The Buffalo trunk, as it is called, provides a stretch ratio of approximately 3 25 in a typical area of the trunk The inflated material thickness is about 0 1 inches for a unit weight of approximately 100 oz/sq yd and a principal (stretch) direction strength of about 600 PLI The application of the new material to the LA 4 and Buffalo ACLS programs is described S J M

**A75-38064 Experimental study of the influence of large blade aspect ratios on axial compressor stage aerodynamic characteristics** A N Aniutin, V N Ershov, V I Komlev, V Iu Nezym, and V A Faminskii *(Aviatsionnaia Tekhnika,* vol 18, no 1, 1975, p 5-9 ) *Soviet Aeronautics,* vol 18, no 1, 1975, p 1-4 6 refs Translation

**A75-38067 Optimizing aircraft gas turbine blade air cooling systems II - Thermodynamic analysis** E N Bogomolov *(Aviatsionnaia Tekhnika,* vol 18, no 1, 1975, p 18-25 ) *Soviet Aeronautics,* vol 18, no 1, 1975, p 12-18 5 refs Translation

An exergonic method of analysis is proposed for internal blade cooling systems Performance criteria are derived for the air supply system and for the air-cooled blade itself A method of optimizing the parameters of the air supply system is described, along with a method of designing blades for maximum cooling depth V P

**A75-38074 Heat and mass transfer during high-enthalpy gas flow in aircraft and rocket engine flow passages** A V Fafurin, Iu D Krechetnikov, A Ia Semichev, and N A Nadyrov *(Aviatsionnaia Tekhnika,* vol 18, no 1, 1975, p 54-60 ) *Soviet Aeronautics,* vol 18, no 1, 1975, p 43-48 16 refs Translation

The rate of burnup of the heat-protective coating of an aircraft engine's air gas flow area is studied analytically A solution is obtained by integrating boundary layer equations in which unsteady-state effects caused by chemical erosion of the flow area surface are taken into account V P

**A75-38075 Analysis of characteristics of bypass turbojet engines with small gas turbine engines in the outer flow** B D Fishbein *(Aviatsionnaia Tekhnika,* vol 18, no 1, 1975, p 61-69 ) *Soviet Aeronautics,* vol 18, no 1, 1975, p 49-55 9 refs Translation

The results of a thermodynamic analysis of the thrust and fuel-consumption characteristics of a ducted fan engine containing a gas-turbine in the outer duct are examined and are compared with those of a turbojet engine with an afterburner A means of reducing the specific fuel consumption during takeoff, acceleration, and supersonic flight conditions is proposed for the configuration employing a gas turbine V P

**A75 38076 Aircraft hydraulic system pressure regulator stability** V V Berdnikov and L Ia Mironiuk *(Aviatsionnaia Tekhnika,* vol 18, no 1, 1975, p 70 72 ) *Soviet Aeronautics,* vol 18, no 1, 1975, p 56, 57 Translation

A stability analysis is carried out for a direct-acting pressure regulator with a positive-displacement variable-stroke pump The stability regions of the regulator are obtained in generalized coordinates The results are applicable to the synthesis and analysis of pressure regulators of various type V P

**A75-38077 Calculation of flow field around air intake operating at zero forward speed by the distributed source-sink method /2 D case/** K V Vafin, L N Bortnikov, V A Prusova, and A M Shapiro *(Aviatsionnaia Tekhnika,* vol 18, no 1, 1975, p 72-76 ) *Soviet Aeronautics,* vol 18, no 1, 1975, p 58-61 5 refs. Translation

The calculations of the flow field are carried out for an ideal potential flow, assuming that the sinks and sources are distributed in the plane of the inlet and in an imaginary plane, respectively A model for calculating air intakes without inner body is proposed, which can be readily extended to air intakes of more complex configuration and to the three-dimensional case It is shown that allowance for finite dimensions of the air intake leads to a substantial increase in local velocities at the casing, as compared to an air intake simulated by a point sink V P

**A75-38122 Some practical considerations found in the use of solid film lubricants in aircraft systems** M B Peterson (Wear Sciences, Scotia, N Y ), M K Gabel, and M J Devine (U S Naval Material Command, Naval Air Development Center, Warminster, Pa ) *Lubrication Engineering,* vol 31, July 1975, p 357-361 9 refs

The article investigates the latest technology in bonded solid film lubricants and processing used in naval aircraft, discusses present and potential applications, and suggests a direction for future research and development efforts Areas where solid lubricants are not currently in use but could be are sealing plus lubrication (between piston and cylinder), corrosion protection plus lubrication, aid for 'run-in', rolling contact bearings, and in difficult to lubricate metals It is recommended that a much wider use can be made of solid lubricants in aircraft to increase life and reliability of components Applications which should be considered are hinges, brake splines, door latches, electrical connectors, control cables and microswitches M G

**A75-38136** # **Mechanism of generating a normal force by a beat of the wings (O mekhanizme obrazovaniia normal'noi sily pri vzmakhe kryl'ev)** S M Belotserkovskii, V V Guliaev, and M I Nisht (Tsentral'nyi Aerogidrodinamicheskii Institut, Moscow, USSR) In *Selected problems in applied mechanics Collection of*

works dedicated to the sixtieth birthday of academician Vladimir Nikolaevich Chelomei Moscow, Izdatel'stvo VINITI, 1974, p 97-102 8 refs In Russian

Weis-Fogh (1973) has proposed a special mechanism to explain the superior performance of the chalcid wasp Eucarsia formosa The buildup of the lift coefficient by other hovering insects is delayed by the Wagner effect, i e , the time required for vorticity shedding from the trailing edge to generate the necessary circulation around the wing Encarsia formosa, however, eliminates the Wagner effect in building up maximum lift by preceding each beat of the wings by a special movement, the 'clap and fling' In the present paper, the Weis-Fogh mechanism of lift generation is analyzed on the basis of unsteady-state aerodynamics for plane flow It is shown that, in addition to the elimination of the Wagner effect, flow separation effects are an important factor in the Weis-Fogh mechanism V P

**A75-38144** # **Investigation of self-oscillations of an autopilot mount (Issledovanie avtokolebanii stenda s avtopilotom)** N V Butenin, P A Zemskov, and V S Metrikin (Gor'kovskii Gosudarstvennyi Universitet, Gorki, USSR) In Selected problems in applied mechanics Collection of works dedicated to the sixtieth birthday of academician Vladimir Nikolaevich Chelomei (A75-38126 18-39) Moscow, Izdatel'stvo VINITI, 1974, p 179-186 8 refs In Russian

The existence and uniqueness of stable asymmetric self-oscillatory motion without slippage in an autopilot mount are proven by the method of point-to-point mapping It is shown that stable symmetric modes with slippage do not exist Quantitative characteristics of the motion are analyzed together with the separation of the parameter plane in the region of stability F G M

**A75-38261** # **The cost-effectiveness of inertial navigation for civil aircraft** A A Edwards *Journal of Navigation,* vol 28, July 1975, p 274 282, Discussion, p 282 285

The article compares the 1969 predictions and the 1974 actual cost and accuracy of inertial navigation The realized capital outlay and maintenance expenditure were greater than predicted but these were offset in 1974/5 by higher system utilization The difference between predicted and realized expenditure did not exceed 3 percent The earlier progress and temporary setbacks, which caused significant improvements and beneficial design changes in INS are explained Future INS developments include a grid point storage system for magnetic variation, navigational accuracy improvement methods and new sensor techniques Strap down techniques are seen by the airlines as an extremely promising development and would be acceptable both as a vertical reference and as a source of navigational data M G

**A75-38262** # **Future trends in flight control systems** G H Hunt (Royal Aircraft Establishment, Farnborough, Hants , England) *(Royal Institute of Navigation and Institution of Electronic and Radio Engineers, Joint Meeting on Advances in Airborne Equipment for Navigation and Freight Control, London, England, Jan 15, 1975 ) Journal of Navigation,* vol 28, July 1975, p 286 299

The problems of reliability, integrity, and failure in flight control systems are followed by separate discussions of the outer-loop system, which can fail but being of limited authority can be switched out, and the inner loop system which must never completely fail, otherwise the control of the whole aircraft is lost The relationship between system failure rate and complexity for systems principally comprised of processors, rather than sensors and actuators is shown The fly by wire control system, its advantages, and the disadvantages resulting from the presence of the mechanical standby linkage are discussed The advantages that digital computers and data transmission possess for the fly-by wire applications are summarized Current FBW/CCV (control configured vehicle) programs represent a large and important trend in aircraft technology, in which the control system is assuming an importance in the design cycle equal to that of the airframe and engines M G

**A75-38340** **National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings** Symposium sponsored by the American Helicopter Society New York, American Helicopter Society, Inc , 1975 224 p $20

The proceedings deal with the influence of rotor aerodynamic design on performance and noise, advanced airfoil developments, and parasite drag reduction Among the major topics discussed are the identification of factors influencing the hovering performance of helicopter rotors, the use of antitorque devices other than tail rotors, the improvement of performance by tip air mass injection, evaluation of airfoil sections for helicopter rotor applications, the effects of parasite drag on rotor performance and dynamic response, a cost benefit evaluation of helicopter parasite drag reductions, and a tunnel spanning airfoil testing technique S D

**A75-38341** # **Uniform downwash with rotors having a finite number of blades** F D Harris and M A McVeigh (Boeing Vertol Co , Philadelphia, Pa ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 1 1-1 26 20 refs

The classical blade element momentum theory for an infinite bladed rotor is reexamined to show that the historically defined optimum rotor is not correct for a practical rotor with a finite number of blades Fixed-wing aerodynamic theory is used to demonstrate that the loading on a single blade is better represented by treating the rotor blade as a wing in a linearly varying spanwise velocity field An approximation for the velocity induced by a rolled-up trailed tip vortex is suggested Realistic goals for maximum hovering performance efficiency of rotors with a finite number of blades and uniform downwash are discussed S D

**A75 38342** # **A second approximation to the induced drag of a rotor in forward flight** R W Prouty (Summa Corp , Hughes Helicopters Div , Culver City, Calif ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 2 1 2 4

The method of determining the induced drag of a wing from the distribution of circulation in its wake has been adapted for an infinite bladed helicopter rotor Using this method, a 'rotor induced efficiency factor' can be determined which will result in computing more realistic induced drag values than the conventional momentum method The factor is shown to be a function of rotor geometry and flight conditions and is plotted for several combinations of these parameters (Author)

**A75-38343** # **Trimming dual control rotors for optimum performance** D W Robinson, Jr and F K Dunn (Kaman Aerospace Corp , Bloomfield, Conn ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 3 1-3 13 5 refs

Certain advanced rotor concepts, in addition to the conventional collective and first harmonic control inputs, feature a secondary control input to alter the loading distribution, thereby improving performance Trimming such a rotor requires selecting primary and secondary control input settings to achieve specified trim forces at the most favorable trade off of performance parameters Trade off optimization using typical aeroelastic rotor analyses directly is prohibitively expensive The paper discusses and illustrates an indirect approach using response surface analysis Results of a limited number of aeroelastic analysis cases are used to develop a simple mathematical model of rotor responses of interest Optimization is performed with the simple model, and the final selection of controls confirmed by the main rotor analysis program (Author)

**A75-38344** # **Summary of antitorque devices other than tail rotors** F Raitch (U S Army, Army Mobility Research and Development Laboratory, Fort Eustis, Va ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 4 1-4 9 6 refs

Past and present efforts in replacing tail rotors on single-main-rotor helicopters for reasons of safety, vulnerability, noise, efficiency, and high-speed dynamics are reviewed Fan in-fin and fan-in-fuselage designs are discussed It is shown that modifying any existing helicopter with a different antitorque and yaw control device will cause serious weight and center-of-gravity problems, and that alternatives to the tail rotor are likely to best serve their purpose on small-to-medium-seized vehicles with indifferent yaw stability contribution, especially near zero thrust Most helicopters already have insufficient yaw damping, which will be aggravated by tail rotor elimination S D

**A75-38345** * # **Summary of results indicating the beneficial effects of rotor vortex modification** R P White, Jr , J C Balcerak (Systems Research Laboratories, Inc , Rochester, N Y ), and R J Pegg (NASA, Langley Research Center, Hampton, Va ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 5 1 5 15 15 refs

The possibility of reducing blade-slap noise and high-frequency air loads and of increasing performance by tip air mass injection (TAMI) is investigated The discussion is limited to two types of TAMI chordwise injection with air injected at the blade tip in a chordwise direction and spanwise injection with air injected in a spanwise direction Experimental and analytical results indicate that a properly designed TAMI system can restructure the near field characteristics of a concentrated vortex that trails off the tip of a lifting surface, that the tip vortex is spread by the application of chordwise TAMI, that mixing exists between the injected air mass and the vortex flow which enhances vortex decay, that the net power requirements to implement the system on operational helicopters are within acceptable levels, that maximum drop of noise level reductions of about 25 dB can be achieved, and that a decrease in the drag induced by the tip vortex in a spanwise TAMI system can be obtained by restructuring the vortex as it forms along the airfoil chord and by moving the vortex farther outboard of the tip S D

**A75-38346** # **The supersonic rotor** J P Jones (Westland Helicopters, Ltd , Yeovil, Somerset, England) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 6 1 6 8 9 refs

An account is given of some theoretical studies of the operation of a helicopter rotor at tip speeds which are about twice the speed of sound It is shown that the blade loadings of a supersonic rotor operating near its optimum are about three times those of a conventional rotor One horse power generates two to three pounds of lift The power required does not increase with altitude and in forward flight the supersonic lift does not vary significantly as the blade rotates Theoretical estimates of the noise are compared with experimental evidence and it is shown that the noise level will remain sensibly constant beyond a Mach number at the tip of about 1 1 There are shock-free zones above and below the rotor The implications of these features for helicopter aerodynamic design are discussed (Author)

**A75-38347** # **Acoustic effects of rotor-wake interaction during low-power descent** B D Charles (Bell Helicopter Co , Fort Worth, Tex ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 7 1 7 8 6 refs

Helicopter blade vortex interaction noise has been measured in partial-power descent using a microphone array mounted external to the vehicle The array was designed to permit spatial location of dominant slap noise sources while mapping intensity levels with forward speed and descent rate Vortex interactions were predicted using a free-wake aerodynamic analysis, and show good trend correlation with noise intensity variations with descent rate However, the predicted intersection azimuth positions yield only fair agreement with position data Vortex interaction aerodynamics are modeled simply by two-dimensional, quasi static theory and indicate that shock formation and stall may be responsible for intense slap noise (Author)

**A75-38348** # **A state-of-the-art survey of two-dimensional airfoil data** R W Prouty (Summa Corp , Hughes Helicopters Div , Culver City, Calif ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 8 1 8 12 32 refs

A survey of existing two dimensional airfoil data has been made in order to provide the basis for developing new airfoils with particular characteristics or for comparing an existing airfoil with the current state-of the art It is shown that the most significant aerodynamic characteristics are related to a few key physical parameters It is also shown that test differences in Reynolds numbers can seriously distort comparisons of one airfoil with another (Author)

**A75-38349** * # **An analytical and experimental evaluation of airfoil sections for helicopter rotor application** G J Bingham and K W Noonan (U S Army, Air Mobility Research and Development Laboratory, NASA, Langley Research Center, Airfoil Research Section, Hampton, Va ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 9 1 9 10 20 refs

The influence of the more independent airfoil parameters such as thickness, thickness distribution, leading-edge radius, camber, and camber distribution on lift Mach number characteristics is investigated at lift coefficients up to near maximum lift The analysis is based on the drag divergence Mach number (Md) prediction techniques, where Md is the free stream Mach number at which the rate of increase of drag coefficient with Mach number equals 0 1 The analytical results obtained indicate the compromises in Md which result from changes in thickness ratio, location of maximum thickness, leading edge radius, camber addition, and location of maximum camber for four and five digit airfoils and some six series airfoils of potential interest for helicopters An example of airfoil sections which combines several of the favorable geometric changes is evaluated analytically and experimentally A comparison of results shows that the relative effect of the geometric changes on the lift coefficient Md relation is realistic, and that the methods of analysis employed can be effectively used during preliminary vehicle design and airfoil selection S D

**A75-38350** # **A tunnel spanning airfoil testing technique** D R Chaddock (U S Naval Material Command, Ship Research and Development Center, Bethesda, Md ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 12 1-12 12 6 refs

Several helicopter airfoil blade sections are tested in a transonic wind tunnel in order to obtain transonic two-dimensional data The airfoil models are described along with the transonic wind tunnel of rectangular cross-section Center span pressures are integrated to calculate lift, pitching moment, and drag A wake rake is used to measure wake total and static pressures which are integrated to calculate drag All data are measured simultaneously by using scani-valves under identical conditions for a constant angle of attack, and balance data are averaged for each data point Comparisons

between integrated surface pressure data, balance data, and wake rake transverse show that the integrated pressure data give displaced curves, reduced pitching moments, and are consistent with the balance drag data Wake rake data indicate a lower level and different gradient for the drag rise as a function of angle of attack than either the pressure or the balance data Means of reducing discrepancies between the measuring techniques are discussed S D

**A75-38351 A simplified approach to generalized helicopter configuration modeling and the prediction of fuselage surface pressures** T W Sheehy (United Aircraft Corp , Sikorsky Aircraft Div , Stratford, Conn ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 15 1 15 8

An analytical method using well tried potential flow techniques has been developed to analyze the aerodynamic flow field on and about aircraft configurations To simplify the use of the techniques, a computer aided method to generate analytical models of aircraft configurations has been developed The method has demonstrated good correlation with experimental data and its potential for being a beneficial design tool In addition, the computer modeling technique developed reduces user responsibility while accurately modeling the configuration analyzed (Author)

**A75-38352 # Wasted fuel - Another reason for drag reduction** J P Rabbott, Jr and R H Stroub (U S Army, Air Mobility Research and Development Laboratory Moffett Field, Calif ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 17 1 17 6 14 refs

The effects of changes in helicopter parasite drag on fuel costs in the period 1970-1990 are reviewed for both the civil and military fleet Factors considered include the fleet mix of light, medium and heavy helicopters and the gradual phasing out of in-service helicopters and introduction of more modern designs This leads to a composite fleet cruise speed and equivalent flat plate parasite drag area An equivalent speed for fuel utilization is defined and yearly parasite drag fuel costs computed based on current parasite drag design practices Three improved levels of drag technology are postulated and associated potential savings in fuel costs presented It is concluded that the potential savings in fuel costs are measured in tens of millions of dollars per year (Author)

**A75-38353 # Effects of parasite drag on rotor performance and dynamic response** A F Smith (Kaman Aerospace Corp , Blumfield, Conn ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 18 1-18 6

A coupled aeroelastic analysis including two elastic modes and three rigid body response modes is used to compute the rotor response of a typical helicopter with the aid of FORTRAN IV language The effect of drag on rotor dynamic loadings, bending moment distributions, blade section angle of attack, rotor power, and hub shears is evaluated over a range of forward flight speeds and typical rotor loading conditions It is shown that (1) increasing helicopter flat plate area increases rotor power, tip angle of attack, blade flapping, resultant hub shears, and higher harmonic flatwise bending moments, but reduces first harmonic flatwise bending moments, and (2) every additional square foot of drag reduces rotor maximum forward speed by 2 5 knots S D

**A75-38354 # Effect of helicopter drag reduction on rotor dynamic loads and blade life** A W Kerr (Lockheed-California Co , Burbank, Calif ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 19 1 19 7

Helicopter drag as reflected in rotor propulsive force requirements has a significant effect on dynamic blade loads which can affect blade life These loads also generate excitation for airframe vibrations A detailed analysis has been made to assess the impact of helicopter drag on blade and rotor hub loads Predicted dynamic loads are presented for a 16,000 pound helicopter with a four-bladed stiff-inplane hingeless rotor flying at 150 knots with airframe (including hub and pylon) parasite drag levels between 0 and 30 square feet of equivalent flat-plate drag area The analysis used is described briefly and correlation with flight data shown The significance of dynamic loads on blade life and airframe vibration are discussed Reduction of airframe drag level decreases vibration excitation and blade loads significantly, which can result in opportunity for weight reduction and a secondary impact on extension of blade life (Author)

**A75-38355 # Cost benefit evaluation of helicopter parasite drag reductions** J M Duhon (Bell Helicopter Co , Fort Worth, Tex ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 16 1 16 3

The paper discusses means of evaluating the effect of drag reduction on empty weight, cost to manufacture, and cost to operate Drag reduction in the design phase is shown to be much more effective than such reduction attempted in the development or product improvement phase The paper proposes guidelines for determining how much weight and how many dollars can be expended beneficially on drag reduction A numerical example shows cost and weight evaluation for a simple commercial application (Author)

**A75-38356 * # A comprehensive plan for helicopter drag reduction** R M Williams and P S Montana (U S Naval National Command, Ship Research and Development Center, Bethesda, Md ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 13 1-13 26 31 refs Navy NASA-Army supported research

Current helicopters have parasite drag levels 6 to 10 times as great as fixed wing aircraft The commensurate poor cruise efficiency results in a substantial degradation of potential mission capability The paper traces the origins of helicopter drag and shows that the problem (primarily due to bluff body flow separation) can be solved by the adoption of a comprehensive research and development plan This plan, known as the Fuselage Design Methodology, comprises both nonaerodynamic and aerodynamic aspects The aerodynamics are discussed in detail and experimental and analytical programs are described which will lead to a solution of the bluff body problem Some recent results of work conducted at the Naval Ship Research and Development Center (NSRDC) are presented to illustrate these programs It is concluded that a 75 per cent reduction of helicopter drag is possible by the full implementation of the Fuselage Design Methodology (Author)

**A75-38357 # A study of the potential benefits of advanced airfoils for helicopter applications** V M Paglino and D R Clark (United Aircraft Corp , Sikorsky Aircraft Div , Stratford, Conn ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 11 1 11 15 6 refs Contract No N00019-73-G 0225

An analytical study is made of the potential benefits of advanced airfoils for helicopter applications Representative missions are defined and partial derivatives are developed which relate specific airfoil characteristics to rotor aerodynamic efficiency and to helicopter design gross weight Selected airfoils are incorporated in design applications so that computed aerodynamic benefits are interfaced with rotor dynamic limitations, structural weight requirements, and cost elements It is demonstrated that airfoil improvements may contribute to reduction in power required, increases

in load carrying capacity for a given blade area, or increased load factor capability during maneuvers This study addresses the reduced power or performance benefits only (Author)

**A75-38358** **A review of design objectives for advanced helicopter rotor airfoils** L U Dadone and T Fukushima (Boeing Vertol Co , Philadelphia, Pa ) In National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn , March 6, 7, 1975, Proceedings New York, American Helicopter Society, Inc , 1975, p 10 1-10 18 19 refs

The main features of several recent advanced airfoils are reviewed in order to define the degree of commonality present in the guidelines under which they were developed and, when possible, to explain the differences in design objectives The advanced airfoils are discussed under three categories modifications of the NACA 0012 airfoil, modified versions of high speed cambered airfoils, and transonic airfoils designed for helicopter rotors based on methodology for high-speed fixed wing applications The flow environment of a helicopter rotor and the key sectional characteristics for hover and forward flight are examined The sectional characteristics necessary to improve Vertol rotors are determined through several airfoil design, airfoil test and rotor test iterations It is shown that while the design guidelines under which all advanced helicopter airfoils are developed recognize the importance of high lift, low pitching moments, and good high Mach number performance, only the Vertol guidelines actually specify a lower limit for the maximum lift coefficient and prescribe nose-up pitching moments S D

**A75-38370** **Looping in a hydrogen cooling system** I N Moisheev *(Teplofizika Vysokikh Temperatur,* vol 12, Nov -Dec 1974, p 1257-1266 ) *High Temperature,* vol 12, no 6, July 1975, p 1103-1110 Translation

The present paper considers the problem of circuit design for a forced hydrogen cooling system for aircraft subjected to high heat loads The hydrogen in such systems is used both as a fuel and as a coolant Two methods of using the hydrogen are compared a single-circuit method and a double circuit method In the single-circuit system, the hydrogen flows directly in a cooling jacket, where it is heated In the double-circuit system, the aerodynamically generated heat is accumulated by a high-temperature heat-transfer agent which circulates in a closed circuit, then the heat is transferred to the hydrogen coolant in a high-temperature heat exchanger A liquid-metal heat-transfer agent is used in the present case It is shown that the double-circuit system can offer considerable advantages over a single circuit system, especially for high heat loads A T S

**A75-38375** **Reflection of a shock wave from a wedge** G A Makarevich, O A Predvoditeleva, and G S Lisenkova *(Teplofizika Vysokikh Temperatur,* vol 12, Nov -Dec 1974, p 1318 1321 ) *High Temperature,* vol 12, no 6, July 1975, p 1172-1175 12 refs Translation

Experimental studies were made of the reflection of shock waves of various intensities in the region of intermediate angles between regular and irregular reflections A wedge-shaped model was used in an electric-discharge shock tube 80 mm in diameter During the experiments, the Mach number was 1 85, 6, or 10, and the initial pressure in the tube was varied from 4 to 30 torr High-speed motion pictures were made at rates from 125,000 to 187,000 frames/sec A T S

**A75-38406** # **Hypersonic flow past V-shaped conical wings (Giperzvukovoe obtekanie konicheskikh kryl'ev V-obraznoi formy)** A L Gonor and N A Ostapenko *Moskovskii Gosudarstvennyi Universitet, Institut Mekhaniki, Otchet* no 1164, 1971 24 p 23 refs In Russian

An analytical method is proposed for calculating a hypersonic flow past a conical wing Assuming that the flow patterns are curvilinear Mach shock waves and that the region of turbulent flow is a strongly compressed layer, a closed solution is constructed which allows regions bounded by a contact discontinuity as well as bow and internal shock waves to be joined smoothly It is shown that the problem reduces mathematically to the solution of two integro-differential equations On the basis of an approximate solution, the characteristics of the flow field are determined, and the maximum L/D ratio is established with a wing conic angle of less than 180 deg F G M

**A75-38407** # **Integral method for calculating a detached stream behind a body in a supersonic flow (Integral'nyi metod rascheta otryvnogo techeniia za telom v sverkhzvukovom potoke)** L V Gogish and G Iu Stepanov *Moskovskii Gosudarstvennyi Universitet, Institut Mekhaniki, Otchet* no 1188, 1971 36 p 25 refs In Russian

A stream behind a body in a supersonic flow is examined taking into account the basic characteristics of the flow about its leading edge the presence of shock waves and entropic layers, the nature of the boundary layer, and its interaction with an inviscid stream Characteristic subregions of the stream in the wake are delimited, and stream conditions in these subregions are formulated for viscous and inviscid flow layers with allowance for their interaction Integral relations are obtained in a general form for two-dimensional viscous and inviscid gas flows in jets, layers, and wakes, and a simple method for calculating detached streams is constructed on the basis of these relations together with assumptions about velocity profiles, boundary layers, and closure relationships Simple approximations are described for calculating a turbulent boundary layer and the wake in a gas with arbitrary pressure and heat exchange gradients F G M

**A75-38550** # **LTA aerodynamic data revisited** H C Curtiss, Jr , D C Hazen, and W F Putman (Princeton University, Princeton, N J ) *American Institute of Aeronautics and Astronautics, Lighter Than Air Technology Conference, Snowmass, Colo , July 15 17, 1975, Paper 75-951* 17 p 38 refs

Sources of aerodynamic data for lighter than-air vehicles are surveyed, and their probable accuracy is critically evaluated It is noted that most of the cited literature was published prior to 1930 Attention is restricted to essentially fully buoyant craft employing conventional airship-shaped hulls of more or less circular cross section and fineness ratios ranging from 3 to 10 Major topics discussed include drag, lift, and sideforce aerododynamics, equilib rium flight, dynamic stability, and controllability It is shown that modern analytical methods based on boundary layer and flow theory should be utilized to obtain more reliable data on drag effects as well as hull forces and moments Previously published papers on estimation of stability derivatives, response rates, coupling effects, and controllability are found to be less than satisfactory due to the inadequate testing method of the time It is suggested that analytical predictive techniques be employed in these areas without experimental verification F G M

**A75-38576** # **New structural form of sandwich core** K Miura (Tokyo, University, Tokyo, Japan) *Journal of Aircraft,* vol 12, May 1975, p 437-441

The purpose of this study is to present a new structural form of sandwich core The observation, that the characteristics of honeycomb core is distinctly attributable to its stabilized perpendicular wall elements, leads to the possibility of a hypothetical core concept characterized by stabilized oblique wall elements To embody the hypothetical concept, the core form constituted by superposing two mutually orthogonal corrugations is proposed The resultant core can be manufactured from a single sheet by some press forming technique The theoretical and experimental analyses of the core reveal that the shear modulus and strength are comparable with those of honeycomb core, and the elastic properties can be designed to be either isotropic or orthotropic Other features of the core such as the simplicity of form, the applicability to both flat and curved sandwiches, and the possibility of circulating fluid between facings, may excite new applications of sandwich construction in aircraft structures (Author)

**A75-38579** # **Static stability and aperiodic divergence** G Sachs (Darmstadt, Technische Hochschule, Darmstadt, West Germany) *Journal of Aircraft*, vol 12, May 1975, p 497 500 6 refs

The present work shows conditions under which static stability cannot prevent aperiodic divergence and indicates cases where static stability is and is not sufficient for dynamic stability Root locus analyses and stability boundary graphs are given for various aerodynamic quantities involved In the cases considered, stability is found to be sufficient for dynamic stability and sufficient to prevent aperiodic divergence S J M

**A75-38601** **The acoustic response of a nozzle flow to an externally applied low frequency pressure field** J R Jacques (Cambridge University, Cambridge, England) *Journal of Sound and Vibration*, vol 41, July 8, 1975, p 13 32 17 refs

A theoretical discussion is presented of the noise generated when a jet exhausts from a constant pressure plenum chamber into an unsteady atmosphere That unsteadiness provokes fluctuations at the nozzle exit and these are evaluated by taking into account a model of the axisymmetric jet instability modes It is found that the radiated noise is virtually omnidirectional and that it depends strongly on both the jet Mach number and nozzle contraction ratio This sound mechanism vanishes completely when the jet becomes sonic Then, despite the unsteady external field, the nozzle flow is unperturbed The sound power radiated scales on the sixth power of jet speed so that it is likely to dominate over the jet mixing noise at low Mach number The mechanism can be driven by any aerodynamic perturbation around the nozzle, but it is found that if the perturbation is acoustic, the scattered energy is an altogether negligible fraction of that incident on the nozzle area (Author)

**A75-38603** **A social survey to examine the variance of aircraft noise annoyance** R M Edwards (Loughborough University of Technology, Loughborough, Leics , England) *Journal of Sound and Vibration*, vol 41, July 8, 1975, p 41-51 10 refs Research supported by the Civil Aviation Authority

The large variability in the measurement of human response to aircraft noise is described, and the philosophy behind a social survey designed to eliminate some causes of this variability, by considering a small geographical area over which the noise from one aircraft flyover is nearly constant, is outlined Results from this survey show that it is not noise measurements and noise indices that need improvement, but measures of human response Until we have a better measure of response than McKennell's Guttman Annoyance Scale efforts to improve noise indices are wasted The variability in annoyance score of the residents of the area studied is just as high as that in previous surveys in which NNI has been used as an Index to group areas of equal noise exposure Some objections to the operation of this particular Guttman scale are raised Analysis of the Coefficients of Reproducibility of the scale as used in various surveys shows that the scale has behaved differently in different surveys (Author)

**A75-38618** # **Turbulent near wake of a flat plate II - Effects of boundary layer profile and compressibility** K Toyoda (Hokkaido Institute of Technology, Sapporo, Japan) and N Hirayama (Tokyo Metropolitan University, Tokyo, Japan) *JSME, Bulletin*, vol 18, June 1975, p 605 611 12 refs

In the previous report, we proposed a method to calculate the development of the incompressible turbulent wake close to a flat plate The calculated results were compared with experimental data in which the wake started from the turbulent boundary layers on both sides of a thin flat plate The agreement between the calculated and the experimental results was very good, and we can conclude that the diffusion phenomenon of the turbulent near wake has been made clear both qualitatively and quantitatively In that case the shape parameters of the boundary layers at the trailing edge of the plate were all equal to 1 45 Here in this report, we extend the previous method so that we can study the effect of the boundary layer profile and that of compressibility upon the development of the turbulent wake close to a flat plate The calculated results show that the wake profile is dependent on the boundary layer profile and compressibility The agreement between the calculated and the experimental results is excellent (Author)

**A75-38629** **Possibilities concerning a use of borescope inspection methods in nondestructive material testing and the significance of these methods (Moglichkeiten der Borescope-Untersuchungsmethoden in der zerstorungsfreien Werkstoffprufung und deren Aussagekraft)** H -G Straatmann (Lufttransport Unternehmen GmbH, Dusseldorf, West Germany) *(Deutsche Gesellschaft fur Zerstorungsfreie Prufverfahren, Vortragstagung uber Zerstorungsfreie Materialprufung, Berlin, West Germany, May 5-7, 1975 ) Materialprufung*, vol 17, July 1975, p 220, 221 In German

Industrial glass fiber borescopes are used for the examination of cavities in the case of accessibility difficulties The employment of the borescope technique in the case of an inspection involving an aircraft engine is discussed The engine consists of five different modules Openings for borescope inspection are provided in each module G R

**A75-38668** **UTTAS** *Air International*, vol 9, Aug 1975, p 67-74

Two competing designs for the Utility Tactical Transport Aircraft System (UTTAS) are outlined The UTTAS will be a utility transport helicopter powered by twin turboshaft engines Although only slightly advanced over the UH-1, which it is to replace, in terms of troop capacity, the UTTAS will have greater payload capacity in high-temperature and high-altitude operations, superior performance, and improved reliability and availability Cutaway drawings of the two designs are provided P T H

**A75-38726** # **Spike, relays and aircraft electric systems** O Markowitz (U S Navy, Aviation Supply Office, Philadelphia, Pa ) In Annual National Relay Conference, 23rd, Oklahoma State University, Stillwater, Okla , April 29, 30, 1975, Proceedings Conference sponsored by the Oklahoma State University and National Association of Relay Manufacturers Scottsdale, Ariz , National Association of Relay Manufacturers, 1975, p 12-1 to 12-14 8 refs

A spike is produced by the interruption of current flow or a sudden change in current level that releases stored magnetic energy Spike generators are considered to be aircraft relays, solenoids, magnetic clutches, actuators, pulsing switches, motors, transformers, and the like The specific characteristics of a spike are translated into generic characteristics which are used for defining the spike A review of the existing approaches to spike suppression in a relay suggests that a directed total approach is required by the relay industry to provide the optimal system approach to relay suppression A basic spike generator circuit is presented along with an aircraft electric system design S D

# STAR ENTRIES

**N75-25863** Georgia Inst of Tech , Atlanta
**DYNAMIC STALL CHARACTERISTICS OF AN OSCILLATING AIRFOIL IN A HARMONICALLY VARYING FREESTREAM VELOCITY Ph D. Thesis**
John Bruce Malone 1974 184 p
Avail Univ Microfilms Order No 75-13001

The unsteady freestream environment of a helicopter rotor blade in forward flight was simulated using a gust generator mechanism installed in a low-turbulence wind tunnel A model is used for this investigation An operational analog computer is used to obtain both the aerodynamic moment acting on the model, and the work done by the moment during pitching oscillations of the airfoil The experimental tests indicate that the unsteady freestream can produce large changes in the shape of the aerodynamic moment versus angle of attack hysteresis loops The test results also show that the stability of the system can be adversely affected by the unsteady freestream under certain parametric conditions Dissert Abstr

**N75-25865** Virginia Polytechnic Inst and State Univ Blacksburg
**INVESTIGATION OF THE TURBULENT PROPERTIES OF THE WAKE BEHIND SELF PROPELLED, AXISYMMETRIC BODIES Ph D Thesis**
Ching-Chang Chieng 1974 125 p
Avail Univ Microfilms Order No 75-11930

The turbulent wakes behind a streamlined drag body a jet-propelled body and a propeller-driven body are studied experimentally in stability wind tunnel at a nominal free stream velocity of 206 ft/sec The turbulence properties investigated are axial, radial, and tangential turbulence intensities and radial and tangential shear stresses Data was taken at five axial stations downstream of the tail of the body X/D = 2, 5, 10, 20 and 40 It is found that the propeller-driven body produces the largest wake throughout the axial distance covered by these tests The jet-propelled body produces the middle sized wake compared to the other two models up to the station X/D = 20 beyond this station this wake becomes the smallest Dissert Abstr

**N75-25866** Virginia Polytechnic Inst and State Univ Blacksburg
**TURBULENT WAKE BEHIND SLENDER BODIES, INCLUDING SELF-PROPELLED CONFIGURATIONS Ph D Thesis**
Roy Charles Swanson Jr 1975 115 p
Avail Univ Microfilms Order No 75-11950

The turbulent wakes behind a streamlined drag body a jet-propelled body and a propeller-driven body are studied experimentally in a subsonic wind tunnel at a principal nominal freestream velocity of 206 ft/sec The wakes produced by the latter two bodies are momentumless Mean flow data taken at five axial stations (X/D = 2 5 10, 20 and 40) downstream of the sterns of these bodies include velocity and static pressure distributions The streamwise variation of the maximum values of axial turbulence intensity and radial shear stress are also presented The mean flow data for the wake behind the drag body compare favorably with previous experiments and establish a rigid reference for the wakes behind slender self-propelled configurations Dissert Abstr

**N75-25867** Stanford Univ Calif
**POTENTIAL FLOW ABOUT THREE-DIMENSIONAL STREAMLINED LIFTING CONFIGURATIONS, WITH APPLICATION TO WINGS AND ROTORS Ph D Thesis**
James Michael Summa 1975 158 p
Avail Univ Microfilms Order No 75-13606

A numerical method is developed and successfully applied for converging to the exact calculation of three-dimensional lifting potential flows including cases of unsteady motion The exact body surface boundary conditions are enforced, and all wake surfaces are unconstrained The assumptions made in the theoretical model are that the fluid is ideal and that no separation may take place The basic solution consists of the Green's function approach, where the velocity potential at any point in the fluid is represented by continuous distribution of doublets of unknown strength on each of the bounding surfaces Application of the surface tangency condition yields a set of coupled, singular Fredholm integral equations of the first kind relating the velocity potential doublet distributions to the normal velocity on the body surfaces and subject to the Kutta-Joukowski condition at trailing edges and the dynamic and geometric surface conditions on all wakes Dissert Abstr

**N75-25868#** National Aviation Facilities Experimental Center Atlantic City, N J
**THE MEASUREMENT OF THE BOEING 707 TRAILING VORTEX SYSTEM USING THE TOWER FLY-BY TECHNIQUE Final Report, Oct. - Nov 1972**
Leo Garodz, David Lawrence, and Nelson Miller Mar 1975 124 p refs
(AD-A008384, FAA-NA-74-37, FAA-RD-75-15) Avail NTIS HC $5 25 CSCL 01/1

The results are presented for a series of low-altitude flight tests in which the trailing vortices of the Boeing 707 airplane were investigated using a 140-foot tower instrumented with airspeed, velocity, direction temperature, and humidity sensors Flow visualization was employed and motion picture records made The data presented consists of plots of vortex tangential velocity distribution, peak tangential velocity as a function of time, airplane configuration, windspeed, and airplane altitude in proximity to the tower, vortex descent rates, lateral transport velocities, and specimen time histories of the velocities measured by individual sensors Author

**N75-25870*#** National Aeronautics and Space Administration Langley Research Center Langley Station, Va
**COMPARISON OF MEASURED AND CALCULATED AIRCRAFT LIFT GENERATED PRESSURES**
Donald S Findley Jun 1975 17 p refs
(NASA-TM-X-72707) Avail NTIS HC $3 25 CSCL 01A

Lift generated pressures produced by large heavy aircraft at low altitudes were investigated due to concern over their possible effects on ground objects Aircraft lift generated pressures were calculated using elementary airfoil theory, and these values were compared with ground level measurements made during an overflight program The predicted and the measured values were in relatively good agreement Due to lack of experimental investigations of this phenomenon opportunity was taken during an overflight program to use a specially instrumented test range to measure the ground pressures produced for a range of aircraft weights and distances Author

**N75-25871*#** Boston Univ , Mass Coll of Engineering
**STEADY AND OSCILLATORY, SUBSONIC AND SUPERSONIC, AERODYNAMIC PRESSURE AND GENERALIZED FORCES FOR COMPLEX AIRCRAFT CONFIGURATIONS AND APPLICATIONS TO FLUTTER M S Thesis**
Lee-Tzong Chen 1975 201 p refs
(Grant NGR-22-004-030)
(NASA-CR-142983) Avail NTIS HC $7 25 CSCL 01A

A general method for analyzing aerodynamic flows around complex configurations is presented By applying the Green function method, a linear integral equation relating the unknown small perturbation potential on the surface of the body, to the known downwash is obtained The surfaces of the aircraft wake and diaphragm (if necessary) are divided into small quadrilateral elements which are approximated with hyperboloidal surfaces The potential and its normal derivative are assumed to be constant within each element This yields a set of linear algebraic equations and the coefficients are evaluated analytically By using Gaussian elimination method equations are solved for the potentials at the centroids of elements The pressure coefficient is evaluated by the finite different method, the lift and moment coefficients are evaluated by numerical integration Numerical results are presented, and applications to flutter are also included Author

**N75-25874*#** Mississippi State Univ , Mississippi State Aerophysics and Aerospace Engineering
**NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR ARBITRARY TWO-DIMENSIONAL MULTI-ELEMENT AIRFOILS Semiannual Status Report, 1 Jan. - 30 Jun 1975**
Joe F Thompson 1 Jul 1975 8 p
(Grant NGR-25-001-055)
(NASA-CR-143038) Avail NTIS HC $3 25 CSCL 01A

Abstracts are presented on a method of numerical solution of the Navier-Stokes equation for the flow about arbitrary airfoils, using a numerically generated curvilinear coordinate system having a coordinate line coincident with the body contour Results of continuing research are reported and include application of the Navier-Stokes solution in the vorticity-stream function formulation to a number of single airfoils at Reynolds numbers up to 2000, programming of the Navier-Stokes solution for multiple airfoils in the primitive variable formulation testing of the potential flow solution of multiple bodies and development of a generalized coordinate system program L B

**N75-25875#** Technion - Israel Inst of Tech Haifa Dept of Aeronautical Engineering
**AERODYNAMIC EFFECTS OF VORTEX SUPPRESSORS**
H Portnoy Jul 1974 20 p refs
(Grant AF-AFOSR-2145-71, AF Proj 6813, AF Proj 9781)
(AD-A003750 TAE-221, AFOSR-75-0013TR, SR-4) Avail NTIS CSCL 01/1

The effectiveness of various devices in accelarating the dissipation of wing-tip vortices has received considerable attention recently These devices include jets blown into or near the vortex core, both in the upstream and downstream direction, small cruciform wings, both fixed and rotating mounted close behind the wing near tip and angled fences or vortex generators mounted on the wing upper and lower surfaces so as to produce swirl opposite to that of the tip vortex In this report are proposed mathematical models for representing some of these devices in order to calculate their effects on the wing aerodynamic properties These models are incorporated into a lifting-line theory and examples are calculated for high-aspect-ratio, unswept untwisted wings of the elliptic planform In order to obtain results of a more useful kind, it is suggested that these models be used with a lifting-surface theory of the vortex-lattice type GRA

**N75-25877#** Flow Research, Inc , Kent Wash
**BOUNDARY LAYER TRANSITION ON BLUNT BODIES Scientific Report, 15 Jan - 14 Jul 1974**
Denny R S Ko Charles L Merkle and Toshi Kubota Oct 1974 8 p refs
(Contract F44620-74-C-0049, AF Proj 4730A)
(AD-A004826, AFOSR-75-0191TR) Avail NTIS CSCL 16/2

The results of linear stability theory have been used to predict the location of boundary-layer transition with emphasis on including the effects of surface roughness and axisymmetric geometry Both of these parameters are important in determining transition on re-entry vehicles The effects of surface roughness were included by means of a turbulent sublayer model which attributes the effects of roughness to an alteration in the mean velocity profile Axisymmetric effects were included by a proper consideration of the growth rate of the boundary-layer thickness GRA

**N75-25878#** Army Aviation Engineering Flight Activity Edwards AFB Calif
**ARTIFICIAL ICING TESTS CH-47C HELICOPTER Final Report, 8 Apr - 2 May 1974**
Carl F Mittag James C OConnor, and Louis Kronenberger, Jr Aug 1974 71 p
(AD-A004008, USAAEFA-73-04-1) Avail NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a limited evaluation of the CH-47C helicopter in artificial icing conditions from 8 April 1974 through 2 May 1974 These tests were conducted at Moses Lake, Washington and consisted of 2 9 hours in an artificial icing environment Artificial icing tests were conducted to evaluate the capability of the CH-47C helicopter to safely operate in an icing environment and to verify the icing limitations presented in the operator's manual Additionally, the capabilities of the standard anti-ice systems and installed special equipment were evaluated GRA

**N75-25879#** Naval Postgraduate School Monterey Calif
**AERODYNAMIC CHARACTERISTICS OF AN AXISYMMETRIC BODY UNDERGOING A UNIFORM PITCHING MOTION Ph D Thesis**
Lloyd Henry Smith Dec 1974 99 p refs
(AD-A003859) Avail NTIS CSCL 16/2

An experimental investigation was conducted to determine the effect of a uniform pitching motion on a slender axisymmetric body while undergoing large excursions in angle of attack Force and moment measurements were obtained for a slender tangent-ogive/cylindrical body over a range of Reynolds numbers from 50,000 to 140,000 while varying the angle of attack from zero to 90 degrees and the pitch rate between zero and 281 degrees per second Smoke flow visualization studies were used as an aid in assessing wake vortex transitions GRA

**N75-25881#** Naval Air Development Center, Warminster, Pa Air Vehicle Technology Dept
**AERODYNAMIC ANALYSIS OF A GENERAL PURPOSE TOW TARGET**
J B Smith 3 Dec 1974 21 p refs
(AD-A003497, NADC-74132-30) Avail NTIS CSCL 01/3

This report presents the aerodynamic characteristics of a proposed aerial tow target configured to meet the general purpose tow target requirements of the Navy Standard Tow Target System The General Purpose Tow Target will serve as a target for missile and gunnery weapon firing exercises and will be capable of air launch and recovery GRA

**N75-25882#** Marquardt Corp , Van Nuys, Calif
**A/A 47U-3 TOW TARGET REELING MACHINE LAUNCHER SYSTEM**
Dec 1974 16 p Revised
(AD-A004622) Avail NTIS CSCL 01/3

The A/A 47 U-3 target launcher designed to provide target towing capability for subsonic and supersonic military aircraft is described Performance, design features, operation installation, and ground support equipment are included J M S

**N75-25883#** Lockheed-Georgia Co Marietta
**A METHOD FOR PREDICTING ACOUSTICALLY INDUCED VIBRATION IN TRANSPORT AIRCRAFT, APPENDIX Final Report**
Harold W Bartel and Cecil W Schneider Sep 1974 54 p refs
(Contract F33615-73-C-3638 AF Proj 1370)
(AD-A004215, LG74ER0121-App-1 AFFDL-TR-74-App-1) Avail NTIS CSCL 01/3

A method is set forth for predicting the acoustically induced structural vibration in transport category aircraft Charts are presented which correlate third-octave random noise and vibration levels at various confidence levels for the frequency range of 50 to 2500 Hertz The prediction charts are based on measured data from modern transport aircraft and are presented for the normal direction, ground operation, and a reference structural mass and rigidity Shell-type structure (fuselage, pods, fairings) and box-type structure (wing horizontal/vertical stabilizer) are treated separately Means are provided for predicting lateral and tangential vibration vibration in pressurized cruise flight, and for correcting for changes in structural mass and rigidity Application of the method to a hypothetical airplane design case is illustrated in an example GRA

**N75-25884#** Lockheed-Georgia Co , Marietta
**REYNOLDS NUMBER EFFECTS ON THE BOATTAIL CHARACTERISTICS OF A SIMULATED NACELLE AT A MACH NUMBER OF 0 8 Final Report, 1 Dec 1973 - 8 Aug 1974**
Ted Dansby Oct 1974 78 p refs
(Contract F33615-74-C-4021 AF Proj 7064)
(AD-A004803 LG74ER0078 ARL-74-0120) Avail NTIS CSCL 01/3

The effect of Reynolds number on the boattail drag of three simulated afterbody configurations is presented for zero angle of attack for a Mach number of 0 8 The boattail pressure drag for one of the configurations is shown to first decrease then significantly increase as the Reynolds number increases The behavior is explained by the regular variation of pressures in regions of the boattail The mechanism governing this behavior is discussed and is partially predicted from state-of-the-art theoretical techniques The influence of model installations and test techniques is shown to have a marked effect on the level of the drag GRA

**N75-25885#** Advanced Technology Center, Inc Dallas Tex
**EXPERIMENTAL MATING OF TRAPPED VORTEX DIFFUSERS WITH LARGE AREA RATIO THRUST AUGMENTORS Final Report, Jun 1973 - Jan 1974**
Charles H Haight and Robert M ODonnell Sep 1974 52 p refs
(Contract F33615-73-C-4151 AF Proj 7116)
(AD-A004802 B-94300/4CR-8 ARL-74-0115) Avail NTIS CSCL 01/3

The performance of a straight wall diffuser and various trapped vortex diffusers was measured with a basic ARL ejector as a test bed The straight wall diffuser, termed Configuration F by Aerospace Research Laboratories (ARL) yielded thrust augmentation ratios in near agreement with those previously obtained by ARL Also, as noted by ARL the thrust augmentation of Configuration F was insensitive to changes in the primary injector pressure The trapped vortex diffusers investigated were of varying lengths GRA

**N75-25887#** Air Force Systems Command Wright-Patterson AFB Ohio Foreign Technology Div
**A STUDY OF THE FLOW AROUND PLANE AND AXIALLY SYMMETRICAL BODIES WITH A SEPARATED SHOCK WAVE BY A FLOW AT LOW SUPERSONIC SPEED**
S M Gilinskii and M G Lebedev 6 Dec 1974 20 p refs Transl into ENGLISH from Akad Nauk SSSR Izv Mekhan (USSR) no 1 Jan - Feb 1965 p 17-23
(AD-A004442, FTD-MT-24-2287-74) Avail NTIS CSCL 20/4

This work is a continuation of the study of the flow around bodies of various forms by a supersonic flow of an ideal gas G F Telenin's method for the integration of equations of gas dynamics is used in the calculation of the flow around plane and axially symmetrical bodies by a flow at low supersonic speed Basically the range of Mach numbers M -2 is examined A comparison is carried out with experimental data and the results of calculations with the use of other numerical methods GRA

**N75-25891#** Texas A&M Univ , College Station
**THEORETICAL PREDICTION OF AIRLOADS ON THIN DELTA WINGS IN INCOMPRESSIBLE FLOW**
B M Rao and W P Jones Jan 1975 46 p refs
(Contract N00014-68-A-0308-0007)
(AD-A004654, TEES-3029-75-01) Avail NTIS CSCL 01/1

Two methods are developed for the prediction of aerodynamic loads on sharp-edged delta wings in incompressible flow The first method is based on the application of the Polhamus suction analogy to the potential flow solution which is obtained in this paper by a unique numerical lifting surface method developed at Texas A and M University The second method is a direct extension of potential flow theory The mathematical model is modified by introducing a vortex system to represent the leading edge separation The strength of the separated vortices are adjusted by an empirical factor whose value is chosen in such a way that the total system gives the required lift GRA

**N75-25892#** Naval Air Development Center Warminster, Pa Dept of Air Vehicle Technology
**AIR LAUNCH CHARACTERISTICS OF THE MQM-74C TARGET DRONE FROM DC-130A AIRPLANE**
Mark Lempert 9 Jan 1975 125 p refs
(AD-A004190, NADC-74079-30) Avail NTIS CSCL 01/3

A six-degree-of-freedom simulation study was conducted to predict air launch separation characteristics of the MQM-74C aerial target drone from a DC-130A The effects of various launch aircraft flight conditions, flow field effects autopilot control system malfunction and loss of engine power on target separation characteristics were analyzed GRA

**N75-25894#** Texas A&M Univ College Station Flight Mechanics Lab
**AERODYNAMIC SPOILER FOR PREVENTING AIRPLANE STALL/SPIN TYPE ACCIDENTS Final Report**
H I Chevalier Dec 1974 77 p refs
(Contract DOT-FA73WA-3192)
(AD-A006995 FAA-RD-75-21) Avail NTIS HC $4 75 CSCL 01/3

A flight test investigation was conducted to evaluate the feasibility of an aerodynamic spoiler system installed on a Piper PA-30 airplane for deterring stall, and to determine its effectiveness as a stall deterrent for other light twin-engine general aviation airplanes Flight tests were conducted for the airplane without the spoiler installed, with the spoiler operated manually and with the spoiler operated automatically Test results were obtained for different c g locations, flap positions, and engine thrust Flight test maneuvers included approaches to stall from straight level flight, climbs, descents, turns slips and skids with both engines operating and with simulated single engine operation Tests also included takeoffs and landings Test results show that the spoiler concept is feasible for an airplane with a horizontal tail where the complete surface is moveable Author

**N75-25896#** Aeronautical Systems Div , Wright-Patterson AFB Ohio
**WET RUNWAY AIRCRAFT CONTROL PROJECT F-4 RAIN TIRE PROJECT Final Report, Mar 1971 - Oct 1974**
William V Tracy Jr Oct 1974 383 p refs
(AF Proj 5549)
(AD-A004768 ASD-TR-74-37) Avail NTIS CSCL 01/3

This report presents the results of all efforts to study the problem of wet runway control of the F-4 fighter aircraft The hardware tested is as follows Hytrol Mark II Brake Control System Hytrol Mark III Brake Control System, Standard Main Tire, Dunlop Main Tire Sommer Main Tire, BFG Main Tire USAF Main Tire, Dual Mode Hydro-Electrical Control Steering System, Standard Nose Tire, Dunlop Nose Tire BFG Nose Tire, and USAF Nose Tire In addition to this testing was also completed to determine the variation in main tire spinup time with touchdown sink rate and the effect resulting from 50% worn main tires GRA

**N75-25901*#** Massachusetts Inst of Tech Cambridge Dept of Aeronautics and Astronautics
**FLIGHT TEST AND EVALUATION OF OMEGA NAVIGATION FOR GENERAL AVIATION**
Peter V Hwoschinsky Jun 1975 266 p refs
(Grant NGL-22-009-640)
(NASA-CR-132677) Avail NTIS HC $8 50 CSCL 17G

A seventy hour flight test program was performed to determine the suitability and accuracy of a low cost Omega navigation receiver in a general aviation aircraft An analysis was made of signal availability in two widely separated geographic areas Comparison is made of the results of these flights with other navigation systems Conclusions drawn from the test experience indicate that developmental system improvement is necessary before a competent fail safe or fail soft area navigation system is offered to general aviation Author

**N75-25903#** Naval Postgraduate School, Monterey, Calif
**IMPROVEMENT OF AN/TPQ-27 FILTER AND CONTROL TECHNIQUES M S Thesis**
Robert Eugene Lentz Dec 1974 201 p refs
(AD-A003878) Avail NTIS CSCL 17/7

A modified linear Kalman filter with deterministic forcing is used to improve the tracking capabilities of the Marine Corps AN/TPQ-27 remote tactical aircraft guidance system Both sixth and ninth order filters are developed and used with the Precision and Coarse Guidance simulation programs A technique for overcoming the effects of autopilot bias is presented and tested through simulation Precision Guidance control is modified to utilize angle error and angle error rate to generate corrective commands Significant improvement in aircraft state estimation, bombing accuracy, and overall system response is shown The Coarse guidance algorithms and simulation program perform aircraft guidance to the bombing run with more than adequate precision under simulated conditions GRA

**N75-25905#** Aeronautical Systems Div Wright-Patterson AFB, Ohio
**A UNIVERSAL FLIGHT DIRECTOR COMPUTER Final Report**
Gerald W Francis Aug 1974 59 p
(AD-A003634, ASD-TR-74-20) Avail NTIS CSCL 17/7

A technique is proposed which will make the flight director computer performance independent of aircraft dynamics, wind or aircraft position relative to the navigation beam The control law proposed will compensate for all such variables with an error correcting mechanism This technique results in a computer that is universal in its application GRA

**N75-25914*** National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
**HIGH LIFT AIRCRAFT Patent**
Willard S Blanchard, Jr and Joseph L Johnson, Jr , inventors (to NASA) Issued 20 May 1975 6 p Filed 5 Jun 1973 Supersedes N73-26007 (11-17, p 1980)
(NASA-Case-LAR-11252-1, US-Patent-3 884,432, US-Patent-Appl-SN-367268, US-Patent-Class-244-15, US-Patent-Class-D12-76 US-Patent-Class-244-13, US-Patent-Class-244-42DA, US-Patent-Class-244-55) Avail US Patent Office CSCL 01C

An aerodynamically balanced high-lift aircraft is proposed in which the problems of large nose-down pitching moments generated by the flap high-lift forces, the loss of trim lift during high-lift flight and the yawing moments caused by the loss of an engine are solved without the use of large horizontal and vertical tails A wing is carried by and bounced on the tips by spaced-parallel fuselages, horizontal tails are mounted only onto the outboard surfaces of the wing-tip fuselages the centroid-of-lift of the high-lift flaps is located substantially at the center of gravity of the aircraft and the exhausts of the engines are emitted in the vertical plane of symmetry of the aircraft Yawing moments ockurring during flight with an engine inoperative are reduced, the horizontal tails carry an upload and contribute positive trim lift, large nose-down pitching moments generated by the high-lift flaps are minimized and noise levels are reduced
Official Gazette of the U S Patent Office

**N75-25915*** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
**SHOULDER HARNESS AND LAP BELT RESTRAINT SYSTEM Patent**
Albert P Garavaglia and Dennis S Matsuhiro, inventors (to NASA) Issued 3 Jun 1975 4 p Filed 19 Mar 1974 Supersedes N74-18805 (12 - 10, p 1137)
(NASA-Case-ARC-10519-2 US-Patent-3,887,233, US-Patent-Appl-SN-452767, US-Patent-Class-297-389 US-Patent-Class-280-150SB US-Patent-Class-297-385, U S-Patent-Class-297-388) Avail US Patent Office CSCL 06Q

A shoulder harness and lap belt restraint system are provided where the lap belt is combined with the shoulder harness so that a single fastening secures both the shoulder strap and the lap belt Official Gazette of the U S Patent Office

**N75-25916*#** Douglas Aircraft Co , Inc , Long Beach, Calif
**ENGINE/AIRFRAME COMPATIBILITY STUDIES FOR SUPERSONIC CRUISE AIRCRAFT**
May 1975 59 p
(Contract NAS1-13229)
(NASA-CR-132610-1 MDC-J4505-Suppl) Avail NTIS HC $4 25 CSCL 01C

Engine/airframe compatibilities are studied utilizing the advanced supersonic transport point design as the baseline for comparison Detailed studies of four engines are given The technical analysis, configuration descriptions, and study results are presented for each of the four specific engines studied
M C F

**N75-25917*#** National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
**A STOL AIRWORTHINESS INVESTIGATION USING A SIMULATION OF AN AUGMENTOR WING TRANSPORT VOLUME 2 SIMULATION DATA AND ANALYSIS Final Report**
Robert K Heffley, Robert L Stapleford, Robert C Rumold, John M Lehman, Barry C Scott, and Charles S Hynes Oct 1974 222 p refs Prepared in cooperation with Systems Technology, Inc , Mountain View, Calif and FAA, Moffett Field, Calif
(Contract NAS2-7926)
(NASA-TM-X-62396, AD-A006602, FAA-RD-74-179-Vol-2, A-5798) Avail NTIS CSCL 01/3

A simulator study of STOL airworthiness was conducted using a model of an augmentor wing transport The approach, flare and landing, go-around, and takeoff phases of flight were investigated The simulation and the data obtained are described These data include performance measures, pilot commentary, and pilot ratings A pilot/vehicle analysis of glide slope tracking and of the flare maneuver is included Author

**N75-25918*#** Scientific Translation Service, Santa Barbara, Calif
**DESIGN OF AIRCRAFT WHEELS AND BRAKE SYSTEMS**
I I Zverev and S S Kokonin Washington NASA Jun 1975 260 p refs Transl into ENGLISH of the book "Proyektirovaniye Aviatsionnykh Koles i Tormoznykh Sistem" Moscow, Mashinostroyeniye Press, 1973 224 p
(Contract NASw-2483)
(NASA-TT-F-15764) Avail NTIS HC $8 50 CSCL 01C

The experience in the design and analysis of aircraft wheels and brakes, brake systems, brake control systems, and antiskid systems is summarized The static and fatigue strength of aircraft wheels, calculation of brake service life, brake dynamics, techniques for increasing brake energy absorption capacity, and design of the basic antiskid system elements are examined
Author

**N75-25919#** Fairchild Republic Div , Farmingdale, N Y
**PRELIMINARY DESIGN OF WINGS VOLUME 4 MINIMUM WEIGHT DESIGN OF COMPOSITE STRUCTURE Final Technical Report, Feb 1971 - Oct, 1972**
Harold Switzky Mar 1974 58 p refs
(Contract F33615-71-C-1241, AF Proj 1368)
(AD-A003667, AFFDL-TR-74-20-Vol-4) Avail NTIS CSCL 01/3

Minimum weight design procedures are developed for composite structure fabricated with plies oriented 0, plus or minus 45, and 90 degrees to the longitudinal axis and subjected to an arbitrary biaxial loading The design technique for stable structure is based upon a generalized ellipsoidal failure model which includes as special cases the classical models for orthotropic and isotropic structural behavior The strength and interaction parameters are established by a statistical fit of the available experimental data GRA

**N75-25921#** Princeton Univ , N J Dept of Aerospace and Mechanical Sciences
**AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF A FUSELAGE ON WING CHARACTERISTICS Final Report, 1 Apr 1964 - 31 Mar, 1968**
Fumio Yoshino Oct 1975 215 p refs
(Contract Nonr-1858(46), NR Proj 212-155)
(AD-A003955, AMS-TR-1151) Avail NTIS CSCL 01/1

A series of experimental investigations utilizing flow visualization, force measurement and pressure distribution techniques to investigate the effect on wing lift of fuselage placement and cross-sectional shape are reported Emphasis is placed on conditions involving large circulation including the use of circulation control GRA

**N75-25922#** Naval Postgraduate School, Monterey, Calif
**AIRCRAFT FUEL TANK VULNERABILITY TO HYDRAULIC RAM: MODIFICATION OF THE NORTHROP FINITE ELEMENT COMPUTER CODE BR-1 TO INCLUDE FLUID-STRUCTURE INTERACTION THEORY AND USERS MANUAL FOR BR-1 HR Final Report, 1 Jul 1973 - 30 Jun. 1974**
R E Ball Jul 1974 35 p refs
(AD-A003471, NPS-57BP74071) Avail NTIS CSCL 01/3

The finite element digital computer code BR-1, developed by the Northrop Corporation, for predicting the effects of internal air blast on combat aircraft structures is modified to include the effects of compressible fluid-structure interaction The true interaction phenomenon is approximated by the piston theory The modification enables the code to be used to predict the structural response of aircraft fuel tanks subjected to penetrating bullets and fragments GRA

**N75-25923#** Army Aviation Engineering Flight Activity, Edwards AFB, Calif
**GUARDRAIL IIA RU-21H EVALUATION Final Report**
George M Yamakawa, Tom P Benson, and Larry K Brewer Jul 1974 34 p refs
(AD-A004009, USAAEFA-74-35) Avail NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a flying qualities evaluation of the GUARDRAIL IIA RU-21H aircraft, manufactured by Beech Aircraft Corporation The RU-21H aircraft was tested at the Beech facility in Wichita, Kansas, on 11 and 12 May 1974 During the test program, 4 0 productive hours were flown The program included a stability and control evaluation and miscellaneous engineering tests necessary to provide substantiating data to aid the GUARDRAIL IIA airworthiness determination Within the scope of this test, the flying qualities of the GUARDRAIL IIA RU-21H aircraft are satisfactory GRA

**N75-25925#** General Dynamics Corp , San Diego, Calif Convair Aerospace Div
**APPLICATION OF HIGH TEMPERATURE COMPOSITES TO AN AIRCRAFT COMPONENT Final Report, Jun 1973 - Mar. 1974**
W F Wennhld May 1974 124 p refs
(Contract N62269-74-C-0757)
(AD-A003546, CASD-NSC-74-001) Avail NTIS CSCL 11/4

The initial phase covered by this report was to include the design and analysis of two canard structures, one constructed primarily of boron/aluminum, the other primarily of graphite/polyimide Both designs were then to be compared for weight saving, cost, and technical risk A decision was then to be made to build two canard structures for structural testing Depending upon the outcome of the evaluation, one of each material or two of one material would be built and tested A NASTRAN model was prepared and used in the sizing of structural elements Up to eight iterations were required in order to achieve a design which met the requirements The Gr/Pl canard design was not successfully completed Because of the results with the Gr/Pl canard, the effort was diverted to the B/Al configuration Two subelement specimen tests were performed in order to evaluate the use of boron/aluminum crossplied material in a reversing stress fatigue spectrum The testing showed that microcracking can occur in the aluminum matrix material and that additional testing is necessary A manufacturing plan and a production cost estimate were made for a canard with boron/aluminum skins and titanium substructure GRA

**N75-25926#** Trans-Sonics, Inc , Burlington, Mass
**HELICOPTER LIFT MARGIN SYSTEM Final Report**
Bradford W Edgerton and Sidney B Williams Dec 1974 48 p refs
(Contract N00014-72-C-0001, NR Proj 213-087)
(AD-A003917, Rept-80003, JANAIR-731003) Avail NTIS CSCL 01/3

Helicopter power requirements are generally maximum when hovering out of ground effect Thus, takeoff and landing maneuvers are the most critical, since the power requirements may not be clear to the pilot at the time he must make the corresponding decisions Power deficiencies at takeoff or landing are very hazardous To maximize safety of takeoff and landing operations, a system has been devised which presents to the pilot his lift margin, a figure which represents the excess weight which could be accommodated under locally-existing barometric pressure, outside-air-temperature conditions, and engine and rotor system conditions GRA

**N75-25927#** Georgia Inst of Tech , Atlanta School of Engineering Science and Mechanics
**MINIMUM WEIGHT DESIGN OF FUSELAGE TYPE STIFFENED CIRCULAR CYLINDRICAL SHELLS SUBJECT TO UNIFORM AXIAL COMPRESSION**
George J Simitses and Variddhi Ungbhakorn Aug 1974 147 p refs
(Grant AF-AFOSR-2655-74, AF Proj 9782)
(AD-A004412, AFOSR-75-0137TR) Avail NTIS CSCL 01/3

This report contains a technical procedure by which one may design a fuselage-type stiffened thin circular cylindrical shell to carry safely a specified uniform axial compression with minimum weight GRA

**N75-25928#** Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
**AN INVESTIGATION OF THE DEPARTURE MODES OF A F-4D AIRCRAFT FROM A STEADY SIDESLIP FLIGHT CONDITION M S. Thesis**
Max L Hawkins Dec 1974 138 p refs
(AD-A004795, GAE/MC/74-6) Avail NTIS CSCL 01/1

This study consisted of modeling the motion of an F-4D with both the linear and non-linear equations of motion The characteristic roots of the linear equations were first analyzed to predict the unstable flight conditions in the high angle of attack flight regime The linear equations were then integrated to obtain a time history, and more explicit picture, of motion predicted by the characteristic roots when the aircraft is perturbed from the unstable condition The validity of the linear equations is then checked and a more detailed picture of the nature of the motion obtained by numerically integrating the non-linear equations of motion at the same flight condition GRA

**N75-25929#** Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
**SEQUENTIAL ATTACK IN AERIAL COMBAT M.S Thesis**
Robert D Powell Dec 1974 71 p refs
(AD-A004796, GAE/MC/74-7) Avail NTIS CSCL 01/3

The main features of a new system of aerial combat tactics, called sequential attack, are discussed One of the primary maneuvers of this system, the pitchback, is modeled as a minimum time turn optimal control problem Optimized trajectories are found by the ordinary gradient method using a realistic model of the F-4 aircraft A simple rule of thumb is found which produces maneuvers whose final times differ from the optimal by less than one second over the region of principal interest GRA

**N75-25930#** Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
**THE EFFECT OF ROLL RATE ON AIR COMBAT M.S. Thesis**
James W Tilley, II Dec 1974 64 p refs
(AD-A004794, GAE/MC/74-4) Avail NTIS CSCL 01/3

A study was made to determine the effects of roll rate on air combat The effects of increased roll rate responses were analyzed by comparing various performance parameters at specific times during three maneuvers the high speed yo-yo, the high speed barrel roll, and the low speed barrel roll The parameters compared were (1) the range between an attacking and defending aircraft, (2) the difference in specific energy between an attacking

and defending aircraft, and (3) the velocity difference between the attacker and defender GRA

**N75-25931#** Air Force Inst of Tech, Wright-Patterson AFB, Ohio School of Engineering
**ANALYTICAL DETERMINATION OF AIRCRAFT SPIN MODES M.S. Thesis**
David L. Westgate Dec 1974 77 p refs
(AD-A004798, GAE/MC/74-11) Avail NTIS CSCL 01/3

Six non-linear equations of motion for a rigid body are used to model the aircraft's motion while in a spin After applying the conditions for an equilibrium spin, the resulting six non-linear simultaneous equations are solved using a method that is accurate and well suited for use with a high-speed digital computer The solution yields the equilibrium spin conditions and these solutions were usually obtained with less than three seconds of computer time These results are compared with the results from previous prediction schemes The linear characteristics of the aircraft about the equilibrium points are also presented The model chosen for this study was a delta-wing fighter configuration GRA

**N75-25932#** Air Force Inst. of Tech, Wright-Patterson AFB, Ohio School of Engineering
**DESIGN OF A DEPLOYABLE WING GLIDER M.S. Thesis**
Phillip L Abold Dec 1974 77 p refs
(AD-A004800 GAE/MC/74D-1) Avail NTIS CSCL 01/3

An unpowered, unguided vehicle to be deployed from a 4 75 inch flare tube was designed The design criteria were six cubic inch, two pound payload, minimum glide speed of 50 knots, and stable with particular emphasis on heading stability Two basic configurations were considered in the analysis the first was a tailless vehicle, and the second was a conventionally tailed vehicle It was found that the tailless vehicle could not meet the stability requirements and thus the tailed vehicle was chosen to meet the design criteria The analysis procedure consisted of a computer model to analyze vehicle stability, wind tunnel tests to calculate aerodynamic derivatives, and flight tests to demonstrate performance The finalized vehicle had a folding wing and flexible tail-boom to meet the packaging requirement The resulting vehicle had a glide ratio of 25 and was very stable in heading, while meeting all other design requirements GRA

**N75-25933#** Naval Postgraduate School, Monterey, Calif
**INVESTIGATION OF THE A-7 HOOK POINT ATTACHMENT LOOSENING PROBLEM M S Thesis**
Allen William Roessig, Jr Dec 1974 76 p refs
(AD-A004256) Avail NTIS CSCL 01/3

Loosening of the hook point attachment bolt in the aircraft arresting hook assembly of the A-7 attack aircraft has caused a potentially dangerous situation and has demanded considerable maintenance effort This report reviews the history of the loosening problem and attempted solutions to it Research into a hitherto neglected possible causal mechanism, self loosening, is discussed Experiments designed to evaluate the contribution of this new factor to the problem are reported The conclusions drawn from these tests are that loosening occurs as a result of plastic strain of the bolt that the crushing of the washer also causes loss of torque, and that the existence or non-existence of a self loosening contribution could not be established GRA

**N75-25934#** Bell Helicopter Co, Fort Worth, Tex
**APPLICATION OF ROTORCRAFT FLIGHT SIMULATION PROGRAM (C81) TO PREDICT ROTOR PERFORMANCE AND BENDING MOMENTS FOR A MODEL FOUR-BLADED ARTICULATED ROTOR SYSTEM Final Report, Jan 1973 - Jul 1974**
F D Freeman and R L Bennett Nov 1974 268 p refs
(Contract DAAJ02-72-C-0086, DA Proj 1F1-63204-D-157)
(AD-A004015, BHC-299-099-691 USAAMRDL-TR-74-70)
Avail NTIS CSCL 01/3

Four sets of model H-34 helicopter rotor blades were built and tested by the Sikorsky Aircraft Corporation Rotorcraft Flight Simulation Program with Aeroelastic Rotor Representation Program C81, was used to predict rotor performance and blade bending moments for comparison with the test results Performance predictions made using the steady-state two-dimensional airfoil data (GFE) supplied by the Army for the model airfoils showed stall characteristics at much lower rotor lift levels than recorded in the tunnel test Application of unsteady aerodynamic and yawed flow effects did not sufficiently improve the performance correlation The lift and stall characteristics of the model rotor in the tunnel were found to be very similar to full-scale 0012 airfoil properties GRA

**N75-25935#** Parsons of California, Stockton
**DESIGN CONCEPTS FOR HELICOPTER PALLETS AND GONDOLAS Final Report**
C Weber and R Young Nov 1974 179 p refs
(Contract DAAJ02-73-C-0058, DA Proj 1F1-62203-AA-33)
(AD-A004013, USAAMRDL-TR-74-91) Avail NTIS CSCL 01/3

This report presents the results of the design concepts investigation and preliminary design of externally suspended cargo pallets and/or gondolas to be utilized with the CH-47, CH-54, and HLH helicopters Results of the investigation demonstrated that gondolas of two sizes could be coupled to develop full payload capacity of any of the three helicopters The basic gondola was right rectangular to accommodate vehicles and equipment or break-bulk cargo if required The investigation and supporting analyses eliminated pallets with lifting points at the base which make it both unstable and structurally inefficient Therefore pallets were not considered as a viable design concept The gondola provides compatibility with ANSI/ISO geometry and can be transported with slings or other load acquisition equipment GRA

**N75-25936#** Mechanical Technology, Inc, Latham, N Y
**APPLICATION OF HIGH FREQUENCY RESONANCE TECHNIQUES FOR BEARING DIAGNOSTICS IN HELICOPTER GEARBOXES Final Technical Report**
Mark S Darlow, Robert H Badbley, and G W Hogg Oct 1974 177 p
(Contract DAAJ02-73-C-0086, DA Proj 1F1-62205-A-119)
(AD-A004014, MTI-74TR25, USAAMRDL-TR-74-77) Avail NTIS CSCL 01/3

The feasibility of the High-Frequency Resonance Technique (HFRT) for defect analysis of rolling-element bearings found in a UH-1 helicopter main transmission was demonstrated A study was conducted to determine optimum conditions under which to test each bearing These included accelerometer location speed, load, housing design and detection frequency The results provided general testing criteria for each bearing An analytical and experimental bearing race resonance study was conducted on each bearing The bearings were then mounted in a test rig and run at various speeds, loads and housing designs Good bearings and bearings with artificially-induced discrete defects were run GRA

**N75-25942#** Shock and Vibration Information Center (Defense) Washington, D C
**THE SHOCK AND VIBRATION DIGEST, VOLUME 6, NO 12**
Dec 1974 168 p refs
(AD-A003455) Avail NTIS CSCL 20A

The various fan noise sources are discussed which are believed to be of significance in modern high bypass ratio engines Such fans operate at both subsonic and supersonic tip speeds and these two operating regimes are discussed separately The analytical techniques which have been evolved to calculate the noise are described Both the classical and the more recently developed methods are considered Author

**N75-25944*#** National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
**TURBOFAN COMPRESSOR DYNAMICS DURING AFTERBURNER TRANSIENTS**
Anatole P Kurkov 1975 17 p refs Presented at the Symp on Unsteady Phenomena in Turbomachinery, Monterey, Calif

22-26 Sep 1975, sponsored by AGARD Propulsion and Energetics Panel
(NASA-TM-X-71741 E-8375) Avail NTIS HC $3 25 CSCL 21E

The effects of afterburner light-off and shut-down transients on compressor stability were investigated Experimental results are based on detailed high-response pressure and temperature measurements on the Tf30-p-3 turbofan engine The tests were performed in an altitude test chamber simulating high-altitude engine operation It is shown that during both types of transients flow breaks down in the forward part of the fan-bypass duct At a sufficiently low engine inlet pressure this resulted in a compressor stall Complete flow breakdown within the compressor was preceded by a rotating stall At some locations in the compressor, rotating stall cells initially extended only through part of the blade span For the shutdown transient, the time between first and last detected occurrence of rotating stall is related to the flow Reynolds number An attempt was made to deduce the number and speed of propagation of rotating stall cells Author

**N75-25946*#** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
**WIND TUNNEL MEASUREMENTS OF FORWARD SPEED EFFECTS ON JET NOISE FROM SUPPRESSOR NOZZLES AND COMPARISON WITH FLIGHT TEST DATA**
Adolph Atencio Jr May 1975 10 p refs Presented at AIAA 8th Fluid and Plasma Dyn Conf Hartford 16-18 Jun 1975 Prepared in cooperation with Army Air Mobility R and D Lab , Moffett Field, Calif
(NASA-TM-X-62449, A-6054) Avail NTIS HC $3 25 CSCL 20A

The results of a test program conducted in the NASA Ames 40- by 80-Foot Wind Tunnel to determine the effect of forward speed on the noise levels emanating from a conical ejector nozzle, a 32-spoke suppressor nozzle, and a 104-elliptical-tube suppressor nozzle are reported It is shown that noise levels are reduced as forward speed is increased and that, for one suppressor configuration, forward speed enhances suppression Comparisons of noise measurements made in the wind tunnel with those obtained in flight tests show good agreement It is concluded that wind tunnels provide an effective means of measuring the effect of forward speed on aircraft noise Author

**N75-25948*#** National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
**INTERIM PREDICTION METHOD FOR FAN AND COMPRESSOR SOURCE NOISE**
M F Heidmann Jun 1975 83 p refs
(NASA-TM-X-71763, E-8398) Avail NTIS HC $4 75 CSCL 21E

A method is presented for interim use in assessing the noise generated by fans and compressors in turbojet and turbofan engines One-third octave band sound pressure levels consisting of broadband, discrete tone, and combination-tone noise components are predicted Spectral distributions and directivity variations are specified The method is based on that developed by other investigators with modifications derived from an analysis of full-scale, single-stage fan data Comparisons of predicted and measured noise performance are presented, and requirements for improving the method are discussed Author

**N75-25949#** Avco-Everett Research Lab , Everett Mass
**FIELD TESTS OF A LASER RAMAN MEASUREMENT SYSTEM FOR AIRCRAFT ENGINE EXHAUST EMISSIONS Final Technical Report**
Donald A Leonard Oct 1974 181 p refs
(Contract F33615-71-C-1875, AF Proj 3066)
(AD-A003648, AFAPL-TR-74-100) Avail NTIS CSCL 07/4

Laser induced Raman and fluorescence measurements were made in the exhaust of a T53-L13A gas turbine engine with a new field portable instrument devised specifically for gas turbine exhaust emission measurements The gas turbine exhaust was analyzed by conventional instruments for CO, CO2, NO, NOx, total hydrocarbons, smoke and temperature, and these data were used as a calibration standard for the evaluation of the laser Raman instrument The most severe problem area was laser induced hydrocarbon fluorescence when the exhaust contained large total hydrocarbon concentrations The overall conclusion was that the laser Raman method shows a good potential for aircraft gas turbine emission analysis GRA

**N75-25950#** Pratt and Whitney Aircraft, West Palm Beach, Fla Research and Development Center
**MODIFIED CENTRIFUGAL COMPRESSOR Final Report, 23 Oct 1973 - 23 Jul 1974**
Gary B Reeves and Jeffrey K Schweitzer Nov 1974 83 p (Contract DAAJ02-74-C-0003, DA Proj 1G2-62207-AH-89) (AD-A004002, PWA-FR-6583, USAAMRDL-TR-74-96) Avail NTIS CSCL 21/5

A single-stage centrifugal compressor designed to produce a 10 1 pressure ratio at a flow rate of 3 2 lb/sec was tested An earlier version of this compressor was tested under US-AAMRDL Contract DAAJ02-70-C-0006 and was found to have excessive losses in the tandem inducer In addition, diffuser damage was incurred during that testing, which also prevented the achievement of the full design potential The objective of this follow-on program was therefore to demonstrate improved performance for the 10 1 pressure ratio single-stage centrifugal compressor with a modified inducer and a new (undamaged) diffuser Modifications to the design of the inducer were made to improve its high-speed (Mach number) performance and to decrease the required inlet prewhirl and a test program was conducted to obtain overall and inducer performance data GRA

**N75-25959** Stanford Univ Calif
**SELECTION OF SAMPLING RATE FOR DIGITAL CONTROL OF AIRCRAFTS Ph D Thesis**
Paul Katz 1975 242 p
Avail Univ Microfilms Order No 75-13537

The considerations in selecting the sampling rate for a digital control of aircrafts are identified and evaluated Optimal discrete synthesis is the design method used Due to discretization of the continuous plant this method of design does not introduce an artificial limitation on the sampling rate The principal example used is the short period mode of a hypothetical high performance aircraft The assumed model includes a bending mode and wind gusts Major factors which influence the selection of the sampling rate are identified and investigated (1) the time response to control inputs, (2) the response to an external disturbance, (3) the sensitivity to variation of parameters, and (4) the roughness of the response to control inputs It was found that the limiting factors in the selection of the sampling rate for the example are the time response to a control input, and the response to an external disturbance Dissert Abstr

**N75-25961#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany) Abteilung Luftfahrtpsychologie
**COCKPIT-SYSTEM STUDY YAK 40 A PILOT OPINION SURVEY TO THE AIRCRAFT HANDLING AND SYSTEM QUALITIES**
Konrad Steininger and Guenter Neumann 2 Jan 1975 72 p In GERMAN, ENGLISH summary Sponsored by Bundesmin fuer Verkehr
(DLR-FB-75-15) Avail NTIS HC $4 25 DFVLR, Porz, West Ger 24,90 DM

A representative sample of pilots employed with an airline operating the Russian short haul jet transport aircraft YAK 40 assessed the acceptability of the cockpit layout and instrumentation, the handling quality, and the feasibility of the systems with regard to the pilot's workload The assessment of the concerned qualities was quantitatively conducted by using a 7-scale rating of 82 items of a questionnaire, and qualitatively by tape-recorded descriptions of critical experiences with the aircraft The method of subjective assessment, rating, and description of a system was used to find the critical weakness and the favorable points of an aircraft-operation It is a heuristic

approach towards a direct recognition of the strain and attention needed to cope with the operation of the aircraft
Author (ESRO)

**N75-25962#** Lear Siegler, Inc , Oklahoma City, Okla Management Services Div
**FLIGHT CONTROL ACTUATOR SYSTEM DEVELOPMENT Final Report, 24 Nov 1972 - 18 Dec 1973**
Dale G Bazill, Harry S Schreadley, and B H Earley Aug 1974 225 p
(Contract F33615-73-C-3024, AF Proj 8225)
(AD-A004853, AFFDL-TR-74-82) Avail NTIS CSCL 01/3
This report describes the following research tasks The test and evaluation of a quadruplex redundant Pitch Axis Test Rig (PATR) to fully describe the hydraulic, mechanical and electronic technology contained therein, and the design of a Roll Axis Test Rig (RATR) to permit hardware simulation of quad redundant, force sharing, active standby, median select and split surface flight control system mechanizations that have high dynamic response GRA

**N75-25963#** Air Force Inst of Tech , Wright-Patterson AFB, Ohio School of Engineering
**STABILITY ANALYSIS OF AN F-4C AIRCRAFT IN STEADY LEVEL TURNING FLIGHT M S Thesis**
Richard J Rudolph Dec 1974 74 p refs
(AD-A004797, GAE/MC/74-9) Avail NTIS CSCL 01/3
A stability analysis of an F-4C aircraft (SAS off) in a coordinated, constant velocity, steady level turn is performed The linearized nondimensional equations of motion were used to solve for equilibrium positions about the steady turn and for the resulting aircraft motions Five flight regions were investigated to determine the effects of altitude and speed variations for load factors ranging from 1 0 to 3 0 in 0 5 increments Root locus plots and Argand diagrams are employed to isolate and identify three complex motions Results indicate adverse dutch rolling motion present at moderate load factors for several flight regions GRA

**N75-25967#** Rome Air Development Center, Griffiss AFB, N Y
**FAA LIGHTNING PROTECTION STUDY LIGHTNING PROTECTION FOR STATUS AND CONTROL LINES OF AN/GRN-27(V) INSTRUMENT LANDING SYSTEM Final Report, 1 Jan 1974 - 1 Feb. 1975**
Gene K Huddleston Feb 1975 26 p refs
(Contract DOT-FA72WAI-356)
(AD-A006997, FAA-RD-75-24) Avail NTIS HC $3 75 CSCL 01/5
Specific recommendations for the protection of the AN/GRN-27 (5) instrument landing system from lightning-induced transients on the buried control cables comprising the status and control lines of the system are presented Avalanche diode transient voltage suppressors in leadless packages are the recommended protection devices Author

**N75-26137*#** National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
**FRICTION AND WEAR OF CARBON-GRAPHITE MATERIALS FOR HIGH ENERGY BRAKES**
Robert C Bill Washington Jun 1975 28 p refs Prepared in cooperation with Army Air Mobility R and D Lab Cleveland (NASA-TN-D-8006 E-8259) Avail NTIS HC $3 75 CSCL 11G
Caliper-type brakes simulation experiments were conducted on seven different carbon-graphite material formulations against a steel disk material and against a carbon-graphite disk material The effects of binder level, boron carbide (B4C) additions, graphite fiber additions and graphite cloth reinforcement on friction and wear behavior were investigated Reductions in binder level and additions of B4C each resulted in increased wear The wear rate was not affected by the addition of graphite fibers Transition to severe wear and high friction was observed in the case of graphite-cloth-reinforced carbon sliding against a disk of similar composition This transition was related to the disruption of a continuous graphite shear film that must form on the sliding surfaces if low wear is to occur The exposure of the fiber structure of the cloth constituent is believed to play a role in the shear film disruption Author

**N75-26149*#** Kanner (Leo) Associates, Redwood City Calif
**FUEL FOR COMPRESSION MICROMOTORS**
A V Babichev Washington NASA Jul 1975 2 p Transl into ENGLISH from Russian Patent no 247713 (Appl no 1085220/23-4 23 Jun 1966) 1 p
(Contract NASw-2481)
(NASA-TT-F-16446) Avail NTIS HC $3 25 CSCL 21D
This fuel for a compression micromotor contains kerosene aviation oil, castor oil amyl nitrite, nitrobenzene and ethyl ether Calcium dioctylphenyldithiophosphate, a rugged, antiwear and antiscoring substance is added to improve motor starting, to increase its service life by 45-50% and decrease scale formation AS-6 lubricating oil is added to decrease scale formation Cyclohexane is added to attain a 20-25% increase in fuel economy The proposed fuel is used in modeling aircraft, ships, motor vehicles and air-cushion craft Author

**N75-26152#** Materials Research Labs Maribyrnong (Australia)
**THEORETICAL PREDICTIONS OF THERMAL EXPLOSIONS PART 1 A MATHEMATICAL MODEL OF A BOMB IN A FIRE**
D B Stroud Feb 1975 21 p refs
(Rept-623-Pt-1) Avail NTIS HC $3 25
A mathematical model is proposed for describing the flow of heat into a bomb and the subsequent build-up to explosion when the bomb is placed in a large, aviation fuel fire The model has been used to predict the time to explosion for various bombs and good agreement is obtained with experimental values from the literature The time to explosion has also been calculated for a bare bomb and for one covered by a thermally protective coating under various fire conditions Several calculations have been performed to determine the sensitivity of the time to explosion to changes in some of the input parameters
Author

**N75-26273#** Rockwell International Corp , Los Angeles Calif Aircraft Div
**INFLUENCE OF SOLID STATE ELECTRICAL DISTRIBUTION ON AIRCRAFT POWER GENERATION SOLID STATE POWER CONTROLLER COMPATIBILITY Final Report, Jan - Aug 1974**
S Dawson, J E Phillips and R Urdanivia 27 Jul 1974 228 p
(Contract F33615-72-C-1759 AF Proj 3145)
(AD-A003834, AFAPL-TR-74-86) Avail NTIS CSCL 09/3
A compatibility study and engineering test evaluation on solid state power controllers (SSPC) was conducted to provide documentation and technical information to the Air Force of the factors needed for the technical decision of compatibility of SSPC on the B-1 air vehicle Part I of this report documents the Baseline Analysis Weight-Volume NA-72-229-1 The Supplement to the report contains a summary of a series of evaluation tests on Solid State Power Controllers The tests were intended to verify operational characteristics of these devices in simulated B-1 environments and with simulated and actual B-1 loads
GRA

**N75-26323#** Pennsylvania State Univ University Park Applied Research Lab
**ON THE INVESTIGATION OF CASCADE AND TURBOMACHINERY ROTOR WAKE CHARACTERISTICS Ph D Thesis**
Rishi Raj Nov 1974 206 p refs
(Contract N00017-73-C-1418)
(AD-A003580, TM-74-267) Avail NTIS CSCL 21/5
The objective of the investigation reported in this thesis is to study the mean and turbulence characteristics of a turbomachinery rotor wake, both analytically and experimentally The turbulence closure problem for the rotor wake in generalized tensors and non-inertial frame of reference is developed

Simplified solutions are obtained for the prediction of mean properties of the cascade and the rotor wake respectively as a function of the downstream distance from the trailing edge, pressure gradient and other parameters of the cascade and rotor geometry GRA

**N75-26336*#** Rockwell International Corp Anaheim, Calif Electronic Research Div
**INVESTIGATION OF SYSTEM INTEGRATION METHODS FOR BUBBLE DOMAIN FLIGHT RECORDERS Final Report, 7 Jun 1973 - 9 Dec 1974**
T T Chen O D Bohning et al May 1975 240 p refs
(Contract NAS1-12435)
(NASA-CR-132643 C74-1041/501) Avail NTIS HC $7 50 CSCL 14B

System integration methods for bubble domain flight records are investigated Bubble memory module packaging and assembly, the control electronics design and construction field coils, and permanent magnet bias structure design are studied A small 60-k bit engineering model was built and tested to demonstrate the feasibility of the bubble recorder Based on the various studies performed, a projection is made on a 50 000 000-bit prototype recorder It is estimated that the recorder will occupy 190 cubic in , weigh 12 lb, and consume 12 w power when all of its four tracks are operated in parallel at 150 kHz data rate Author

**N75-26693*#** National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
**A COMPUTER PROGRAM FOR FITTING SMOOTH SURFACES TO AN AIRCRAFT CONFIGURATION AND OTHER THREE DIMENSIONAL GEOMETRIES**
Charlotte B Craidon Washington Jun 1975 112 p refs
(NASA-TM-X-3206, L-9934) Avail NTIS HC $5 25 CSCL 09B

A computer program that uses a three-dimensional geometric technique for fitting a smooth surface to the component parts of an aircraft configuration is presented The resulting surface equations are useful in performing various kinds of calculations in which a three-dimensional mathematical description is necessary Programs options may be used to compute information for three-view and orthographic projections of the configuration as well as cross-section plots at any orientation through the configuration The aircraft geometry input section of the program may be easily replaced with a surface point description in a different form so that the program could be of use for any three-dimensional surface equations Author

**N75-26780** Marconi-Elliott Avionic Systems Ltd Rochester (England)
**THE APPLICATION OF DISPLAYS IN NAVIGATION/ATTACK SYSTEMS**
J T Shepherd *In* AGARD Electro-Opt Systems May 1975 19 p

The use of display systems during the navigation/attack phase of an aircraft mission is outlined The types of display used and their advantages and limitations are discussed Author

**N75-26787** British Aircraft Corp Warton (England) Military Aircraft Div
**AIRCRAFT DESIGN IMPLICATIONS OF OPTO-ELECTRONIC SYSTEMS**
W I McFarlane *In* AGARD Electro-Opt Systems May 1975 22 p

The application of electro-optical systems to low level aircraft and helicopters is discussed with particular emphasis on the installational problems of weight drag the need for transparencies and power and cooling requirements In addition the need for integration and matching of these systems with other equipments weapons and each other is illustrated from the point of view of optimizing the overall weapon system Finally an objective is stated whereby these new developments can be integrated to maximize the usefulness of the crew by providing them with the right information from the right sensor on the right display at the right time for them to take executive action Author

**N75-26968*#** National Aeronautics and Space Administration Lewis Research Center, Cleveland Ohio
**EFFECT OF INLET INGESTION OF A WING TIP VORTEX ON COMPRESSOR FACE FLOW AND TURBOJET STALL MARGIN**
Glenn A Mitchell Washington Jul 1975 78 p refs
(NASA-TM-X-3246 E-8213) Avail NTIS HC $4 75 CSCL 01A

A two-dimensional inlet was alternately mated to a coldpipe plug assembly and a J85-GE-13 turbojet engine and placed in a Mach 0 4 stream so as to ingest the tip vortex of a forward mounted wing Vortex properties were measured just forward of the inlet and at the compressor face Results show that ingestion of a wing tip vortex by a turbojet engine can cause a large reduction in engine stall margin The loss in stall compressor pressure ratio was primarily dependent on vortex location and rotational direction and not on total-pressure distortion Author

**N75-26970*#** Wichita State Univ Kans
**EXPERIMENTAL STUDIES OF FLOW SEPARATION AND STALLING ON A TWO-DIMENSIONAL AIRFOIL AT LOW SPEEDS**
H C Seetharam and W H Wentz, Jr Washington NASA Jul 1975 64 p refs
(Grant NGR-17-003-021)
(NASA-CR-2560) Avail NTIS HC $4 25 CSCL 01A

Detailed measurements of flow fields associated with low-speed turbulent boundary layers were made for the 17% thick GA(W)-1 airfoil section at nominal angles of attack of 10 deg 14 deg and 18 deg Reynolds number 2 2 x 10, and Mach number 0 13 The data include pressure and velocity surveys of the pre- and post-separated regions on the airfoil and the associated wake The boundary layer characteristics including regions of separation on the airfoil are also presented Author

**N75-26972*#** Old Dominion Univ Norfolk Va School of Engineering
**THE FINITE ELEMENT METHOD IN LOW SPEED AERODYNAMICS Final Technical Report**
A J Baker and P D Manhardt (Textron Bell Aerospace) May 1975 73 p refs
(Grant NsG-1038)
(NASA-CR-143190, TR-75-T5) Avail NTIS HC $4 25 CSCL 01A

The finite element procedure is shown to be of significant impact in design of the computational wind tunnel for low speed aerodynamics The uniformity of the mathematical differential equation description for viscous and/or inviscid, multi-dimensional subsonic flows about practical aerodynamic system configurations is utilized to establish the general form of the finite element algorithm Numerical results for inviscid flow analysis as well as viscous boundary layer parabolic and full Navier Stokes flow descriptions verify the capabilities and overall versatility of the fundamental algorithm for aerodynamics The proven mathematical basis coupled with the distinct user-orientation features of the computer program embodiment indicate near-term evolution of a highly useful analytical design tool to support computational configuration studies in low speed aerodynamics Author

**N75-26973*#** Bell Helicopter Co Fort Worth Tex
**DIGITAL COMPUTER PROGRAM DF1758 FULLY COUPLED NATURAL FREQUENCIES AND MODE SHAPES OF A HELICOPTER ROTOR BLADE**
R L Bennett 6 Mar 1975 120 p
(Contract NAS1-13722)
(NASA-CR-132662 Rept-299-099-724) Avail NTIS HC $5 25 CSCL 01C

The analytical techniques and computer program developed in the fully-coupled rotor vibration study are described The rotor

blade natural frequency and mode shape analysis was implemented in a digital computer program designated DF1758 The program computes collective, cyclic and scissor modes for a single blade within a specified range of frequency for specified values of rotor RPM and collective angle The analysis includes effects of blade twist cg offset from reference axis and shear center offset from reference axis Coupled inplane, out-of-plane and torsional vibrations are considered Normalized displacements, shear forces and moments may be printed out and Calcomp plots of natural frequencies as a function of rotor RPM may be produced

Author

**N75-26975*#** National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

**DETAILED TRANSONIC FLOW FIELD MEASUREMENTS ABOUT A SUPERCRITICAL AIRFOIL SECTION**

Francis X Hurley Frank W Spaid Frederick W Roos Louis S Stivers Jr and Angelo Bandettini Washington Jul 1975 64 p refs

(NASA-TM-X-3244 A-5869) Avail NTIS HC $4 25 CSCL 01A

The transonic flow field about a Whitcomb-type supercritical airfoil profile was measured in detail In addition to the usual surface pressure distributions and wake surveys schlieren photographs were taken and velocity vector profiles were determined in the upper surface boundary layer and in the near wake Spanwise variations in the measured pressures were also determined The data are analyzed with the aid of an inviscid transonic finite-difference computer program as well as with boundary layer modeling and calculation schemes Author

**N75-26976*#** Boeing Commercial Airplane Co Seattle Wash

**COMPARISON OF WIND TUNNEL TEST RESULTS AT FREE STREAM MACH 0 7 WITH RESULTS FROM THE BOEING TEA-230 SUBSONIC FLOW METHOD Final Report**

L W Mohn Washington NASA Jul 1975 91 p refs (Contract NAS1-12214)

(NASA-CR-2554 D6-41780) Avail NTIS HC $4 75 CSCL 01A

The use of the Boeing TEA-230 Subsonic Flow Analysis method as a primary design tool in the development of cruise overwing nacelle configurations is presented Surface pressure characteristics at 0 7 Mach number were determined by the TEA-230 method for a selected overwing flow-through nacelle configuration Results of this analysis show excellent overall agreement with corresponding wind tunnel data Effects of the presence of the nacelle on the wing pressure field were predicted accurately by the theoretical method Evidence is provided that differences between theoretical and experimental pressure distributions in the present study would not result in significant discrepancies in the nacelle lines or nacelle drag estimates

Author

**N75-26977*#** National Aeronautics and Space Administration Langley Research Center Langley Station Va

**PROBLEMS OF FLIGHT IN TURBULENCE**

Gabriel Coupry Washington May 1975 35 p refs Transl into ENGLISH from Intern Council of the Aeron Sci Congr, 9th (Haifa Israel) 25-30 Aug 1974 15 p

(NASA-TT-F-16401) Avail NTIS HC $3 75 CSCL 01A

A description of mathematical models which can provide the aircraft designer with a practical representation of the flight environment encountered by an aircraft and classical models with new approaches both British and French, is presented It is shown by calculation of the response of a flexible aircraft to turbulence that as a rule the turbulence field should be considered as isotropic It is also shown how active control systems open the way to a next generation of aircraft that will be less sensitive to gusts Systems at present under test are described Author

**N75-26978#** Nielsen Engineering and Research Inc Mountain View Calif

**SUPERSONIC LIFTING-SURFACE COMPUTER PROGRAM FOR CRUCIFORM WING-BODY COMBINATIONS Technical Report, 1 Oct 1973 - 30 Sep 1974**

Marnix F E Dillenius and Jack N Nielsen Dec 1974 138 p refs

(Contract N00014-74-C-0050 NR Proj 215-226)

(AD-A003925 NEAR-TR-74) Avail NTIS CSCL 16/2

A lifting-surface computer program has been written for supersonic cruciform wing-body combinations at combined pitch and yaw conditions The method involves supersonic line sources and doublets to model the body and uses Woodward s constant pressure panels to represent the wing Such panels are also placed on the body surface to account for wing-body interference GRA

**N75-26979#** Stanford Univ Calif Dept of Aeronautics and Astronautics

**POTENTIAL FLOW ABOUT THREE DIMENSIONAL STREAMLINED LIFTING CONFIGURATIONS, WITH APPLICATION TO WINGS AND ROTORS Interim Report**

J Michael Summa Sep 1974 160 p refs

(Contract F44620-73-C-0036 AF Proj 9781 AF Proj 6813) (AD-A003697 SU-DAAR-485 AFOSR-74-1914TR) Avail NTIS CSCL 01/1

A numerical method is developed and successfully applied which is believed capable of converging to the exact calculation of three-dimensional lifting potential flows including cases of unsteady motion The principal current limitation on its precision is restricted funds for computation The exact body surface boundary conditions are enforced, and all wake surfaces are unconstrained -- allowed to move with the local velocity field The assumptions made in the theoretical model are that the fluid is ideal (incompressible and inviscid) and that no separation may take place GRA

**N75-26980*#** National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif

**EXPLORATORY FLIGHT INVESTIGATION OF AIRCRAFT RESPONSE TO THE WING VORTEX WAKE GENERATED BY THE AUGMENTOR WING JET STOL RESEARCH AIRCRAFT**

Robert A Jacobsen and Fred J Drinkwater III May 1975 19 p refs

(NASA-TM-X-62387 A-5753) Avail NTIS HC $3 25 CSCL 01C

A brief exploratory flight program was conducted at Ames Research Center to investigate the vortex wake hazard of a powered-lift STOL aircraft The study was made by flying an instrumented Cessna 210 aircraft into the wake of the augmentator wing jet STOL research aircraft at separation distances from 1 to 4 n mi Characteristics of the wake were evaluated in terms of the magnitude of the upset of the probing aircraft Results indicated that within 1 n mi separation the wake could cause rolling moments in excess of roll control power and yawing moments equivalent to rudder control power of the probe aircraft Subjective evaluations by the pilots of the Cessna 210 aircraft supported by response measurements indicated that the upset caused by the wake of the STOL aircraft was comparable to that of a DC-9 in the landing configuration Author

**N75-26981#** Naval Postgraduate School, Monterey, Calif

**A PROPOSAL TO IMPLEMENT STATISTICAL RELIABILITY ANALYSIS METHODOLOGY INTO THE NAVAL AVIATION MAINTENANCE PROGRAM M S Thesis**

Thomas Preston Driver and Herbert John Kressel Dec 1974 57 p refs

(AD-A004264) Avail NTIS CSCL 15/5

The thesis investigates the decision logic utilized in the existing and planned aircraft maintenance programs of the United States Navy The authors' basic belief in the profit motive as an incentive for efficiency led to additional research into the decision logic employed by the commercial air carriers The conclusions reflect the contention that a statistical reliability based maintenance program would increase the efficiency of resource allocation and aircraft reliability Recommendations are proposed which would aid in the implementation of such a system GRA

**N75-26982#** National Transportation Safety Board Washington D C Bureau of Aviation Safety
**AIRCRAFT ACCIDENT REPORT AIR EAST, INC BEECHCRAFT 99A, N125AE, JOHNSTOWN-CAMBRIA COUNTY AIRPORT, JOHNSTOWN, PENNSYLVANIA, 6 JANUARY 1974**
15 Jan 1975 32 p
(PB-239891/5 NTSB-AAR-75-3) Avail NTIS HC $3 75 CSCL 01B

Beechcraft 99A crashed while making an instrument approach to runway 33 at the Johnstown-Cambria County Airport Johnstown Pennsylvania Of the 15 passengers and 2 crewmembers aboard, 11 passengers and the captain were killed in the crash The four remaining passengers and the first officer were seriously injured The aircraft was destroyed While on an instrument landing system localizer approach the aircraft struck approach lights about 300 feet from the runway threshold and then crashed into an embankment about 200 feet from the threshold Shortly before and shortly after the accident the reported weather conditions at the Johnstown Airport consisted in part of variable 200- to 400-foot ceilings and a prevailing visibility of 2 miles in very light snow and fog The National Transportation Safety Board determines that the probable cause of this accident was a premature descent below a safe approach slope followed by a stall and loss of aircraft control GRA

**N75-26983#** National Transportation Safety Board Washington D C Bureau of Aviation Safety
**AIRCRAFT ACCIDENT REPORT BRIEF FORMAT, U S CIVIL AVIATION ISSUE NUMBER 3 OF 1974 ACCIDENTS FILE NUMBERS 1-0002 THRU 1-0007, 1-0009 THRU 1-0019, 1-0021 THRU 1-0023, 1-0025 THRU 1-0028, 3-1034, 3-1444, 3-1801 THRU 3-2700**
3 Jan 1975 547 p
(PB-240364/0 NTSB-BA-74-7) Avail NTIS HC $12 50 CSCL 01B

Selected aircraft accident reports are presented in brief format, occurring in U S Civil Aviation operations during calendar year 1974 The brief format presents the facts conditions, circumstances and probable cause(s) for each accident Additional statistical information is tabulated by type of accident, phase of operation kind of flying injury index, aircraft damage conditions of light pilot certificate injuries and casual factors GRA

**N75-26984#** National Transportation Safety Board Washington D C Bureau of Aviation Safety
**AIRCRAFT ACCIDENT REPORT NEW JERSEY AIR NATIONAL GUARD F106, SERIAL NUMBER 59-0044, PIPER PA-24-250, N6876P, MIDAIR COLLISION NEAR SAXIS, VIRGINIA, 11 OCTOBER 1974 Aircraft Accident Report**
29 Jan 1975 18 p
(PB-240250/1 NTSB-AAR-75-6) Avail NTIS HC $3 25 CSCL 01B

About 2023 eastern daylight time on October 11 1974, a New Jersey Air National Guard F106 and a Piper PA 24-250 N6876P collided in midair near Saxis, Virginia The National Transportation Safety Board determines that the probable cause of the accident was the failure of the interceptor pilot to see and avoid a civil aircraft during a high-speed low-altitude intercept *training flight conducted in an area which included major* north-south airways Also contributing to this accident was the system which permitted an incompatible mix of traffic in controlled airspace which resulted in the probability of an inadvertent radar lock-on to a civil aircraft GRA

**N75-26985#** National Transportation Safety Board, Washington, D C Bureau of Aviation Safety
**AIRCRAFT ACCIDENT REPORT AIRCRAFT POOL LEASING CORPORATION, LOCKHEED SUPER CONSTELLATION, L-1049H, N6917C, MIAMI, FLORIDA, 15 DECEMBER 1973**
11 Sep 1974 32 p
(PB-240120/6, NTSB-AAR-74-11) Avail NTIS HC $3 75 CSCL 01B

At 2353 e s t on December 15 1973 an Aircraft Pool Leasing Corporation s Lockheed Super Constellation L-1049H which was operating as a cargo carrier crashed after takeoff from runway 9L of the Miami International Airport Miami Florida The probable cause of this accident was determined to be overrotation of the aircraft at lift-off resulting in flight in the aerodynamic region of reversed command near the stall regime and at too low an altitude to effect recovery The reason for the aircraft s entering this adverse flight condition could not be determined Factors which may have contributed to the accident include (a) improper cargo loading (b) a rearward movement of unsecured cargo resulting in a center of gravity shift aft of the allowable limit and (c) deficient crew coordination GRA

**N75-26986#** National Transportation Safety Board Washington, D C Bureau of Aviation Safety
**AIRCRAFT ACCIDENT REPORT SATURN AIRWAYS INC , LOCKHEED L-382, N14ST, SPRINGFIELD, ILLINOIS, 23 MAY 1974**
22 Jan 1975 37 p
(PB-240119/8 NTSB-AAR-75-5) Avail NTIS HC $3 75 CSCL 01B

About 1653 c d t May 23 1974 Saturn Airways Flight 14 crashed about 2 6 miles southeast of the Capital VOR near Springfield Illinois The outboard section of the left wing including the No 1 engine separated in flight from the remainder of the wing The National Transportation Safety Board determines that the probable cause of the accident was the undiscovered preexisting fatique cracks which reduced the strength of the left wing to the degree that it failed as a result of positive aerodynamic loads created by moderate turbulence GRA

**N75-26987#** Texas Univ Austin Bureau of Business Research
**INVENTORY OF FREIGHT TRANSPORTATION IN THE SOUTHWEST PART 3 AIR FREIGHT SERVICE IN THE DALLAS-FORT WORTH AREA**
J Bryan Adair Jun 1974 83 p refs
(Contract DOT-OS-30093)
(PB-239820/4 DOT-TST-75/31 RR-6) Avail NTIS HC $4 75 CSCL 01B

An inventory is provided of existing air freight transportation facilities services and practices in the twenty-four Texas and two Oklahoma counties surrounding and including Dallas and Fort Worth Included in the inventory are details on air tonnages handled, volume trends an analysis of domestic and foreign air commerce ties information on airports, freight handling facilities, airlines, air freight forwarded and commmuter air carriers serving the area Products and commodities commmonly shipped to and from the Dallas-Fort Worth region by air are listed Actual and potential problem areas are considered for their possible influence on the air freight industry GRA

**N75-26988#** National Transportation Safety Board Washington D C Bureau of Aviation Safety
**ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US GENERAL AVIATION, CALENDAR YEAR 1972**
14 Nov 1974 207 p
(PB-239608/3, NTSB-ARG-74-3) Avail NTIS HC $7 25 CSCL 01B

The Annual Review of Aircraft Accident Data is a statistical compilation from reports of 4 256 general aviation accidents that occurred during calendar year 1972 Also included are 44 collisions between aircraft By coding each aircraft involved in the collisions an additional 44 records are produced, bringing total accidents records to 4 300 GRA

**N75-26989#** National Transportation Safety Board, Washington D C Bureau of Aviation Safety
**AIRCRAFT ACCIDENT REPORT NATIONAL AIRLINES, INCORPORATED, DC-10-10, N60NA, NEAR ALBUQUERQUE, NEW MEXICO, 3 NOVEMBER 1973**
15 Jan 1975 59 p
(PB-239889/9, NTSB-AAR-75-2) Avail NTIS HC $4 25 CSCL 01B

On November 3 1973, at about 1640 MST, National Airlines, Inc Flight 27 was cruising at 39 000 feet, 65 nmi southwest of Albuquerque New Mexico, when the No 3 engine fan assembly disintegrated Fragments of the fan penetrated the fuselage the Nos 1 and 2 engine nacelles and the right wing As a result the cabin depressurized and one cabin window which was struck by a fragment of the fan assembly separated from the fuselage A passenger who was sitting next to the window was forced through the opening and ejected from the aircraft The body of the passenger has not been recovered The aircraft was landed safely at Albuquerque International Airport The National Transportation Safety Board determines that the probable cause of this accident was the disintegration of the No 3 engine fan assembly as a result of an interaction between the fan blade tips and the fan case GRA

**N75-26990#** National Transportation Safety Board Washington, D C Bureau of Aviation Safety
**AIRCRAFT ACCIDENT REPORT IBERIA LINEAS AEREAS DE ESPANA (IBERIAN AIRLINES) MCDONNELL DOUGLAS DC-10-30, EC CBN LOGAN INTERNATIONAL AIRPORT, BOSTON, MASSACHUSETTS, 17 DECEMBER 1973**
8 Nov 1974 33 p
(PB-239890/7 NTSB-AAR-74-14) Avail NTIS HC $3 75 CSCL 01B

About 1543 EST on December 17 1973 Iberia Lineas Aereas de Espana Flight 933 a DC-10-30 crashed while making an instrument landing system approach to runway 33 L at Logan International Airport Boston, Massachusetts Thirteen passengers were injured slightly two passengers and one flight attendant were injured seriously during evacuation The aircraft was substantially damaged The National Transportation Safety Board determines that the probable cause of this accident was that the captain did not recognize and may have been unable to recognize, an increased rate of descent in time to arrest it before the aircraft struck the approach light piers The captain s ability to detect and arrest the increased rate of descent was adversely affected by a lack of information as to the existence of the wind shear and the marginal visual cues available GRA

**N75-26991#** Douglas Aircraft Co Inc Long Beach, Calif
**FEASIBILITY OF REAL TIME SIMULATION OF AIRPORT/AIRSIDE OPERATIONS**
James B ONeill and R T White Mar 1975 42 p
(Contract DOT-FA72WA-2897)
(AD-A006996 FAA-RD-75-18) Avail NTIS HC $3 75 CSCL 17/7

All aspects of an airport airside are examined as are aspects of controller functions A possible real time simulator is defined for simulating the tower cab under conditions of zero visibility This system is composed of cathode ray tubes and driven by minicomputers to give a low cost portable system The number of displays required and the computer load for these systems are defined Application of the proposed system to several typical problems is discussed A detailed analysis of the engineering requirement and the human factors analysis of real time simulation are included Author

**N75-26994#** Boeing Aerospace Co Seattle, Wash
**B-1 UNIQUE SIGNAL TRAIN GENERATION APPLICATION STUDY Final Report, 1 May - 30 Jun 1974**
A R Mandell, E M Costello and D E Hightower Nov 1974 85 p
(Contract F33657-72-C-0600 AF Proj 2007)
(AD-A003682 D229-10363-1, AFWL-TR-74-297) Avail NTIS CSCL 01/3

The background requirement which underlies this study is consideration by the U S Atomic Energy Commission of the incorporation of a device in aircraft-delivered nuclear weapons which would be an additional series safety device in the weapon pre-arm circuits This device would be operated by a pulsating direct current signal whose format and implementation would be so unique that the possibility of its generation and application to the weapon by any means other than deliberate personnel action would be insignificantly small GRA

**N75-26995*#** National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
**COMPARISON OF TWO HEAD-UP DISPLAYS IN SIMULATED STANDARD AND NOISE ABATEMENT NIGHT VISUAL APPROACHES**
Fred Cronn (San Jose State Univ ) and Everett Palmer Washington Jul 1975 23 p refs
(Grant NGL-05-046-002)
(NASA-TM-X-3264 A-5993) Avail NTIS HC $3 25 CSCL 01D

Situation and command head-up displays were evaluated for both standard and two segment noise abatement night visual approaches in a fixed base simulation of a DC-8 transport aircraft The situation display provided glide slope and pitch attitude information The command display provided glide slope information and flight path commands to capture a 3 deg glide slope Landing approaches were flown in both zero wind and wind shear conditions For both standard and noise abatement approaches the situation display provided greater glidepath accuracy in the initial phase of the landing approaches, whereas the command display was more effective in the final approach phase Glidepath accuracy was greater for the standard approaches than for the noise abatement approaches in all phases of the landing approach Most of the pilots preferred the command display and the standard approach Substantial agreement was found between each pilot s judgment of his performance and his actual performance Author

**N75-26996*#** National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
**THREE METHODS OF PRESENTING FLIGHT VECTOR INFORMATION IN A HEAD-UP DISPLAY DURING SIMULATED STOL APPROACHES**
James H Dwyer III and Everett A Palmer III Washington Jul 1975 16 p refs
(NASA-TM-X-3273 A-5992) Avail NTIS HC $3 25 CSCL 01D

A simulator study was conducted to determine the usefulness of adding flight path vector symbology to a head-up display designed to improve glide-slope tracking performance during steep 7 5 deg visual approaches in STOL aircraft All displays included a fixed attitude symbol a pitch- and roll-stabilized horizon bar, and a glide-slope reference bar parallel to and 7 5 deg below the horizon bar The displays differed with respect to the flight-path marker (FPM) symbol display 1 had no FPM symbol display 2 had an air-referenced FPM and display 3 had a ground-referenced FPM No differences between displays 1 and 2 were found on any of the performance measures Display 3 was found to decrease height error in the early part of the approach and to reduce descent rate variation over the entire approach Two measures of workload did not indicate any differences between the displays Author

**N75-26997*#** McDonnell Aircraft Co St Louis Mo
**A FUSELAGE/TANK STRUCTURE STUDY FOR ACTIVELY COOLED HYPERSONIC CRUISE VEHICLES AIRCRAFT DESIGN EVALUATION**
T Nobe [1975] 116 p refs
(Contract NAS1-12995)
(NASA-CR-132668) Avail NTIS HC $5 25 CSCL 01C

The effects of fuselage cross sections and structural members on the performance of hypersonic cruise aircraft are evaluated Representative fuselage/tank area structure was analyzed for strength stability fatigue and fracture mechanics Various thermodynamic and structural tradeoffs were conducted to refine the conceptual designs with the primary objective of minimizing weight and maximizing aircraft range M C F

**N75-26998*#** McDonnell Aircraft Co St Louis Mo
**A FUSELAGE/TANK STRUCTURE STUDY FOR ACTIVELY COOLED HYPERSONIC CRUISE VEHICLES ACTIVE**

**COOLING SYSTEM ANALYSIS**
James E Stone [1975] 104 p refs
(Contract NAS1-12995)
(NASA-CR-132669) Avail NTIS HC $5 25 CSCL 01C

The effects of fuselage cross section and structural arrangement on the performance of actively cooled hypersonic cruise vehicles are investigated An active cooling system which maintains the aircraft s entire surface area at temperatures below 394 K at Mach 6 is developed along with a hydrogen fuel tankage thermal protection system Thermodynamic characteristics of the actively cooled thermal protection systems established are summarized Design heat loads and coolant flowrate requirements are defined for each major structural section and for the total system Cooling system weights are summarized at the major component level Conclusions and recommendations are included J M S

**N75-26999*#** McDonnell Aircraft Co St Louis, Mo
**A FUSELAGE/TANK STRUCTURE STUDY FOR ACTIVELY COOLED HYPERSONIC CRUISE VEHICLES STRUCTURAL ANALYSIS Technical Report, 11 Mar 1974 - 30 Jun 1975**
Allen H Baker [1975] 65 p refs
(Contract NAS1-12995)
(NASA-CR-132670) Avail NTIS HC $4 25 CSCL 01C

The effects of fuselage cross-section (circular and elliptical) and structural arrangement (integral and nonintegral tanks) on the performance of actively cooled hypersonic cruise vehicles was evaluated It was found that integrally machined stiffening of the tank walls while providing the most weight-efficient use of materials results in higher production costs Fatigue and fracture mechanics appeared to have little effect on the weight of the three study aircraft The need for thermal strain relief through insulation is discussed Aircraft size and magnitude of the internal pressure are seen to be significant factors in tank design Author

**N75-27001*#** Virginia Univ Charlottesville School of Engineering and Applied Science
**THE EFFECTS OF AIRCRAFT DESIGN ON STOL RIDE QUALITY**
Craig R Jones and Ira D Jacobson May 1975 103 p refs (Grant NGR-47-005-208)
(NASA-CR-143113 ESS-4035-103-75) Avail NTIS HC $5 25 CSCL 01C

Effects of aircraft dynamic characteristics on passenger ride quality are investigated to determine ride-quality isocontours similar to aircraft handling-qualities contours Measurements are made on a moving-base simulator while varying the aircraft short-period and Dutch Roll frequencies and dampings Both pilot ratings and subjective ride-quality ratings are obtained during flight Ride and handling qualities were found to be complementary for the Dutch Roll mode, but not for the short-period mode Regions of optimal ride and handling qualities are defined for the short-period mode and the effects of turbulence levels studied Author

**N75-27002#** Fairchild Republic Div Farmingdale N Y
**PRELIMINARY DESIGN OF WINGS VOLUME 1 DESIGN PHILOSOPHY Final Technical Report, Feb 1971 - Oct 1972**
Harold Switzky Mar 1974 39 p refs
(Contract F33615-71-C-1241 AF Proj 1368)
(AD-A003649 AFFDL-TR-74-20-Vol-1) Avail NTIS CSCL 01/3

A philosophy and methodology for performing preliminary designs of wings are presented The philosophy is to treat each segment of the problem with a different degree of completeness depending upon the present state of the art Each segment of the preliminary design is made as complete as possible within the constraints of obtaining a reliable and significant solution within a reasonable time In segments where an analytical philosophy exists assumptions are made to result in rapid and relatively accurate solutions In segments where it is not possible to establish analytical solutions semi-empirical statistical relationships are sought GRA

**N75-27003#** Fairchild Republic Div, Farmingdale N Y
**PRELIMINARY DESIGN OF WINGS VOLUME 2 PRELIMINARY FATIGUE DESIGN Final Technical Report, Feb 1971 - Oct 1972**
Harold Switzky Mar 1974 37 p refs
(Contract F33615-71-C-1241 AF Proj 1368)
(AD-A003650 AFFDL-TR-74-20-Vol-2) Avail NTIS CSCL 01/3

This report describes an approach for obtaining ultimate tensile design allowables which should result in satisfactory fatigue performance Thus fatigue considerations can be included in the original design rather than being checked as an afterthought after the design has been set This can avoid costly redesigns to obtain structural integrity in fatigue GRA

**N75-27004#** Fairchild Republic Div Farmingdale N Y
**PRELIMINARY DESIGN OF WINGS VOLUME 3 MINIMUM WEIGHT DESIGN OF STIFFENED PLATE Final Technical Report, Feb 1971 - Oct 1972**
Harold Switzky Mar 1974 66 p refs
(Contract F33615-71-C-1241 AF Proj 1368)
(AD-A003651 AFFDL-TR-74-20-Vol-3) Avail NTIS CSCL 01/3

A design philosophy based upon mathematical logic and structural behavior is developed to obtain the minimum weight design of determinate structures The philosophy is applied to stiffened skin constructions to obtain a nondimensional minimum weight design procedure and digital program which are readily applicable to any material temperature loading thickness stiffener spacing or height Techniques for improving the efficiency by choice of stiffener and material are also presented The assumptions utilized to analyze and design the structure are reviewed and their effect upon the weight and margin of safety of the design is assessed GRA

**N75-27005#** *Naval Postgraduate School Monterey Calif*
**HYDRAULIC RAM PRESSURE MEASUREMENTS M S Thesis**
Clifford Milton Holm Dec 1974 51 p refs
(AD-A004241) Avail NTIS CSCL 01/3

Hydraulic ram concerns the dynamic loads and catastrophic failure of liquid-filled fuel tanks impacted by high speed projectiles Hydraulic ram is divided into two phases the shock phase and the drag phase Analytic models have been proposed for the shock phase by Yurkovich and for the drag phase by Lundstrom An attempt was made to correlate these theoretical pressure predictions with experimental data obtained from 0 222 caliber projectiles impacting a small water-filled tank This comparison showed reasonable correlation but indicates that more work must be done to permit predictions of hydraulic ram pressures accurate enough for the purpose of fuel cell design GRA

**N75-27008*#** National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
**ACOUSTIC CHARACTERISTICS OF A LARGE SCALE WIND-TUNNEL MODEL OF A JET FLAP AIRCRAFT**
Michael D Falarski Thomas N Aiken and Kiyoshi Aoyagi Washington Jul 1975 36 p refs Prepared in cooperation with Army Air Mobility R and D Lab Moffett Field Calif
(NASA-TM-X-3263 A-5923) Avail NTIS HC $3 75 CSCL 20A

The expanding-duct jet flap (EJF) concept is studied to determine STOL performance in turbofan-powered aircraft The EJF is used to solve the problem of ducting the required volume of air into the wing by providing an expanding cavity between the upper and lower surfaces of the flap The results are presented of an investigation of the acoustic characteristics of the EJF concept on a large-scale aircraft model powered by JT15D engines The noise of the EJF is generated by acoustic dipoles as shown by the sixth power dependence of the noise on jet velocity These sources result from the interaction of the flow turbulence with flap of internal and external surfaces and the trailing edges Increasing the trailing edge jet from 70 percent span to 100 percent span increased the noise 2 db for the equivalent nozzle area Blowing at the knee of the flap rather

than the trailing edge reduced the noise 5 to 10 db by displacing the jet from the trailing edge and providing shielding from high-frequency noise Deflecting the flap and varying the angle of attack modified the directivity of the underwing noise but did not affect the peak noise A forward speed of 33 5 m/sec (110 ft/sec) reduced the dipole noise less than 1 db Author

**N75-27015*#** National Aeronautics and Space Administration Flight Research Center, Edwards, Calif
**FLIGHT EVALUATION OF THE M2-F3 LIFTING BODY HANDLING QUALITIES AT MACH NUMBERS FROM 0 30 TO 1 61**
Robert W Kempel, William H Dana, and Alex G Sim Washington Jul 1975 43 p refs
(NASA-TN-D-8027, H-852) Avail NTIS HC $3 75 CSCL 01C

Percentage distributions of 423 pilot ratings obtained from 27 flights are used to indicate the general level of handling qualities of the M2-F3 lifting body Percentage distributions are compared on the basis of longitudinal and lateral-directional handling qualities, control system, control system status, and piloting task Ratings of longitudinal handling qualities at low speed were slightly better than those for transonic and supersonic speed The ratings of lateral-directional handling qualities were unaffected by speed and configuration Specific handling qualities problems are discussed in detail, and comparisons are made with pertinent handling qualities criteria Author

**N75-27021#** ARO, Inc Arnold Air Force Station Tenn
**EVALUATION OF A WEDGE ON A FORCE BALANCE AS A FLOW ANGLE PROBE Final Report**
H Maxwell and W Luchuk AEDC Feb 1975 68 p refs
(AD-A004765 AEDC-TR-74-110 ARO-PWT-TR-74-88) Avail NTIS CSCL 20/4

A wedge wing on a force balance designed for use at Mach numbers 1 6 and 2 0 has been evaluated as a continuously moving flow angle probe and calibrated in the range of Mach numbers from 0 6 to 1 3 Moving at standard speeds of the Captive Trajectory System (CTS) it has proved to be accurate and repeatable when operating in the three translational modes and the roll mode Performance is also reported in the pitch and yaw motions An extensive survey made at Mach number 0 6 shows the flow direction in the 4 tunnels used to be upward and toward the north wall with maximum components of 0 58 deg in pitch and 0 52 deg in yaw GRA

**N75-27223#** IIT Research Inst Chicago Ill
**ANALYSIS, TEST AND EVALUATION SUPPORT TO THE USAF ADVANCED LANDING SYSTEM PROGRAM VOLUME 1 PROGRAM DESCRIPTION AND RESULTS Final Report, Jan 1972 - May 1974**
A E Brindley L C Calhoun T N Patton and L Valcik Aug 1974 301 p refs
(Contract F33615-72-C-1024)
(AD-A004419 AFFDL-TR-74-62-Vol-1) Avail NTIS CSCL 17/7

The report describes the efforts undertaken by IITRI in support of USAF s microwave landing system concept validation program It is concluded that the doppler guidance technique is conceptually sound but that considerable work is required to improve the implementation of the technique fundamental research in the area of multipath reflections is strongly recommended GRA

**N75-27224#** IIT Research Inst Chicago Ill
**ANALYSIS, TEST AND EVALUATION SUPPORT TO THE USAF ADVANCED LANDING SYSTEM PROGRAM VOLUME 2 INDEX OF APPROACHES Final Report, Jan 1972 - May 1974**
A E Brindley L C Calhoun T N Patton and L Valcik Aug 1974 73 p refs
(Contract F33615-72-C-1024)
(AD-A004420 AFFDL-TR-74-62-Vol-2) Avail NTIS CSCL 17/7

Volume II is an index of the approaches flown during the MLS Concept Validation Program Part I lists the approaches in the order that they were flown it also contains information on the magnetic storage location of reduced data An explanation of the terms used is given as is a code for the notes used on the index of data Data from these approaches are plotted and contained in Volume III Part II is a listing of the approaches after sorting The sorting brings together similar approaches for comparison purposes GRA

**N75-27225#** IIT Research Inst Chicago Ill
**ANALYSIS, TEST AND EVALUATION SUPPORT TO THE USAF ADVANCED LANDING SYSTEM PROGRAM VOLUME 3, PART 1 DOPPLER MLS GUIDANCE ERROR DATA (DOTS TRACKING SYSTEM) Final Report, Jan 1972 - May 1974**
A E Brindley L C Calhoun T N Patton and L Valcik Aug 1974 275 p
(Contract F33615-72-C-1024)
(AD-A004421, AFFDL-TR-74-62-Vol-3-Pt-1) Avail NTIS CSCL 17/7

Volume III Part I contains guidance error data for the Doppler MLS computed from the Digital Optical Tracking System (DOTS) information Separate plots are included for the azimuth system and the elevation system Volume III Parts 1, 2, and 3 contain the data used in determining the findings presented in Volume I GRA

**N75-27226#** IIT Research Inst , Chicago, Ill
**ANALYSIS, TEST AND EVALUATION SUPPORT TO THE USAF ADVANCED LANDING SYSTEM PROGRAM VOLUME 3, PART 2 DOPPLER MLS GUIDANCE ERROR DATA (M-33 TRACKING SYSTEM, FLIGHTS 22 JUNE 1973 TO 10 SEPTEMBER 1974) Final Report, Jan 1972 - May 1974**
A E Brindley L C Calhoun T N Patton and L Valcik Aug 1974 323 p
(Contract F33615-72-C-1024)
(AD-A004422 AFFDL-TR-74-62-Vol-3-Pt-2) Avail NTIS CSCL 17/7

**N75-27227#** IIT Research Inst Chicago, Ill
**ANALYSIS, TEST AND EVALUATION SUPPORT TO THE USAF ADVANCED LANDING SYSTEM PROGRAM VOLUME 3, PART 3 DOPPLER MLS GUIDANCE ERROR DATA (M-33 TRACKING SYSTEM, FLIGHTS 12 SEPTEMBER 1973 TO 29 JANUARY 1974) Final Report, Jan 1972 - May 1974**
A E Brindley L C Calhoun T N Patton and L Valcik Aug 1974 283 p
(Contract F33615-72-C-1024)
(AD-A004423 AFFDL-TR-74-62-Vol-3-Pt-3) Avail NTIS CSCL 17/7

**N75-27244** British Library Lending Div Boston Spa (England)
**ELECTRIC ENERGY AND NOISE**
G Pleeck 14 Feb 1975 21 p refs Transl into ENGLISH from French report Presented at 9th World Energy Conf Detroit, 1974
(BLL-CE-Trans-6550-(9022 09)) Avail British Library Lending Div Boston Spa, Engl 3 BLL photocopy coupons

Definitions measurements characteristics criteria propagation limiting levels and reduction methods of noise are discussed Some typical power station equipment is considered such as gas reducing valves, steam venting fans, motors turboalternators transformers turbojets, and high voltage lines The trend to incorporate some acoustic absorption materials in the architecture of machine rooms in Belgium is reviewed Ideas concerning the necessity of preliminary acoustical engineering studies for a new installation are also presented J A M

**N75-27334*#** National Aeronautics and Space Administration Langley Research Center Langley Station, Va

**INSTRUMENTATION FOR MEASURING AIRCRAFT NOISE AND SONIC BOOM Patent Application**
Allan J Zukerwar Inventor (to NASA) (Old Dominion Univ ) Filed 1 Jul 1975 17 p
(Contract NAS1-11707)
(NASA-Case-LAR-11476-1 US-Patent-Appl-SN-592159) Avail NTIS HC $3 25 CSCL 14B

Improvements in instrumentation suitable for measuring aircraft noise and sonic booms are reported A converter produces an electric current proportional to the sound pressure level at a condenser microphone The electric current is transmitted over a cable and amplified by a zero drive amplifier The converter consists of a local oscillator a dual gate field effect transistor (FET) mixer and a voltage regulator/impedance translator The local oscillator generates a carrier voltage that is applied to one of the gates of the FET mixer The FET mixer mixes the microphone signal with the carrier to produce an electrical current at the frequency of vibration of the microphone diaphragm The voltage regulator/impedance translator regulates the voltage of the local oscillator and mixer stages, eliminates the carrier at the output and provides a low output impedance at the cable terminals The improvements include automatic tuning compensation against changes in static microphone capacitance and means for providing a remote electrical calibration capability NASA

**N75-27421*#** *National Aeronautics and Space Administration* Lewis Research Center Cleveland Ohio
**ANALYSIS OF THE EFFECTS ON LIFE OF LEADING-EDGE HOLES IN AN AIRFOIL SUBJECTED TO ARBITRARY SPANWISE AND CHORDWISE TEMPERATURE DISTRIBUTIONS**
Albert Kaufman Washington Jul 1975 17 p refs
(NASA-TM-X-3257 E-8277) Avail NTIS HC $3 25 CSCL 01C

The effects of temperature gradients cooling-hole rim and bulk metal temperatures and mechanical stress were investigated by using a finite-element structural analysis of a symmetrical airfoil with and without leading-edge holes The results indicate that leading-edge film cooling is beneficial when large chordwise temperature gradients exist and if the cooling-hole rim temperatures are above the bulk metal temperature The effects of film cooling at other locations on the airfoil were not considered and the relative merits of convection or film cooling at the leading edge in terms of allowable turbine inlet temperature or coolant flow requirements were not evaluated Author

**N75-27422*#** National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
**ANALYTICAL MODELING REQUIREMENTS FOR TILTING PROPROTOR AIRCRAFT DYNAMICS**
Wayne Johnson Washington Jul 1975 59 p refs Prepared in cooperation with Army Air Mobility R and D Lab Moffett Field Calif
(NASA-TN-D-8013 A-5698) Avail NTIS HC $4 25 CSCL 01A

Proprotor and cantilever wing aeroelastic behavior is applied to a gimballed rotor and a hingeless rotor to develop an analytical model for prediction of tilting proprotor aircraft dynamics Particular attention is given to the influence of coupled flap/lag bending modes the influence of rotor blade torsion degrees of freedom on proprotor dynamics and to a constant coefficient approximation representing the dynamics in nonaxial flow through the rotor The following are also examined the number of blade bending and torsion modes required the influence of the rotor aerodynamic model the influence of the blade trim bending deflection the importance of the rotor rotational speed degree of freedom and the effect of the wing aerodynamic forces The origin of the significant influence of the blade pitch motion on the proprotor dynamics is discussed Author

**N75-27590#** Joint Publications Research Service, Arlington, Va
**HIGH-ALTITUDE AIRCRAFT AND THE STRATOSPHERE**
I L Karol 8 Jul 1975 53 p refs Transl into ENGLISH from the book Vysotnyye Samolety i Stratosfera Moscow, Gidrometeoizdat 1974 p 1-49
(JPRS-65171) Avail NTIS HC $4 25

Possible changes in the composition of the stratosphere as a result of the effect exerted on it by the discharge of combustion products from engines of high-altitude aircraft were studied taking into account predictions of the development of supersonic transport aircraft in the 1980 s Investigations of photochemical reactions between atmospheric gases the exhaust of aircraft and planetary distributions of the content of photochemically active small impurities in the stratosphere (especially ozone) were also considered

**N75-27855*#** National Aeronautics and Space Administration Langley Research Center Langley Station Va
**RADIATED NOISE FROM AN EXTERNALLY BLOWN FLAP**
N N Reddy and J C Yu (George Washington Univ ) Washington Jul 1975 36 p refs
(NASA-TN-D-7908 L-9895) Avail NTIS HC $3 75 CSCL 20A

The far field noise from subsonic jet impingement on a wing-flap with a 45 deg bend was experimentally investigated The test parameters are jet Mach number and flap length For long flaps the primary source mechanisms are found to be turbulent mixing and flow impingement For short flaps the interaction of turbulent flow with the flap trailing edge appears to strongly influence the radiated noise Author

**N75-27949*#** Scientific Translation Service, Santa Barbara, Calif
**ORGANIZING CENTRALIZED AIRCRAFT COMPONENT OVERHAUL**
S N Malkov Washington NASA Jul 1975 235 p refs Transl into ENGLISH from the book "Organizatsiya Tsentralizovannogo Remonta Agregatov Samoletov" Moscow Transport Press 1974 p 1-180
(Contract NASw-2483)
(NASA-TT-F-16266) Avail NTIS HC $7 50 CSCL 05A

Preparation of a stable production base and rational organization of centralized component overhaul processes are examined Methods are presented for determining overhaul requirements, optimizing centralized production objects and locations, planning the production program introducing standardized technology, and fully mechanized flow lines for group overhaul of aircraft components Author

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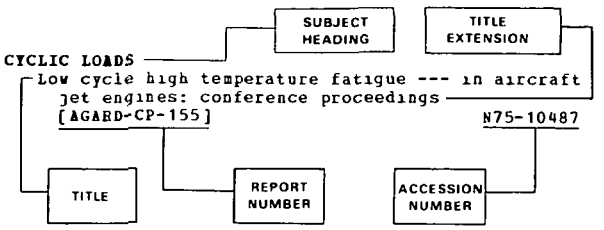


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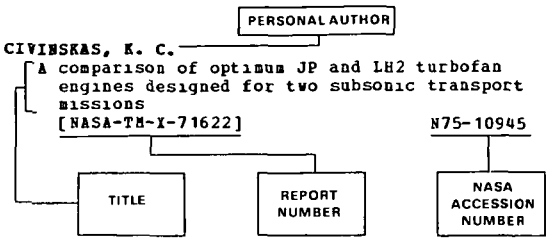


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